Tourism-led Growth Hypothesis in the Top Ten Tourist Destinations: New Evidence Using the Quantile-on-Quantile Approach

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Abstract: This paper examines the empirical validity of the tourism-led growth hypothesis in the toptentourist destinations in the world(China, France, Germany, Italy, Mexico, Russia, Spain, Turkey, the United Kingdom, and the United States)using the quantile-on-quantile (QQ) approach and a new index of tourism activity that combines the most commonly used tourism indicators. This methodology, recently introduced by Sim and Zhou (2015), provides an ideal framework with which to capture the overall dependence structure between tourism development and economic growth. The empirical results primarily show a positive relation between tourism and economic growth for the ten countries considered with substantial variations across countries and across quantiles within each country. The weakest links arenoted for China and Germany,possibly because of the limitedimportance of the tourism sector relative to other major economic activities in those countries. Important country-specific policy implications may be drawn from these findings.
Keywords: tourism, economic growth, tourism-led growth hypothesis, real GDP per capita, quantile-on-quantile (QQ) approach.

1. Introduction

Tourism is one of the fastest growing industries in the world and a leading driver of economic growth and socio-economic progress,not only for many developing countriesbut alsofor somedeveloped countries. The continued surge in international tourist flows over the past few decades is an unequivocal sign of the buoyant and resilient tourism sector worldwide. The United Nations World Tourism Organization (UNWTO) projects that total international tourist arrivals will grow by 3.3%a year to reach 1.8 billion by 2030. Tourism can affect economic activityby a number of channels.The tourism sector generates employment and tax revenues;it stimulates investment in infrastructure, human capital and technology;it enhances the efficiency of local firms by increasing competition; and it facilitates the exploitation of economies of scale. Furthermore, tourismmay be considered an alternative form of export and hence a prime source of foreign exchange earnings, which reducesthedeficitin a country's balance of payments.In addition, tourismcontributes to exchanges of cultures and experiences betweensource and origin countries, thus enhancing social capital. Finally, because ofefforts in green tourism, the tourism sector may also be an important catalyst forthe protection of the environment and wildlife.

The positive and interdependent effects of tourism development on the economy havefosteredthe emergence of thetourism-led growth (henceforth TLG) hypothesis (Balaguer and Cantavella-Jordá, 2002).According to this hypothesis, tourism is a major determinant of overall long-term economic growth. It is crucial for governments to identifythe empirical validity of the TLG hypothesis in a countrytooptimize resource allocation to tourism development and hence to harness the consequent multiple benefits.

However, despite the strong growth of the tourism sector in many countries in recent years, the effect of tourism development on economic growth does not necessarily have to be identicalfor all countries. In this regard, the analysis of the validity of the TLG hypothesis in a group of countries is particularly conducive to achieving a better understanding of the tourism-economic growth nexus and to identifying possible divergences among countries. In cases in which tourism enhances growth, it is critical to discernthe key factors underpinning the sustained link between tourism and economic growth. Conversely, in cases in which the TLG hypothesis does not hold, it becomes evident that tourism policies and the overall socio-economic structureof the involved countries require a thorough re-assessment.

The aim of this paper is to investigate the relation between tourism development and economic growth in the top ten tourist destinations in the world (China, France, Germany, Italy, Mexico, Russia, Spain, Turkey, the United Kingdom and the United States) using thequantile-on-quantile (QQ henceforth) methodology. The QQ approach, recently developed by Sim and Zhou (2015),combines quantile regression and nonparametric estimation techniques and basically involves regressing the quantile of a variable onto the quantile of another variable. As argued by Pablo-Romero and Molina (2013), the literature on the tourism-economic growth link has evolved towards the use of increasingly more sophisticated econometric techniqueswith anincreasing recognition of the importance of nonlinear relations between tourism and economic growth. In a similar vein, Wang (2012) noted that a linear framework may oversimplify the tourism-growth relation and that the link between these variables is indeed complex and nonlinear in nature. In this context, the QQ analysis emerges as quite auseful method, enablinganestimation of the effect of the quantiles of tourism growthon the quantiles of economic growth and providinga comprehensive and precise picture of the overall interdependence of the variables. By its very nature, the QQ frameworkallows uncovering complexities in the relation between tourism activity and economic growth that would be difficult to detect using conventional econometric models.

To the best of our knowledge, this study is the firstto explore therelation between tourismdevelopment and economic growth by applying the QQ method. This approach is particularly interestingwithin this context because the link between tourism and growth can be contingent on the economic cycleand the size and sign of tourism shocks. In this regard, although recognizing that tourism is quite a complex and multifaceted phenomenon and its relationto economic growth depends on a large number of factors,the nature of the link between tourism activity andgrowth can vary depending on the state of the economy (expansion or recession). Similarly, the effect that large changes in tourism activity have on economic growth can be different from the effect associated with smaller changes in tourism activity. Likewise, economic growth can react asymmetrically to negative orpositive tourism shocks.Another relevant contribution of this study is the use of a novel tourist activity indicator, which combines in a single composite indexthe majority ofthe information contained in the threecommonly used measures of tourism development(tourist arrivals, tourism receipts and tourism expenditures) and is constructed by employing principal component analysis.

Our empirical results provide evidence that the relation between tourism and economic growth is primarily positive for the ten countries under consideration although there are substantial differences across countries and across quantiles of tourism and economic growth within each country. Specifically, the weakest tourism-economic growth link is noted for China and Germany, possibly as a result of the lowrelative importance of the tourism sector in both economies. Furthermore, for a number of countries (Mexico, Spain, Turkey, the UK and the US), tourism growthappears to emerge as a significant driving factor of the overall economyonly during periods of economic downturn. This latter finding shows the strategic role of the tourism sector under adverse economic conditions and may have important implicationswhen policy makers are designingoptimal tourism and economic policies.

The remainderof the paper is organized as follows: Section2 provides an overview of the previous literature on the nexus between tourism and economic growth. Section3 presents the data set employed, and Section4 describes the key features of the QQ approach as well as the model used to investigate the tourism-economic growth link. Section5 reports and discusses the primary empirical findings of the QQ analysis. Finally, Section6 offers some concluding remarks.

2. Literature Review

Over the past four decades, a vast amount of literature hasinvestigatedthe relation between tourism development and economic growth, with a particular focus on countries in which the tourism sector plays a more prominent role. Specifically, Ghali (1976) was the first to investigate the nexus between tourism and economic growth from an empirical perspective using the ordinary least square method, and Balaguer and Cantavella-Jordá (2002) were pioneers in examiningthe validity of the TLG hypothesis. The results of this line of research are sensitive to the sample period, model specification, variablesselected,frequency of observations, methodological approachapplied and country/countries involved, althoughthe majority of studies support the TLG hypothesis (e.g.,Brida et al., 2008; Gunduz and Hatemi-J, 2005; Nowak and Sahli, 2007; Tang and Abosedra, 2016; Tang and Tan, 2015).However, a number ofstudies (Lee, 2012; Oh, 2005; Payne and Mervar, 2010; Tang and Jang, 2009)have identified the reverse effect, that economic development boosts tourism expansion. This hypothesis, called the growth-led tourism hypothesis, postulates that the sustained economic growth of a country facilitates the development of the tourism sector in that country.As resources become available for tourism infrastructure, the positive economic climate encourages the proliferation of tourism activities, and international tourists are also attracted by the country's economic vitality. In addition, several contributionsshow a reciprocal influence of economic growth and tourism development, thus suggesting amutually reinforcing effect between tourism and economic growth (Chen and Chiou-Wei, 2009; Dritsakis, 2004; Kim et al., 2006; Shahbaz et al., 2016). Finally, some studies observed no evidence of a significant relation between tourism activity and economic growth for different countries (e.g.,Brida et al., 2011; Katircioglu, 2009; Ozturk and Acaravci, 2009; Tang, 2011).

Despite the potential economic benefits of tourism, a number ofstudies have notednegative externalities of tourism development, such asenvironmental degradation because of over-exploitation of natural resources (Capó et al., 2007; Schubert, 2010), economic impoverishment of the resident population (Chao et al., 2006; Nowak et al., 2003), Dutch disease effects[1] (Capó et al., 2007; Holzner, 2005), loss of cultural and social values of the host community (Cooper et al., 1993), and the highly volatile nature of tourism receipts (Ghalia and Fidrmuc, 2016).[2] In a similar vein, Deng and Ma (2014) and Deng et al. (2014) observed that tourism activity negatively affected Chinese economic growth, principally because of weak institutions, price volatility and the crowding out of human capital.

[1]In the context of tourism, the term 'Dutch disease', also known as Beach disease, refers to unfavourable economic effects intourism-dependent regions or countries induced by a strong growth of the tourism sector. Specifically, a tourist boom can lead to a reallocation of resources away from other sectors of the economy towards the tourism sector andengender an appreciation of the domestic currency. Consequently, the traditional productive sectors become less competitive, which may cause a deindustrialization process with an adverse effect on resident welfare.

[2]As argued by Ghalia and Fidrmuc (2016), tourist flows depend heavily on the economic situation in the source country of tourists and political instability or turmoil in destination countries.

In terms of methodology, Granger causality tests with time series data,primarily within a vector error correction model framework,are the most widelyemployed technique in this field (e.g.,Balaguer and Cantavella-Jordá, 2002; Brida et al., 2008; Pavlic et al., 2015; Ridderstaat et al., 2014; Tang and Tan, 2015). Nevertheless, some recent studies have explored the economic growth-tourism link using increasingly sophisticated time series methodssuch astime-varying models (Antonakakis et al., 2015a; Arslanturk et al., 2011; Balcilar et al., 2014), nonlinear models (Brida et al., 2015; Phiri, 2015; Po and Huang, 2008; Wang, 2012),time-varying copula functions (Pérez-Rodríguez et al., 2015) and a VAR-basedspillover index approach (Antonakakis et al., 2015b).Another importantline of researchhas examined the nexus between economic growth and tourism using panel data techniques for a selected group of countries (Aslan, 2013; Lee and Chang, 2008;Narayan et al., 2010; Sequeira and Nunes, 2008;Tugcu, 2014).The great majority of these panel-data-based studies provide evidence supporting the TLG hypothesis.

3. Data description

The dataset in this study comprises a novel indicator of tourism activity as a proxy for the volume of international tourism and the rate of growth of real Gross Domestic Product (GDP henceforth) per capita in constant 2005 US dollars as a proxy for economic growth for each of the world's top ten countries in terms of tourism receipts (China, France, Germany, Italy, Mexico, Russia, Spain, Turkey, the UK and the US).Consistent with other studies (Balaguer and Cantavella-Jordá 2002; Dritsakis 2004; Kumar et al. 2016; Loganathan et al. 2012; Shahbaz et al. 2016), quarterly data areused in this study. The sample period spans from 1990Q1 to 2015Q4, with a total of 104 quarterly observations.

Three key variables havetraditionally been employed in the tourism economics literature to measure the volume of tourism flows: the total number of international tourist arrivals (Gunduz and Hatemi-J, 2005; Katircioglu, 2009; Kim et al., 2006; Tang and Abosedra, 2016), international tourism receipts (Arslanturk et al., 2011; Balaguer and Cantavella-Jordá, 2002; Chen and Chiou-Wei, 2009; Ridderstaat et al., 2014), and international tourism expenditures (Aslan, 2016; Cárdenas-García et al., 2015; Song et al., 2010; Tugcu, 2014). However, a major drawback of these common tourismactivity indicators is that such indicators only show a partial connection to economic growth. In particular, tourist arrivals indicate the number of international visitors;international tourism receipts reflect the income side and international tourism expenditures cover the expense side.However, it is widely accepted that astrong positive correlation exists amongthese variables because a larger number of tourism arrivals indicates more expenditures and more receipts. As noted by Zaman et al. (2016), the simultaneous use of these three tourismindicators in a regression model may cause serious problems of multicollinearity because of high correlations between these indicators.Acomprehensive indicator of tourism activity not affected by multicollinearity, constructed by applying Principal Component Analysis (PCA) to the three above-mentioned standard tourism variables, is utilized in the present study. Specifically, the new tourism development indicator is a weighted index of international tourist arrivals, international tourism receipts and international tourism expenditures derived using PCA. Its primary advantage is that this indicator combines, in a single composite index,the majority of the relevant information pertinent to the three traditional tourism variables.

Table 1 summarizes the results of the PCA for each of the ten countries under examination. The two first columns show the eigenvalue corresponding to the first principal component and the proportion of total variance explained by the first principal component, respectively.The eigenvalue for the first principal component clearly exceeds 1 for all countries, which indicates the relevance of the first principal component. By contrast, the eigenvalues for the second and third principal components, although not reported here for the sake of brevity, are below 1 for all countries. Consequently, following the Kaiser criterion, the second and third principal components are omitted from the analysis. The importance of the first factor is confirmed by the considerable proportion of variance in the data that accounted for the first principal component. Withthe exception only of Mexico, the first principal component alone explains more than 80% of the total variability for all countries under study and hence it may be considered a good summary indicator of tourism activity. The factor loadings of the first principal component are displayed in the intermediate columns of Table 1. Inspection of the factor loadings reveals that the three standard tourism variables enter the first principal component with a similar positive weight for virtually all countries. In addition, the last three columns of Table 1 show the correlation coefficient between the weighted tourism activity indicator and each of the three traditional tourism variables. As expected, there is a high positive correlation between the weighted tourism index and the three common tourism indicators for all countries. In fact, the correlation coefficients are above 0.75 in the vast majority of cases.

The data on the number of arrivals of international tourists, international tourism receipts in current US dollars and international tourism expenditures in current US dollarswere collected from the World Tourism Organization (Yearbook of Tourism Statistics, 2016: http://www2.unwto.org).[3] The data on real GDP per capita come from the World Bank's World Development Indicators database (CD-ROM, 2016).[4]

[3] International tourism receipts and international tourism expenditures have been converted into real terms by dividing both series by the US exchange rate prevailing in 2005 for each of the top-10 tourist destinations.

[4] The annual time series data are transformed into quarterly frequency data by applying a quadratic match-sum method, which is particularly appropriate for avoiding the small-sample problem. Furthermore, the quadratic match-

<<INSERT TABLE 1 HERE>>

Table 2provides the main descriptive statistics of the growth rates of the weighted index of tourism activity and real GDP per capita for each country over the whole sample period. The mean growth rates of both variables were positive for all countries. As expected, the highest mean growth of real GDP per capitawas observed for China, which is a reflection of the booming Chinese economy over the last twenty-five years. By contrast, Russia and Mexico have the lowest mean growth rates of real GDP per capita. The highest mean growth rate of tourism activity was observed for China and Russia. This result is not surprising given the extremely low beginning levels of tourism in both countries before the early 1990s. Furthermore, the lowest mean growth rates of tourism activity are noted for Italy and Germany. All of the time series of tourism and real GDP per capita growth are negatively skewed, indicating a higher probability of large decreases in these series than increases. The kurtosis exceeds the reference value of the Gaussian distribution (equal to 3) for all cases,implying that the growth rates of the weighted index of tourism activity and real GDP per capita are leptokurtic. This departure from normality is confirmed by the Jarque-Bera test statistics,which reject the null hypothesis of normality at the 1% level for all the time series. In addition, the Augmented Dickey-Fuller (ADF) unit root test was conducted to determine the order of integration of the time series. The results of the ADF test indicate that all variables are integrated in order one, I(1) so that changes in the growth rates of tourism and real GDP per capita are used to ensure the stationarityof the data.

<<INSERT TABLE 2 HERE>>

sum approach adjusts for seasonal variation in the data while transforming data from low frequency to high frequency. In this regard, Cheng et al. (2012) noted that the seasonality problem can be prevented using a quadratic match-sum approachbecausethis technique reduces the point-to-point data variations. Hence, the quadratic match-sum method is preferableto other interpolation alternatives because of its convenient operating procedure.

4. Methodology

This section briefly describes the key features of the QQ approach (Sim and Zhou 2015) as well as the model specification used in this study to examine the relation between tourism activity and economic growth.

The QQ method can be perceived as a generalization of the standard quantile regression model,which enables one to examine how the quantiles of a variable affect the conditional quantiles of another variable. The QQ approach is based on the combination of quantile regression and nonparametric estimation. First, conventional quantile regression is utilized to estimate the effect of an explanatory variable on the different quantiles of the dependent variable. The quantile regression methodology developed by Koenker and Bassett (1978) can be regarded as an extension of the classic linear regression model. Unlike OLS estimation, the quantile regression analyses the effect of the explanatory variables not only at the centre but also at the tails of the distribution of the dependent variable, thus allowing a more comprehensive characterization of the relation between variables. Second, local linear regression is employed to estimate the local effect of a specific quantile of the explanatory variable on the dependent variable. The local linear regression introduced by Stone (1977) and Cleveland (1979) avoids the so-called “curse of dimensionality” problem associated with purely nonparametric models. The basic idea behind this dimension-reduction technique is to fit a linear regression locally around a neighbourhood of each data point in the sample, assigning greater weight to closer neighbours. Therefore, combining these two approaches enablesmodelling the relation between quantiles of the explanatory variable and quantiles of the dependent variable, providing a greater amount of information than alternative estimation techniques such as OLS or standard quantile regression.

In the framework of the present study, the QQ approach is proposed to investigate the effect of the quantiles of tourism growth on the quantiles of economic growth of a country. This approach has its starting point in the following nonparametric quantile regression model:

$$GDP_t = \beta^{\theta}(TOUR_t) + u_t^{\theta} \tag{1}$$

where GDP_t represents the real GDP per capita growth of a given country in period t, $TOUR_t$ denotes the growth rate of the weighted index of tourism activity in that country in period t, θ is the θth quantile of the conditional distribution of thegrowth of real GDP per capita and u_t^{θ} is a quantile error term whose conditional θth quantile is equal to zero. $\beta^{\theta}(\cdot)$ is an unknown function because we had no prior information linking tourism and economic growth.

This quantile regression model measures the effect of tourismactivity growth on the distribution of the growth ofthe real GDP per capita of a country whilst allowing the effect of tourism growth to vary across different quantiles of real GDP growth. The primary advantage of this specification is its flexibility because no hypothesis was developed regarding the functional form of the relation between tourism growth and economic growth. However, a shortcoming of the quantile regression approach is its ability to capture dependence in its entirety. In this regard, the quantile regression model does not consider the possibility that the nature of tourism shocks may also influence the manner in which tourism and economic growth are related. For example, the effects of large positive tourism shocks can be different from the effects of small positive tourism shocks. In addition, economic growth can react asymmetrically to negative and positive tourism shocks.

Then, to analyse the relation between the θth quantile of real GDP per capita growth and the τth quantile of tourism activity growth, denoted by $TOUR^{\tau}$, Eq. (1) is examined in the neighbourhood of $TOUR^{\tau}$ employing local linear regression. Because $\beta^{\theta}(\cdot)$ is unknown, this function can be approximated by a first-order Taylor expansion around a quantile $TOUR^{\tau}$, such that

$$\beta^{\theta}(TOUR_t) \approx \beta^{\theta}(TOUR^{\tau}) + \beta^{\theta'}(TOUR^{\tau})(TOUR_t - TOUR^{\tau}) \tag{2}$$

where$\beta^{\theta'}$ is the partial derivative of $\beta^{\theta}(TOUR_t)$ with respect to $TOUR$, also called marginal effect or response,and is similar in interpretation to the slope coefficient in a linear regression model.

A prominent feature of Eq. (2) is that the parameters $\beta^{\theta}(TOUR^{\tau})$ and $\beta^{\theta'}(TOUR^{\tau})$ are doubly indexed in θ and τ. Given that $\beta^{\theta}(TOUR^{\tau})$ and $\beta^{\theta'}(TOUR^{\tau})$ are functions of θ and $TOUR^{\tau}$ and that$TOUR^{\tau}$ is a function of τ, it is clear that $\beta^{\theta}(TOUR^{\tau})$ and $\beta^{\theta'}(TOUR^{\tau})$ are both functions of θ and τ. Additionally, $\beta^{\theta}(TOUR^{\tau})$ and $\beta^{\theta'}(TOUR^{\tau})$ can be renamed as $\beta_0(\theta,\tau)$and $\beta_1(\theta,\tau)$, respectively. Accordingly, Eq. (2) can be rewritten as

$$\beta^{\theta}(TOUR_t) \approx \beta_0(\theta,\tau) + \beta_1(\theta,\tau)(TOUR_t - TOUR^{\tau}). \tag{3}$$

By substituting Eq. (3) in Eq. (1), the following equation is obtained:

$$GDP_t = \underbrace{\beta_0(\theta,\tau) + \beta_1(\theta,\tau)(TOUR_t - TOUR^{\tau})}_{(*)} + u_t^{\theta}. \tag{4}$$

As can be seen, the part (*) of Eq. (4) is the *θth* conditional quantile of real GDP per capita growth. However, unlike the standard conditional quantile function, this expression reflects the relation between the *θth* quantile of real GDP per capita growth and the *τth* quantile of tourism activity growth because the parameters $\beta_0$and $\beta_1$are doubly indexed in θ and τ. These parameters may vary across different *θth* quantiles of real GDP per capita growth and *τth* quantiles of tourism growth.Moreover, at no time a linear relation is assumed between the quantiles of the variables under study. Therefore, Eq. (4) estimates the overall dependence structure between economic growth and tourism activity growth throughthe dependence betweentheir respective distributions.

Estimating Eq. (4)requires replacing$TOUR_t$ and $TOUR^{\tau}$with their estimated counterparts $\widehat{TOUR}_t$and $\widehat{TOUR}^{\tau}$, respectively. The local linear regression estimates of the parameters $b_0$and b_1, which are the estimates of $\beta_0$and β_1, are obtained by solving the following minimization problem:

$$\min_{b_0,b_1} \sum_{i=1}^{n} \rho_\theta \left[GDP_t - b_0 - b_1\left(\widehat{TOUR}_t - \widehat{TOUR}^{\tau}\right)\right] K\left(\frac{F_n(\widehat{TOUR}_t) - \tau}{h}\right) \quad (5)$$

where$\rho_\theta(u)$ is the quantile loss function, defined as $\rho_\theta(u) = u\left(\theta - I(u < 0)\right)$, Ibeingthe usual indicator function. $K(\cdot)$ denotes the kernel function and h is the bandwidth parameter of the kernel.

The Gaussian kernel, which is one of the most popular kernel functions in economic and financial applications because of its computational simplicity and efficiency, is used in this study to weight the observations in the neighbourhood of $TOUR^{\tau}$. The Gaussian kernel is symmetrical around zero and assigns low weights to observations farther away. Specifically, in our analysis, these weights are inversely related to the distance between the empirical distribution function of $\widehat{TOUR}_t$,denoted by $F_n\left(\widehat{TOUR}_t\right) = \frac{1}{n}\sum_{k=1}^{n} I(\widehat{TOUR}_k < \widehat{TOUR}_t)$, and the value of the distribution function that corresponds to the quantile $TOUR^{\tau}$, denoted by τ.

The choice of the bandwidth is critical when using nonparametricestimation techniques. The bandwidth determines the size of the neighbourhood surrounding the target point and, therefore, the bandwidth controls the smoothness of the resulting estimate. A larger bandwidthindicates a greater potential for bias in estimateswhereas a smaller bandwidth can lead to estimates with greater variance. Thus, a bandwidth that strikes a balance between bias and variance must be selected. Following Sim and Zhou (2015), a bandwidth parameter $h = 0.05$ was employed in this study.[5]

5. Empirical results

5.1. Estimates of the QQ approach

This sectionpresents the primary empirical results of the QQ analysisof tourism growth and real GDP per capita growth for the world's top ten tourist destinations. Figure 1 (a-j) displays the estimates of the slope coefficient $\beta_1(\theta, \tau)$, which captures the effect of the τth quantile of tourism growth on the θth quantile of growth inreal GDP per capita,at different values of θ and $\tau$for the ten countries under consideration.

<<INSERT FIGURE 1 HERE>>

Several interesting results emerge from the graphsin Figure 1.First, the relation between tourismgrowth and economic growth is positive for most combinations of quantiles of both variables inall countries. This findingis consistent with the positive association between tourism development and economic growththat has beenextensively documented in prior literature for a wide range of countries and can be justified by the multiple beneficial effects of tourism on the economy of a country (e.g.,Balaguer and Cantavella-Jordá, 2002; Chen and Chiou-Wei, 2009; Cortés-Jiménez and Pulina, 2010; Gunduz and Hatemi-J, 2005; Ridderstaat et al., 2014).Second, despite the prevailing positive connection,there is a considerable heterogeneity across countries regarding the tourism-economic growth nexus. This result may be attributed to the significant differences across countries in terms of the relative importance of tourism in their overall

[5]A number of alternative values of the bandwidth have also been considered. However, the results of the estimation remain qualitatively identical.

economies, the size and openness of each economy and itsproduction capacity constraints,the role and effectiveness of local businesses in supporting tourism sectordevelopment and the possible negative externalities caused by tourism in some countries.It is also worth mentioning that ignoring such heterogeneity across countries could lead to inaccurate inferences. Third, within each country,sizeable variations of the slope coefficient are observed across different quantiles of tourism growth and real GDP per capita growth. This finding suggests that the link between tourism development and economic growth is not uniform across quantiles, but thatthis relationdepends on both the sign and size of tourism shocks in a country and the specific phase of the economic cycle that a country is experiencing. In addition, the most pronounced (in absolute value) relation between tourism and the overall economy is observed for most countries in extreme circumstances of tourism and economic growth, that is, when considering the lowest and highest quantiles of both variables.

Examining the results by country, the weakest connection between international tourism growth and real GDP per capita growth was observed for China.The tourism-economic growth linktakes quite small or even negative values for the vast majority of combinations of quantiles of tourism and real GDP growth, implying that there is apparently no significant relation between tourism activity and economic development in China. This result may be explained by the extremely limited weight of tourism on the Chinese economy and is consistent with the empirical evidence previously reported for China by, among others, Chiang (2012), Deng and Ma (2014), He and Zheng (2011)and Li et al. (2015).In this regard, according to data of the World Travel & Tourism Council (WTTC) Economic Impact Report, the direct contribution of tourism to the Chinese economy in 2014 was 2.6% of the total Chinese GDP.In fact, a relatively pronounced relation, with a negative sign, was onlyobserved in the area that combines the lowest quantiles of tourism activity growth (0.05-0.10) with the intermediate to upper quantiles of real GDP capita growth (0.60-0.75). This finding suggests that sharp declines in international tourism, which are represented by the lowest quantiles of tourism growth, appear to have a relevantdownward effect on the overall Chineseeconomy,primarily in times of buoyant economic growth, which is represented by the intermediate to upper quantiles of economic growth.

Thelink between tourism developmentand economic growth is equallyweak for Germany. More precisely, the tourism-economic growthrelationhas extremely low values for most combinations of quantiles of tourism and real GDP per capita growthin Germany, which indicates that,in general, tourism cannotbe regarded as a major driver of the German economy. This minor role of the German tourism industry is not surprising if we consider that Germany, which is the leading European economy and the second largest exporter worldwide,is basically specialized in non-tourism-related and technologically advanced industriessuch as automobiles, chemicals, electrical equipment and machinery (Antonakakis et al., 2015b).In fact, according to the WTTC Economic Impact Report, in 2014, the direct contribution of tourism to the German economy was 3.8% of the total German GDP. In the case of Germany, the mainexception to the generally poor tourism-economic growth nexus islocated in the area that combines the lowest quantiles of tourism growth (0.05-0.15) with the lowest quantiles of real GDP per capita growth (0.05-0.15). The relatively high positive relation observed in this region can be interpreted to indicate that sharp falls in tourismappear to contribute to the aggravation of the German economic situation duringperiods of deep economic downturn.

Notably, France and Italy share some commonalities regarding the association between tourismdevelopment and economic growth. Inboth countries, the tourism-economic growth connection is positive for the great majority of combinations of quantiles. However, the intensity of the relation is in general not extremely high, which suggests that the economies of France and Italy are not excessively dependent on the tourism industry. In particular, the most accentuated positive connection for both countriesis in areas combininglow quantiles of tourism growth (0.15-0.30) with the lowest quantiles of real GDP per capita growth (0.05-0.15). A possible explanation for this result is that significant drops in inbound tourism inFrance and Italy appear to have led to further deterioration of theirrespective economiesduring a strong economic recession.

Mexico, the UK and, to a lesser extent, Spain exhibit a similar pattern of the association between tourism development and economic activity. The tourism-economic growth link is positive for Mexico and the UK regardless of the combinations of quantiles of tourism and real GDP per capita growth, whereas for Spain thislink shows small negative values in some regions of the sample. The most intense relation between tourism and the overall economy is positive for these three countries and is identified in the area that combines the highest quantiles of tourism (0.90-0.95 for Mexico and the UK and 0.70-0.80 for Spain) with the lowest quantiles of real GDP growth per capita (0.05-0.15 for the three countries). This particularly pronounced positiveconnection in times of strong tourism growth and deep economic downturn suggests that the tourism sector acts as a relevant engine of economic growth for these countries during periods characterized by a booming tourism sector and poor general economic performance. Bycontrast, the tourism-economic growth nexus is rather weak in the areas that combine the highest quantiles of tourism growth with the highest quantiles of real GDP per capita growth, indicating that the tourism industry loses its status of key growth driver in times of a buoyant economy. In any case, it is notable that the strongest connection between tourism activity and the overall economy was observed for Mexico, reflecting the heavily tourism-dependent nature of the Mexican economy. The positive effect of tourism on economic growth in Mexico, the UK and Spain is consistent with the evidence previously reported by Brida et al. (2008), Santana-Gallego et al. (2010) and Cortés-Jiménez and Pulina (2010), respectively.

The connection between inbound tourism and the overall Russianeconomy is also predominantly positive for the great majority of combinations of quantiles of tourism and real GDPper capita growth. In this case, the strongest positive relationis manifested in the regionthat combines thelowest quantiles of tourism growth (0.05-0.10) and theintermediate to upper quantiles (0.45-0.65) of real GDP per capita growth. This finding suggests thatRussian economic developmentappears to have an encouraging effect on the tourism sectorprincipally during periods of healthy economic growth and low or negative growth in tourism activity. A possible explanation for this phenomenon is that economic expansion and the subsequent availability of resources, investments and infrastructure may generate a positive economic climate that favours tourism activities in Russia. This singular nature of the tourism-economic growth nexus may also be related to the fact that the Russian tourism industry remains in its infancy. In fact,the deregulation of tourism in Russia began in the 1990s, after the collapse of the Communist regime.

In the case of Turkey, a positiverelation between tourismand economic growth was also consistently observed for most combinations of quantiles of tourism and real GDP per capita growth. The most pronounced positive tourism-economic growth link was found in the area combining the intermediate to upper quantiles of tourism growth (0.50-0.65) with the lowest quantiles of real GDP per capita growth (0.05-0.10). This result indicates that the effect of tourism on Turkish economic growthis particularly beneficial in periods of robust growth in the tourism sector and extremely adverse conditions in the overall Turkish economy. However, a strong positive association betweentourism activity and economic development was also noted in the area that combines the highest quantiles of tourism growth (0.80-0.90) with thehighest quantiles of economic growth (0.90-0.95), suggesting that tourism also has a significant positive effect on the Turkish economy in times of a booming tourism industry and a booming economy. This empirical evidence is consistent with the findings ofArslanturk et al. (2011), Aslan (2016), Katircioglu (2009) and Ozturk and Acaravci (2009), who demonstrated that the relation between tourism and economic growth in Turkey is not stable over time, but depends on general business conditions and major economic events.

Finally, the tourism-economic growth nexus for the US was also prevalently positive for most combinations of quantiles of tourism and real GDP per capita growth. The highest positiveconnection betweentourism growth and the US general economywas detected in the regionthat combines the intermediate quantiles of tourism growth (0.40-0.55) with the lowest quantiles of real GDP growth (0.05-0.10). However, a relatively strong positive relationwas also observed in the region combining the highest quantiles of tourism growth (0.85-0.90) with the lowest quantiles of real GDP growth (0.05-0.10).This result indicates that inboundtourism appears to have a particularly beneficial effect on the US economy during times ofsharp economic downturn and vigorous growth of the tourism sector.By contrast, the weakest relation was found in the region combining the lowest quantiles of tourism growth (0.05-0.15) with the highest quantiles of real GDP growth (0.85-0.95), indicating that in times of economic boom and low tourism growth, the tourism-economic growth link is quite limited. Accordingly, it appears clear that tourism activity only has a significant influence on US economic activity during a strong economic recession. This evidenceis consistent with the results of Tang and Jang (2009), in the sense that,in general, the US tourism industry is not a key driving factor of the overall US economy, which seems reasonable considering that the US is not a particularly tourism-oriented economy.

5.2. Checking the validity of the QQ method

The QQ approach can be viewed as a method that decomposes the estimates of the standard quantile regression model, enabling specific estimates to be obtained for different quantiles of the explanatory variable. In the framework of the present study, the quantile regression model is based onregressing the θth quantile of real GDP per capita growth on tourism growth; hence the quantile regression parameters are only indexed by θ. However, as stated earlier, the QQ analysis regresses the θth quantile of growth of real GDP per capita on the τth quantile of tourism activity growth,and, hence, its parameters will be indexed by both θ and τ. Thus, the QQ approach contains more disaggregated information regarding the tourism-economic growth link than the quantile regression model asthis relation is perceived by the QQ methodto be potentially heterogeneous across the quantiles of tourism activity growth.

Given this property of decomposition inherent in the QQ approach, it is possible to use the QQ estimates to recover the estimates of the standard quantile regression. Specifically, the quantile regression parameters, which are only indexed by θ, can be generated by averaging the QQ parameters along τ. For example, the slope coefficient of the quantile regression model, which measures the effect of tourism growth on the distribution of real GDP per capita growth and is denoted by $\gamma_1(\theta)$, can be obtained as follows:

$$\gamma_1(\theta) \equiv \overline{\hat{\beta}_1}(\theta) = \frac{1}{S}\sum_\tau \hat{\beta}_1(\theta, \tau) \tag{6}$$

where S=19 is the number of quantiles $\tau = [0.05, 0.10, \ldots, 0.95]$ considered.

In this context, a simple manner of checking the validity of the QQ approach is to compare the estimated quantile regression parameters with the τ-averaged QQ parameters. Figure 2 plots the quantile regression and averagedQQ estimates of the slope coefficientthat measures the effect of growth in tourism activity on real GDP per capita growth for all the countries under study.

<<INSERT FIGURE 2 HERE>>

The graphs in Figure 2 (a-j) reveal that the averaged QQ estimates of the slope coefficient are quite similar to the quantile regression estimates for all countries regardless of the quantile considered. This graphical evidence provides a simple validation of the QQ methodology by showing that the primary features of the quantile regression model can be recovered by summarizing the more detailed information contained in the QQ estimates.Therefore, Figure 2 largely confirmsthe results of the QQ analysis reported earlier. First, the effect of tourismgrowth on economic growth is consistently positive across quantiles for all countries. In fact, a negative relation between tourism development and the overall economic performance was only found for some quantiles of real GDP per capita growth in China, Germany and Italy. Second, a notable heterogeneity across countries and across quantiles within each country in terms of the link between tourism growth and real GDP growthwas also observed. Specifically, the largest effect of tourism growth on the overall economy of most countrieswas identified at the lowestquantiles of their respective distributionsof real GDP per capita growth. This finding corroborates the argument that the influence of tourism oneconomic growth tends to be stronger in an environment ofeconomic downturn, suggesting that the tourism sector becomes an important engine of economic growth primarily during periods of economic contraction.

6. Concluding remarks

This study investigates the empirical validity of the tourism-led growth hypothesis for the top ten tourist destinationsworldwide over the period 1990-2015 using the QQ (quantile-on-quantile) approach recently developed by Sim and Zhou (2015). The QQ methodology allows one to estimate how the quantiles of tourism growth affect the quantiles of economic growth, thus providinga more precise description of the overall dependence structure between tourism activity and economic growth compared with conventional techniques such as OLS or quantile regression.

Our empirical results show that the relation between tourismdevelopment and economic growth is primarily positive for all countries, although there are wide differences across countries and across different quantiles of tourism and real GDP per capita growth within each country. The heterogeneity among countries in terms of the tourism-economic growth nexus may be attributed to differences in the relative weight of the tourism industryin the overall economy of each country, the size and openness of each economy and itsproduction capacity constraints,the relevance of local businesses in the tourism industry of each country and the possible negative externalities caused by tourism growth in some countries. In particular, the weakest relationbetween tourism and economic growth was noted for China and Germany,most likelybecause of the scant directcontribution of tourismto the respective economies of those two countries. Furthermore, the marked divergence across quantiles of tourism and economic growth indicates that the tourism-economic growth link is not uniform, but depends on both the phase of the economic cycle and the sign and size of tourism shocks. In this respect, for a wide range of countries, such as France, Italy, Mexico, Spain, Turkey, the UK and the US, the most pronounced link between tourism activity and economic growth was observed only during periods of deep economic downturn.

The empirical evidence presented in this study may have important implications for policy makers, who should consider the specific phase of the economic cycle when designing their tourism policies.Specifically, tourism-enhancing policies may be particularly beneficial to the general economy of many countries during periods of economic downturn. Hence, the tourism sector may play a strategic role in stimulating economic recovery. In any case, this study can be regarded as a first attempt to analyse the link between tourism and economic growth depending on the overall economic conditions and the particular conditions prevailing in the tourism sector. Therefore, future research on the tourism-economic growth nexus under different scenarios of economic and tourism growth appears necessary to shed more light on this issue.

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Table 1:PCA results for the weighted tourism activity index

Country	Eigenvalue PC1	Proportion explained by PC1	Factor loadings of PC1			Correlation with weighted tourism index		
			TOARVL	TORREC	TOREXP	TOARVL	TORREC	TOREXP
China	2.678	0.893	0.576	0.608	0.546	0.777	0.959	0.685
France	2.436	0.812	0.520	0.634	0.572	0.766	0.996	0.895
Germany	2.843	0.948	0.572	0.590	0.570	0.909	0.976	0.991
Italy	2.524	0.841	0.545	0.569	0.616	0.680	0.946	0.920
Mexico	2.277	0.759	0.444	0.618	0.648	0.521	0.962	0.980
Russia	2.627	0.876	0.550	0.603	0.577	0.680	0.925	0.986
Spain	2.802	0.934	0.560	0.588	0.583	0.820	0.981	0.992
Turkey	2.929	0.976	0.580	0.580	0.572	0.966	0.967	0.981
UK	2.796	0.932	0.591	0.574	0.567	0.881	0.773	0.989
US	2.861	0.954	0.577	0.586	0.569	0.850	0.921	0.980

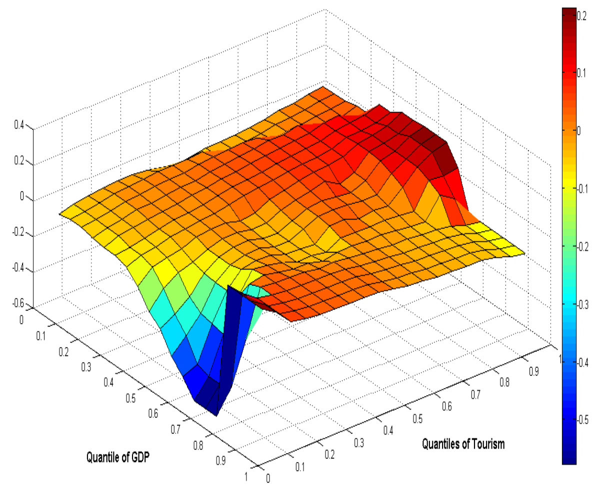
Note: This table summarizes the results of the principal component analysis (PCA) conducted to derive the weighted tourism activity index for the top ten tourist countries worldwide in terms of tourism receipts from1990-2015 (a total of 104 quarterly observations). PC1 denotes the first principal component of the three standard tourism variables (tourist arrivals, tourism receipts and tourism expenditures). The numbers shown include the eigenvalue corresponding to the PC1 for each country, the proportion of total variance accounting for the PC1, the factor loadings of the PC1 and the correlation between the weighted tourism index and each of the three traditional tourism indicators. PTOARVL, TORREC and TOREXPindicatethenumber of tourist arrivals, tourism receipts and tourism expenditures, respectively.

Table 2: Descriptive statistics of the growth rates of the weighted index of tourism activity and real GDP per capita

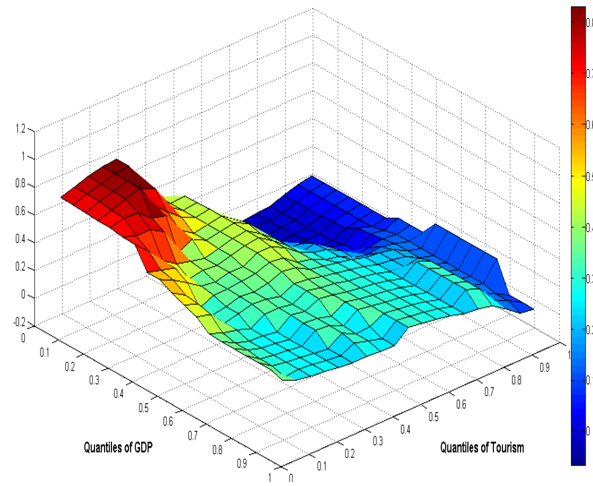
	Mean	**Min.**	**Max.**	**Std. Dev.**	**Skewness**	**Kurtosis**	**J-B Stats.**	**ADF**
Panel A: GDP per capita growth rate								
China	0.0210	-0.0044	0.0414	0.0068	-0.5148	5.3473	28.198***	-3.751***
France	0.0079	-0.0733	0.0382	0.0148	-1.7139	11.0429	321.67***	-4.521***
Germany	0.0034	-0.0388	0.0268	0.0069	-1.9626	16.4552	843.10***	-4.536***
Italy	0.0039	-0.0331	0.0171	0.0065	-1.3821	8.6459	169.59***	-3.953***
Mexico	0.0027	-0.0527	0.0268	0.0100	-2.1609	14.3107	629.208***	-4.686***
Russia	0.0025	-0.0644	0.0381	0.0195	-1.1444	4.3294	30.703***	-3.696***
Spain	0.0037	-0.0237	0.0141	0.0060	-1.1331	5.3179	44.3290***	-3.222**
Turkey	0.0060	0.0040	0.0008	0.0010	-0.0037	1.6939	7.3127**	-4.831***
UK	0.0038	-0.0271	0.0162	0.0055	-2.1360	11.4721	386.37***	-3.629***
US	0.0033	-0.0211	0.0140	0.0049	-1.6338	8.2838	165.63***	-4.355***
Panel B: Tourism activity growth rate								
China	0.0156	-0.1386	0.1871	0.0336	-0.1990	13.4484	460.08***	-4.640***
France	0.0100	-0.1058	0.0898	0.0241	-1.1696	9.8632	221.25***	-4.768***
Germany	0.0052	-0.0769	0.0604	0.0178	-0.4328	7.0402	71.848***	-4.191***
Italy	0.0026	-0.0735	0.0495	0.0162	-0.4795	7.5003	89.101***	-4.342***
Mexico	0.0101	-0.1046	0.0704	0.0182	-2.4470	18.2869	1084.2***	-4.745***
Russia	0.0132	-0.1294	0.0919	0.0347	-1.3364	6.9494	95.706***	-4.205***
Spain	0.0094	-0.1140	0.0711	0.0214	-1.7932	13.4594	514.51***	-4.624***
Turkey	0.0093	-0.1075	0.0933	0.0227	-0.8524	11.8460	341.54***	-4.703***
UK	0.0080	-0.1367	0.0622	0.0224	-3.0367	19.5789	1311.9***	-4.137***
US	0.0069	-0.0957	0.0616	0.0178	-1.8728	14.5856	623.91***	-4.708***

Note: This table reports the primary descriptive statistics of the quarterly growth rates of the weighted index of tourism activity and real GDP per capita of the top ten countries worldwide in terms of tourism receipts from 1990-2015 (a total of 104 quarterly observations). Std. Dev. and J-B stand for standard deviations and statistics of the Jarque-Bera test for normality, respectively. ADF denotes the Augmented Dickey-Fuller unit root test. *** indicates rejection of null hypothesis of normality at a 1% level of significance.

Figure 1: Quantile-on-Quantile (QQ) estimates of the slope coefficient, $\hat{\beta}_1(\theta, \tau)$



a). China



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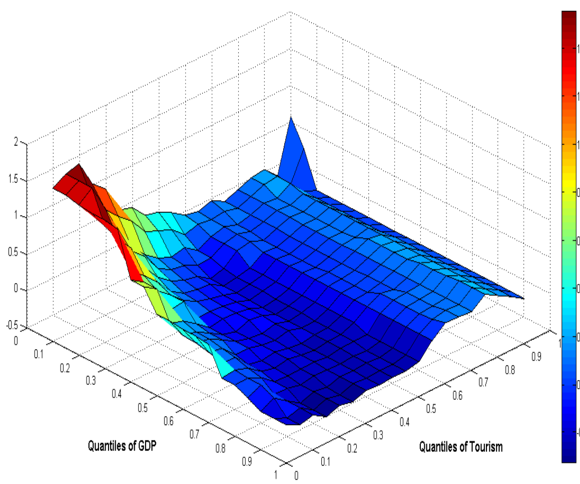
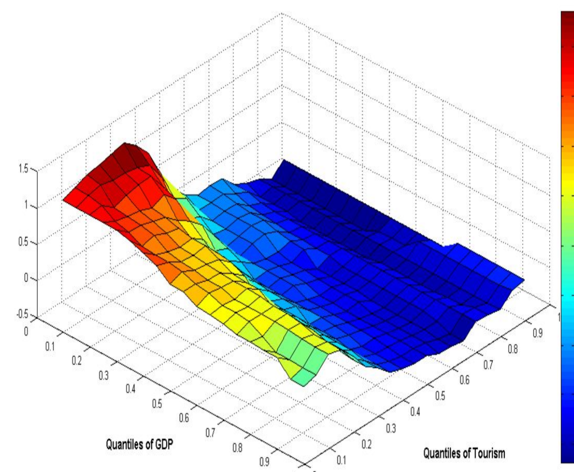
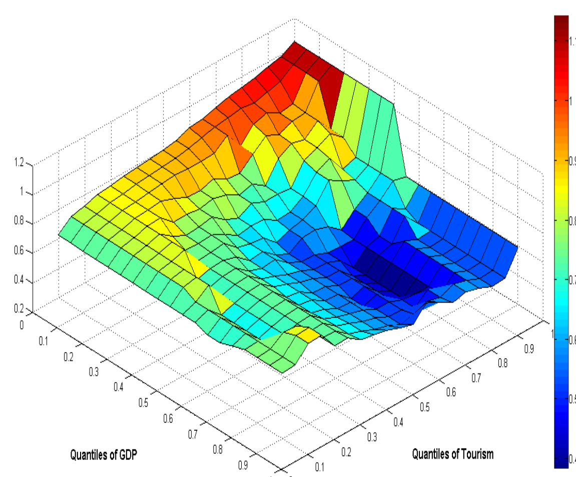


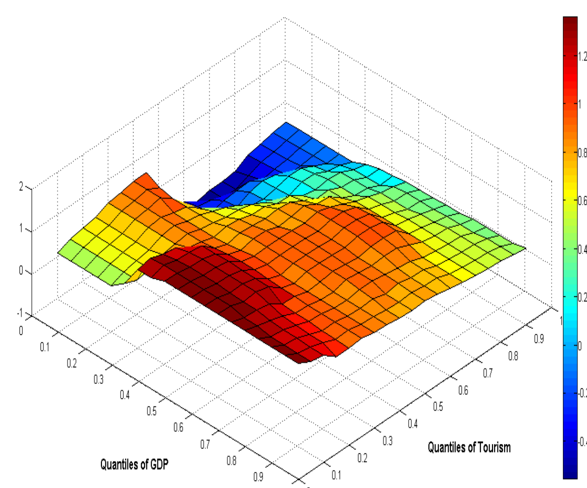
c). Germany



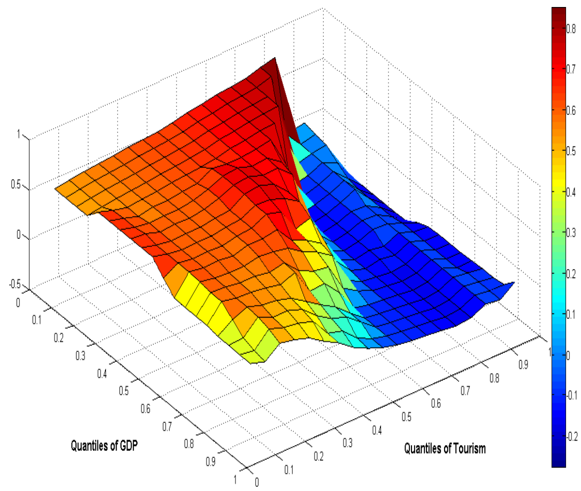
d). Italy



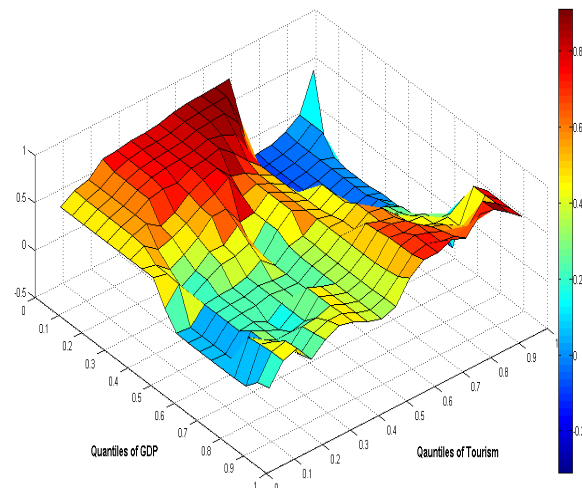
e). Mexico



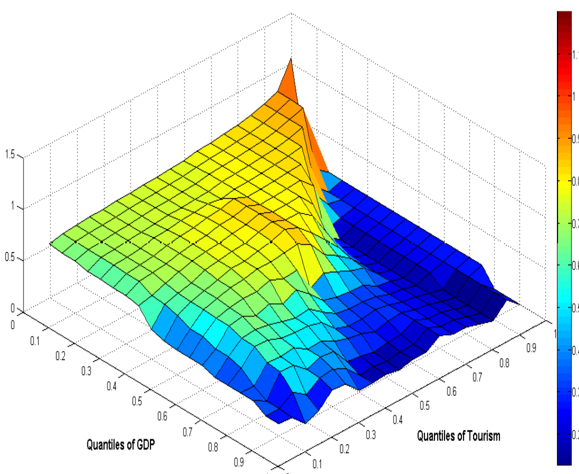
f). Russia



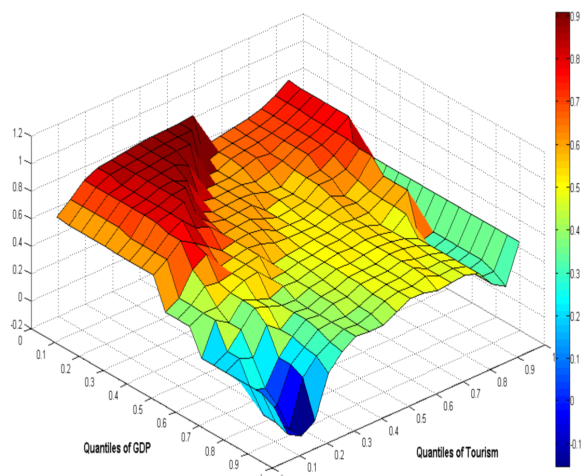
g). Spain



h). Turkey



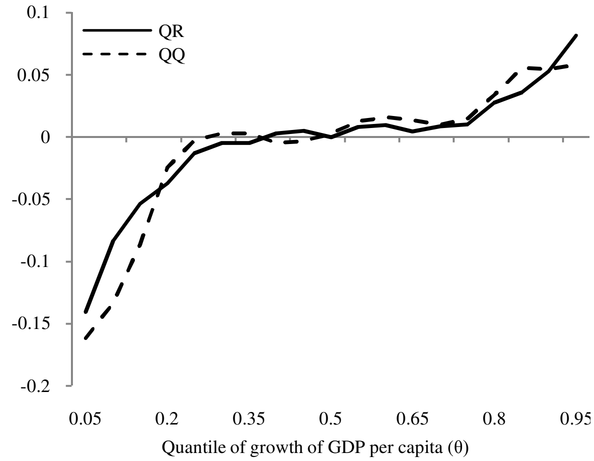
i). UK



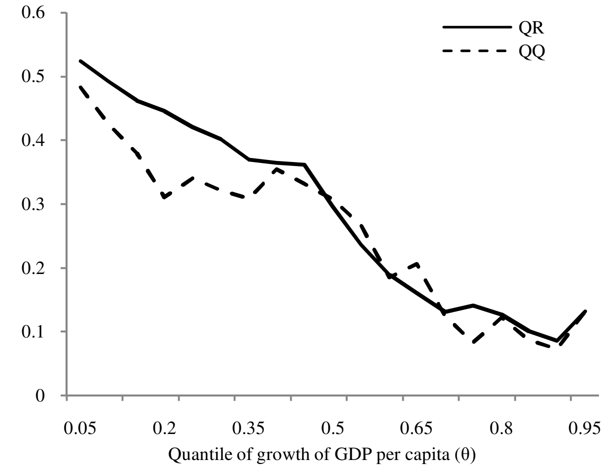
j). US

Note: These graphs show the estimates of the slope coefficient $\beta_1(\theta,\tau)$ in the *z*-axis against the quantiles of growth of GDP per capita (θ) in the *x*-axis and the quantiles of tourism growth (τ) in the *y*-axis.

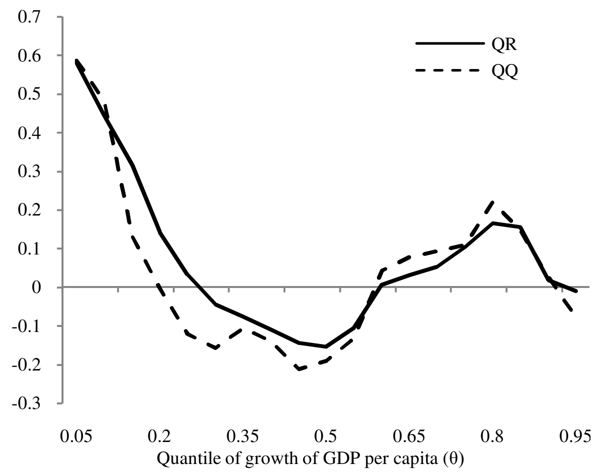
Figure 2: Comparison of Quantile Regression and QQ estimates



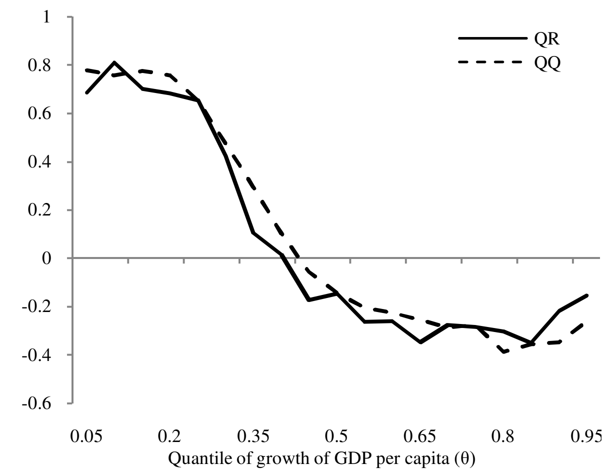
a). China



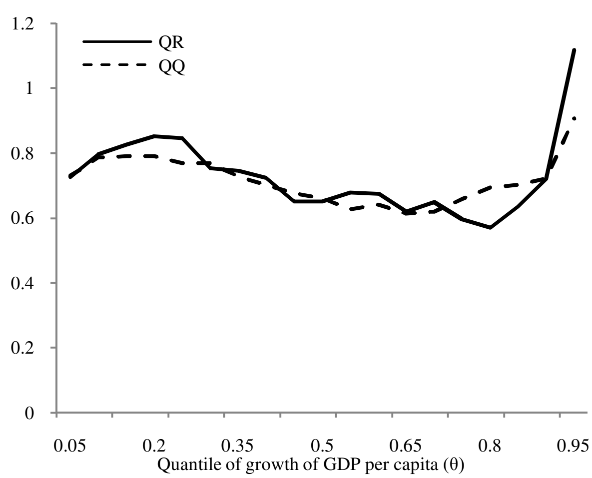
b). France



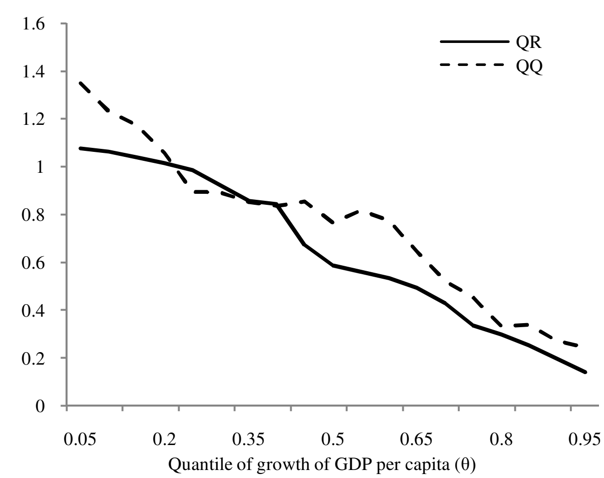
c). Germany



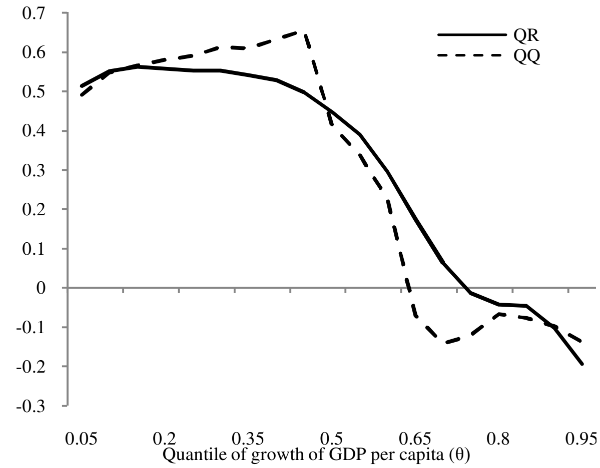
d). Italy



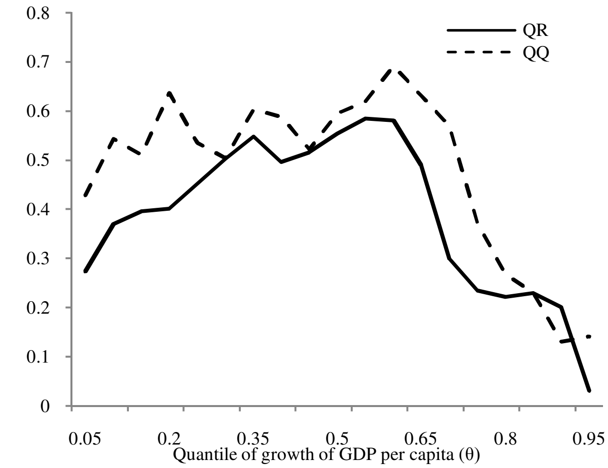
e). Mexico



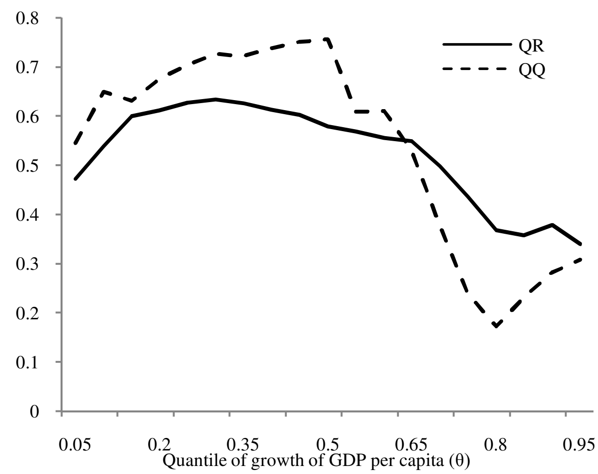
f). Russia



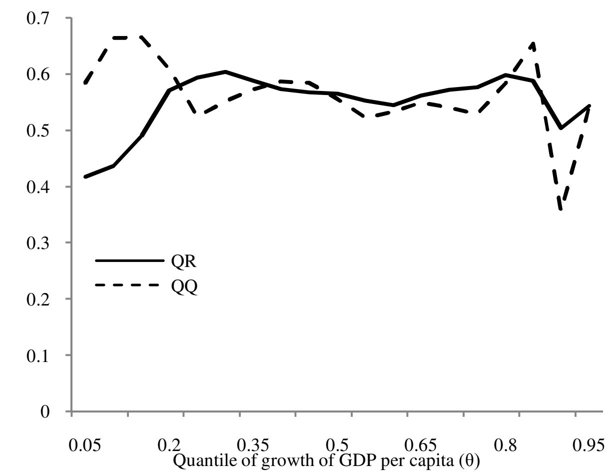
g). Spain



h). Turkey



i). UK



j). USA

Note: These graphs display the estimates of the standard quantile regression parameters, denoted by QR (continuous black line), and the averaged QQ parameters, denoted by QQ (dashed black line), at different quantiles of real GDP per capita growth for all countries examined.