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Are Holidays Good or Bad for the Economy? Cross-national Evidence from 101 Countries

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Abstract

Motivation and aim: In this paper, we attempt to investigate the effects of public holiday on economic growth using a cross-country model approach, and further to examine what is the optimal number of holidays to sustain economic growth? We select 101 countries worldwide (depend on data availability) and test the impact of holidays on economic growth for the year 2019.

Methods and material: Our final estimating model consists of growth in real GDP as the dependent variable; while the regressors are the number of public holidays, growth in labour productivity, capital, growth in tourism, governance, foreign direct investment and growth in urbanisation. We estimate the relationship between economic growth and holidays using three estimators, namely, Ordinary Least Square with robust standard error, the Robust regression M-estimation and quantile regression.

Key findings: Our results suggest that a linear relationship between holiday and economic growth is very weak. On the hand, a nonlinear relationship between economic growth and holidays, indicate an inverted U-shaped curve; implying that initially as the number of public holidays increases, economic growth increases, until an optimal point, thereafter, economic growth decreases as the number of holidays increase further. For robustness, our nonlinear model using quantile regression suggest that the inverted U-shape curve between economic growth and holidays are found at the 30th, 40th, 50th, 60th, 70th, 80th and 90th quantiles.

Policy implications: Results of our study can be translated into some practical implications. First, a government or companies should consider the concept of "optimal" number of public holidays to strike the balance between the amount of leisure time and working hours, so as to sustain economic growth. A country with strong economic growth able to increase the number of public holidays, as well as to raise the income level, in turn, increase the well-being and keep the public/workers happy. Secondly, the government or companies should set up leisure (recreational) facilities in public areas and workplaces to enhance the variety of leisure activities and promote active and healthy leisure participation.

JEL Classifications:
C21, E71, O20

Keywords:
Economic growth; public holidays; cross-country analysis; nonlinear relationship; quantile regression

Are Holidays Good or Bad for the Economy? Cross-National Evidence from 101 Countries

1. INTRODUCTION

The effects of public holidays on the stock market have been one of the most researched topics in the finance literature. Holiday effect tests the anomalies of the efficient market theory of the stock market. The holiday effect is driven by common public holidays, such as Christmas, New Year, and months of Ramadan, among others. The finance literature identified two types of holiday effects: the pre-holiday effect, where stock returns on the days preceding the holidays are significantly high; and post-holiday effect, when the stock returns for the days succeeding the holidays are significantly high compared to those in other days (Pinto et al., 2022). The behavioural finance explains the effect of happiness and sadness on human behaviour and find that happier investor tends to believe in more positive outcomes (Dodd & Gakhovich, 2011). Thus, holidays affect investor sentiment (being happy or sad), and in turn, investor sentiment affect stock prices and stock market returns (Thaler, 1999; Kavanagh & Bower, 1985). As a matter of fact, numerous studies have shown that investor sentiment is closely associated with holidays (Pantzalis & Ucar, 2014; Bialkowski et al., 2012; Baker & Wurgler, 2006). However, the effects of holiday on investors sentiment are not long lasting. According to Liu et al. (2023), investor sentiment significantly increases when entering any form of holiday, but it slows down and diminishes when the length of the holiday exceeds a certain threshold. They also found that investor sentiment deteriorates rapidly when the stock market enters trading hours.

It is a fact that public holidays not only affect the stock market but also economic growth and other sectors of the economy. The study relating holidays and economic growth is rather lacking in the growth literature (Dastidar & Apergis, 2021). Nonetheless, holidays or vacation provide avenue for individuals to spend their leisure time as well as leisure activities, away from work. Studies have indicated that leisure play an important role in affecting happiness and increase their well-being (Wang & Wong, 2011; Wei et al., 2015). Bloom et al. (2011) posited that experiences of relaxation and detachment from work positively influenced health and well-being even after returning home. According to Wang et al. (2022), numerous studies have suggested that leisure time and leisure activities enhance individuals' physical and mental health, promote their quality of life and well-being, improve the quality of individuals' work, reducing work pressure, which eventually promotes work efficiency, in turn, promote economic growth (Bloom et al., 2013; Macchia & Whillans, 2019).

According to Isham et al. (2021), "happy-productive worker" hypothesis posits that worker well-being is a positive determinant of greater level of employee and firm-level labour productivity. Improve physical and mental health, higher levels of well-being, reduction in work-relate stress, and engaging in workplace wellness programmes can enhance productivity. Individuals displaying higher levels of well-being tend to report higher levels of labour productivity. On one hand, study on China, Wei et al. (2015) found that passive leisure activities such as watching TV and surfing on the internet can promote greater level of well-being compared to active leisure activities such as exercising, socialising and shopping. On the other hand, Wei et al. (2022) exerts that sports/health care-type leisure is most helpful in improving individual well-being, followed by general leisure, family-friend leisure and stationary leisure.

In this paper, we attempt to investigate the effects of public holiday on economic growth using a cross-country model approach, and further to examine what is the optimal number of holidays to sustain economic growth? We select 101 countries worldwide (depend on data availability) and test the impact of holidays on economic growth for the year 2019. We estimate the growth-holiday model by using three estimators, namely, Ordinary Least square (OLS) with robust standard error, Robust regression using M-estimation, and the quantile regression. Also, we test for both linear and nonlinear relationship between holidays and economic growth.
In view of the above premises, the paper is organized as follows. In Section 2, we provide a brief discussion on the related literature linking holidays and economic growth. Section 3 describes the data and method used in the analysis. In Section 4 we discuss the empirical results. In Section 5, we conclude.

2. LITERATURE REVIEW

Quality labour is an important factor input in the production process to increase output. By increasing the number of labour or working hours will increase output. However, excessive working hours will lead to fatigue, accidents and illness, and deteriorating social cohesion, among others (Pencavel, 2014; Collewet & Sauermann, 2017: Merz & Osberg, 2006; Cette et al., 2011). According to a study by Cette et al. (2011) on 18 OECD countries, that, a 1% increase in working time would lead to a decrease in productivity of -0.9% for the threshold of 1925 hours and of 1% for the threshold of 2025 hours. On the other hand, Pencavel (2014) exerts that those who work at least 12 hours each day or at least 60 hours per week had considerably higher injury hazard rates than other workers. On the other hand, a study on a sample of part-time workers in the call centre agents in the Netherlands, Collewet and Sauermann (2017) found that an increase in working hours by 1% leads to an increase in output by only 0.9% (measured as the number of calls answered). Collewet and Sauermann further noted that the decreasing in productivity would be much stronger for full-time workers.

Despite low number of research was done investigating the impact of the number of public holidays on economic growth, several studies give us some insight on this relationship. For example, a study by Bruno et al. (2006) on 12 countries in the European Union, found that holidays adversely affect economic growth in Italy, France, Germany, Sweden, the Netherland and Portugal; while in Austria, Belgium, Denmark, Finland and Spain, holidays boost economic growth. As for the sectoral level, the results are at best mixed. On the other hand, Rosso and Wagner (2021) investigate 222 countries for the period 2000-2019, and discover that increase in public holidays has positive effects on economic growth. However, at the sectoral level, extra holidays only affect the manufacturing and the services sectors.

A study on Hong Kong by Ramasamy et al. (2008) suggested that an extra day holiday in Hong Kong will increase consumption expenditure by 0.66%, this implies that on average, each resident would consume about $213 due to the extra day off, during a quarter. Dastidar and Apergis (2020) examine the impact of the increased leisure time (measured using the increased in the number of holidays) on economic growth across 24 Indian states for the time period 2008-2016. They found a weak negative relationship between holidays and economic growth in the panel of Indian states. When segregating the sample into rich and poor states, Dastidar and Apergis (2020) found that holidays adversely affecting economic growth in the rich states but not in the poor states. On the one hand, Wei et al. (2010) finds a negative relationship between economic growth and leisure time for China. However, on the other hand, Wei et al. (2016) found that leisure time improve labour efficiency in the world's three largest economies, namely China, the US and Japan.

The above-mentioned studies were based on the linear relationship between holidays and economic growth. Recent studies have indicated that the relationship between holidays and economic growth could be nonlinear, and in fact, exhibit an inverted U-shape curve. Barrera and Garrido (2017) provide a theoretical model that link public holidays and economic growth nonlinearly. In the first stage, as the number of public holidays increases, there are fewer days to work, the number of days searching for innovation reduces, and this in turn, affect economic growth negatively. In the second stage, as the public holidays increase, the expenditure on domestic tourism increases as well. This activates more resources to increase the innovations during working days, and in turn, this enhances the economic growth of the economy due to the greater number of innovations. These two opposing forces will produce the optimal number of public holidays for the economy.

Thus, during holidays, workers can involve in innovative activities and this will increase expenditure and promotes economic growth. This conjecture is supported by the work of Boikos et al. (2023) which posit that leisure can exert a positive impact on innovative activity that improves the productivity of the researchers (workers). During leisure time, workers can get rest and can enhance their productivity, so finally causing the living standards to raise over the long run. Moreover, several studies find support of the nonlinear impact of holiday/leisure time on economic growth or performance. Nevertheless, despite leisure tourism can enhance economic growth, Min et al. (2016) revealed that leisure tourism contributes to economic growth diminishes as the economy develops. To sustained the positive impact of leisure tourism, an economy must improve productivity through increasing R&D investment and international trade.

In a related work, Cui et al. (2019) examined the nonlinear impact of leisure time on labour productivity in 21 OECD countries for the period 1980-2013. Cui et al. (2019) concluded that when leisure time is far below the optimal level, the positive effect of leisure time on labour productivity is small. However, when leisure time exceeds the optimal value, leisure time has a substitution effect on work hours and can negatively affects labour productivity. In another study, an inverted U-shaped nonlinear relationship between leisure participation and individual job performance in a Chinese manufacturing industry was investigated by Wang et al. (2022). The study reveals that an increase in leisure time, individual job performance showed an inverted U-shaped curve. Leisure time increased job performance before the threshold of 4.7

working hours, and then decreases beyond that threshold working hours. The mediating effect test suggest that leisure participation has an impact on job performance through physical health and happiness.

3. METHODOLOGY

To model the impact of holidays on economic growth in a cross-country growth model, we specify the extension of the new growth theories as follow (see Ulasan, 2012),

$$\text{growth}_i = a_0 + \text{�}_j \text{initial}_{ji} + 8_1 \text{holiday}_i + y_{ki} Z_i + E_i \qquad (1)$$

where growth_i is economic growth measure using growth in real Gross Domestic Product (GDP); and initial_{ji} is the initial condition variable proxy using the initial level of real GDP at the initial year. In this study, we will experiment with several initial years, in particular, initial year for 1960, 1970, 1980, 1990 and 2000. For this, we label the initial condition variables, j, as initial_{1960}, initial_{1970}, initial_{1980}, initial_{1990} and initial_{2000}. The variable of our main interest, holiday_i, is the number of public holidays; while Z_i is a vector of k control variables. In this study, we include macroeconomic variables such as growth in productivity, capital services, growth in tourism, governance, foreign direct investment and growth in urbanisation. Growth in productivity is measure using the growth in GDP per person employed; growth in tourism is proxy using the growth in the tourist arrivals; while the growth in urbanisation is the growth in the ratio of urban population to total population. On the other hand, we measure governance using "voice and accountability", one of the six governance indicators proposed by Kaufman et al. (2008), while foreign direct investment is the ratio of foreign direct investment net inflows to GDP. Parameters a_0, �_j, 8_1 and y_{ki} are coefficients to be estimated; and E_i is the disturbance term which is assume to exhibit zero mean and constant variance.

The impact of the initial level of real GDP on economic growth is expected to be negative, if convergence hypothesis is true across the country (Sala-i-Martin, 1996; Radelet et al., 2001; Ulasan, 2012). If � −convergence exist, it implies that countries with a lower initial level of real GDP grow faster than those with a higher initial level of real GDP, and � represents the speed of convergence to the steady-state. The lack of convergence would signify the heterogeneity of the countries and club convergence is possible among the cross countries. Increase in the number of public holidays would mean that fewer days are available for work. The working time lost to holidays negatively affects firms' productivity, which in turn, reduces economic growth. On the other hand, if during holidays, private consumption and tourism expenditure increases, this will boost economic growth (Dastidar & Apergis, 2021; Barrera & Garrido, 2017; Ramasamy et al., 2008). Thus, *a priori* we would expect that the sign is ambiguous, in other word, $8_1 > 0$, or $8_1 < 0$.

For the control variables, Z_i, it has been recognised in the literature that the increase in the growth in productivity (Dieppe, 2021; Saleem et al., 2019), capital (Fischer, 1992; Levine, 1997; Khalid & Nur-Syazwani, 2018), growth in tourism (Rasool et al., 2021; Naseem, 2021; Pablo-Romero & Molina-Toucedo, 2013; Othman & Salleh, 2010), good governance (Levine, 1997; Burnside & Dollar, 2000; Barro, 1999, 2003; Anyanwu, 2014), foreign direct investment (Bhaskara-Rao & Hassan, 2011; Chang & Mendy, 2012; Lam et al., 2022) and growth in urbanisation (Shaban et al., 2022; Chen et al., 2014; Turok & McGranahan, 2013) will enhance economic growth. Thus, it is expected *a priori* that the impact of productivity, capital, tourism, governance, foreign direct investment and urbanisation is positive on economic growth.

3.1 NONLINEAR EFFECTS OF HOLIDAY ON ECONOMIC GROWTH

Taking the suggestion by Barrera and Garrido (2017) and evidences from previous study which posited that the relationship between economic growth and public holiday could be nonlinear, we also estimate the following regression,

$$\text{growth}_i = a_0 + \text{�}_j \text{initial}_{ji} + 8_1 \text{holiday}_i + 8_2 \text{holiday}_i^2 + y_{ki} Z_i + E_i \qquad (2)$$

We would expect that when $8_1 > 0$ and $8_2 < 0$, the nonlinear relationship between economic growth and holiday is supported. The quadratic form for holiday with $8_1 > 0$ and $8_2 < 0$, will exhibit an inverted U-shaped curve between growth and holidays. Equation (2) suggests that public holidays have a positive effect on economic growth because it allows workers to increase their expenditure on leisure time and leisure activities. This expenditure increases the economic activity, and eventually economic growth. On the other hand, too many public holidays lead to a reduction in work time, and this eventually reduces productivity and, in turn, output of the economy. Thus, the relationship between economic growth and public holiday should display an inverted U-shape curve.

3.2 METHOD OF ESTIMATIONS

To estimate Equation (1) using Ordinary Least Square (OLS) is not appropriate due to the fact that the sample countries are most likely heteroscedastic in nature. To circumvent this problem, we will estimate our growth-holiday model using OLS with robust standard error due to Newey-West procedure. Newey-West standard error method is a robust method/estimator which is very accurate when there is presence of heteroskedasticity and autocorrelation.

Another issue with our sample of countries is that, some of the series exhibit outliers. This is evidence in Figure 1. Boxplots in Figure 1 show some series such as growth, holiday, capital, fdi and urban contained outliers. These outliers are located at the top and/or bottom of the upper and/or lower whiskers. In view of this potential problems, we endeavour to employ another estimator which is robust to the presence of outliers, that is, the robust regression procedure. Barnett and Lewis (1994) have stated that the presence of outliers can lead to inflated error rates and substantial distortions of parameter and statistical estimates when using either parametric or non-parametric tests. Statistically, the increase in error variance will reduce the power of the statistical tests, decrease normality, and seriously bias or influence parameter estimates (Perez et al., 2013). According to Rousseeuw (1984), robust regression is the best method to detect outliers and provides results that are resistant to the outliers. The most common general method of robust regression is the M-estimation method introduced by Huber (1964).

3.3 DATA SOURCES

In this study, we estimate the effects of holidays by using a cross-section analysis on a sample of 101 countries worldwide. Data on real Gross Domestic Product (GDP), productivity, tourism, foreign direct investment, urbanisation and initial conditions' variables were collected from the World Development Indicator, a World Bank database which is available at https://data.worldbank.org/indicator?tab=all. Economic growth is calculated as the percentage growth in real GDP. Growth in productivity is proxy using the growth in GDP per person employed; while tourism is measured using the growth in the number of tourist arrivals.

Foreign direct investment is measured using the percentage ratio of foreign direct investment net inflows to GDP, and urbanisation is the percentage ratio of urban population to total population. The "initial condition" variables - initial_{1960}, initial_{1970}, initial_{1980}, initial_{1990} and initial_{2000} were proxied using level real GDP for year 1960, 1970, 1980, 1990 and 2000, respectively.

Data for capital services was taken from the Penn World Table 10.0 which is available from the University of Groningen website at https://www.rug.nl/ggdc/productivity/pwt/. For the governance indicator, we are using "voice and accountability" which captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. This variable is collected from the Worldwide Governance Indicator which is available at https://databank.worldbank.org/source/worldwide-governance-indicators. Data on public holidays was collected from the timeanddate.com website on "Holidays and Observances Around the World" which is accessible at https://www.timeanddate.com/holidays/.

The year (cross-section) chosen for this study is 2019, that is, the year before the unprecedented Covid-19 pandemic spread around the world. The list of 101 countries included in the study is provided in Table 1. All variables were transformed into logarithm, such that all estimated coefficients are elasticities. For variables having negative values, we employ the formula $\log y_i = \log [y_i + \sqrt{(y_i^2 + 1)}]$ to transform the series into logarithm (Busse & Hefeker, 2007). By employing this method, we maintain the sign of y_i.

4. EMPIRICAL RESULTS

Before we proceed estimating Equation (1), the descriptive statistics of all the variables involve in the study is presented in Table 2. In general, the mean for all series are positive, meaning that positive values outweigh the negative values. For the economic growth variable, the maximum growth of 9.46% was attained by Rwanda, while Zimbabwe experienced negative growth of 6.33% in 2019. The country that having the greatest number of public holidays is Sri Lanka with 26 days; while Switzerland and Uruguay having only 5 days of public holidays. More importantly, most variables demonstrate substantial standard deviations, skewness and kurtosis. About seven variables are highly skewed (initial$_{1960}$, initial$_{1970}$, initial$_{1980}$, initial$_{1990}$ and initial$_{2000}$, capital, and fdi) and three are moderately skewed (holidays, productivity and urban). As for kurtosis, the variables that show the size of greater than 3 include growth, initial$_{1960}$, initial$_{1970}$, initial$_{1980}$, initial$_{1990}$ and initial$_{2000}$, holidays, productivity, capital, tourism, and fdi. These indicate that the series show longer or fatter tail on the right side of the distribution. In other words, the kurtosis shows a leptokurtic type of distribution for the series. Nevertheless, the Jarque-Bera test for normality of the series was rejected for all series except for growth. In view that many of the variables involved in our analysis demonstrate extreme skewness and kurtosis and have non-normal distribution; the common method to circumvent these problems is to transform all variables into logarithm (McKinney et al., 2009; Naidoo & Adamowicz, 2001; Ehrhardt-Martinez et al., 2002).

In Table 3, we present the correlation matrix for the dependent variable (growth) and all the independent variables. Generally, the initial condition's variable is negatively associated with growth. Although these results signify economic convergence, however, the association is not significant. As for all the remaining variables including holiday, they show positive association with the dependent variables, but only in the cases of productivity, capital and tourism that the correlation is statistically significant at least at the 10% level. Interestingly, none of the independent variable, except for the initial conditions' variables, demonstrate potential multicollinearity among themselves. The correlation coefficients between all the independent variables (except initial$_{1960}$, initial$_{1970}$, initial$_{1980}$, initial$_{1990}$ and initial$_{2000}$) are no greater than 0.7.

The results of our regression analyses are presented in Table 4. In our quest to determine the impact of holidays on economic growth, initially all regression equations were estimated using OLS, and the diagnostics tests such as Breush-Pagan-Godfrey (BPG) test for heteroscedasticity, and Jarque-Bera test for normality of the residuals are reported in Table 4 for reference. The diagnostic tests clearly suggest that in all cases, the residuals are heteroscedastic and the assumption of OLS is therefore violated. Taking this information into consideration, we have estimated all regressions by employing OLS with robust standard error due to Newey-West procedure, and these results are reported in Table 4. Furthermore, the estimated regressions presented in Table 4 are the final estimated models for the standard augmented Solow growth with different initial condition's variables to uncover the speed of convergence if it does exist in the model.

In Table 4, we report five models – Models 1 to 5 for each of the initial conditions, $\mathrm{initial}_{1960}$, $\mathrm{initial}_{1970}$, $\mathrm{initial}_{1980}$, $\mathrm{initial}_{1990}$ and $\mathrm{initial}_{2000}$, respectively. However, despite the initial condition variables showing negative relationship with economic growth, but they are all not significant. Nonetheless, variable holiday, which is our variable of interest, despite showing negative impact on economic growth, is only statistically significant at the 10% level in Model **5.** Despite the weak relationship, the result suggests that increase in the number of public holidays will reduce economic growth. On the other hand, increase in the other variables such as growth in productivity, capital services, growth in the number of tourist arrivals, governance, foreign direct investment and growth in urbanisation will enhance economic growth.

As seen in Table 4, the estimated linear relationship between economic growth and public holiday is not encouraging enough to ascertain the impact of holidays on economic growth. The results for the nonlinear relationship between economic growth and public holidays are presented in Table 5. However, similar to Table 4, the results of the initial condition variables are not significant. The nonlinear impact of holiday on economic growth is shown by the variable $\mathrm{holiday}_i$ and $\mathrm{holiday}_i^2$ with expected sign of positive on $\mathrm{holiday}_i$ and negative sign for $\mathrm{holiday}_i^2$, and both are significant. As shown in Table 5, in all five models, the estimated coefficient on $\mathrm{holiday}_i$ is positive, while the estimated coefficient on $\mathrm{holiday}_i^2$ is negative. But, the nonlinear relationship between economic growth and holiday are only found for Models 2 to 5. This implies that as the number of public holidays increases, initially economic growth increases, but after some optimal point, when the number of public holiday increases further, economic growth starts to decline, therefore, exhibiting an inverted U-shaped curve. As shown in Table 5, the optimal days calculated is between 9 days (Model 9) and 10 days (Models 3 to 5). As for the control variables, the growth in productivity, capital services, growth in tourism, governance, foreign direct investment and growth in urbanisation contribute positively to economic growth. All these variables are statistically significant at least at the 10% level in Models 3 to 5.

Since in both occasions, the initial condition variables are not significant as evidence in Tables 4 and 5, we have re-estimate our model by excluding these variables. The results are shown in

Table 6. As illustrated in Table 6, columns 2 and 3 are the estimated results for both linear and nonlinear between economic growth and holiday by using the OLS-robust estimation; while columns 4 and 5 are the results for both linear and nonlinear models using the robust regression M-estimation. Results in Table 6, clearly indicate that both nonlinear estimated regressions show better model compared to the linear model in which holiday variable in quadratic form are highly significant at the 1% level, with positive coefficient for $holiday_i$, and negative estimated coefficient for $holiday_i^2$, thus, exhibiting an inverted U-shaped curve. Our redundant variable test suggests that the null hypothesis that variable $holiday_i^2$ is zero can be rejected at the 5% level. The calculated optimal number of public holidays suggest by our analysis is between 10 days for OLS-robust and 11 days for robust regression. However, results from the OLS-robust estimation suggest that growth in productivity, capital, growth in tourism, governance, fdi and growth in urbanisation positively affect economic growth; while only growth in productivity, capital, fdi and growth in urbanisation affect economic growth in the robust regression.

4.1 FURTHER ANALYSIS WITH QUANTILE REGRESSIONS

One strong simplification of the OLS estimates is that the explanatory variables determine the effects on the mean of the conditional distribution of the dependent variable. To allow the effects of the regressors on the entire conditional distribution of the dependent variable, we employ the quantile regression proposed by Koenker and Basset (1978). Quantile regression allows the estimated parameters (slopes) to differ at different points of the conditional distribution of the dependent variable. Since quantile regression is nonparametric procedure, it does not impose any functional form on the economic growth relationship. Furthermore, quantile regression is not sensitive to the presence of outliers. Therefore, a number of different quantile regressions give more complete description of the underlying conditional distribution. The quantile regression is defined as follows

$$growth_i = x_i^{r}\beta_T + \mu_{Ti} \quad 0<r<1 \qquad (3)$$

$$Quantile_T(growth_i|x_i) = x_i^{r}\beta_T \qquad (4)$$

where x_i^r equals a vector of explanatory variables as defined above, β_T equals the vector of parameters associated with the T-th percentile, and μ_{Ti} equals an unknown error term. The $Quantile_T(growth_i|x_i) = x^r_i\beta_T$ equals the T-th conditional quantile of growth given x with T E (0,1). By estimating β_T, using different values of T, quantile regression permits different parameters across different quantiles of economic growth. In other words, repeating the estimation for different values of T between 0 and 1, we trace the distribution of growth conditional on x and generate a much more complete picture of how explanatory variables affect the dependent variable. The T-th quantile regression estimates β_T, by solving the following minimization problem and the median regression occurs when T = 0.5 and the coefficients of the absolute values both equal one.

$$\beta(T) = \arg\min_{\beta} \left[T \sum_{\{growth_i \geq x_i\beta\}} |growth_i - x^r_i\beta| + (1 - T) \sum_{\{growth_i < x_i\beta\}} |growth_t - x^r_i\beta| \right].$$

Figure 2 shows the quantile-quantile (Q-Q) plots for all the variables in our study. The Q-Q plots show that none of the variables present a good fit to normal distributions. As a matter of fact, Table 2 shows that the Jacque-Bera goodness of fit test rejected the null hypothesis of normality for almost all variables (the exception is the growth variable). Thus, most variables in our model do not follow the normal distribution. It seems that the majority of the data distribution is not normal, thus quantile regression can provide more efficient estimates for detecting the relationship between economic growth and its determinants, and in particularly, the holiday variable.

Table 7 presents the results for the quantile regressions. As to our variable of interest, the nonlinear impact of holiday on economic growth is not significant at the 10th and 20th quantiles. This implies that the number of public holidays has no impact on economic growth for countries in this quantile (characterise by negative and slow growth). The nonlinear impact of holiday on economic growth is strongly establish in the 30th, 40th, 50th, 60th, 70th, 80th, and 90th quantiles. Both variables - $holiday_i$ and $holiday_i^2$ are statistically significant at least at the 5% level, with positive and negative signs, respectively. Our calculation for the optimal number of days by each quantile suggest that as we move from lower quantile to higher quantile, the optimal number of public holidays also increases. As indicated by our results, the optimal number of days for public holidays for countries at the 30th and 40th quantiles are 9 days; for countries in the 50th and 60th quantiles are 10 days; for countries in the 70th quantile is 11 days;

while for countries in the 80th and 90th quantiles, the optimal number of public holidays is 12 days. Our results imply that countries with strong growth will be able to withstand more numbers of public holidays. Thus, our findings support the work by Rosso and Wagner (2021) that as countries get richer, they tend to increase public holidays.

Our quantile regression results also suggest that productivity growth has positive impact on economic growth in all quantiles, with elasticities ranging from 0.35 to 0.70. This implies that a 10% increase in productivity growth will increase economic growth between 3.5% to 7.0%. The important role of capital in enhancing economic growth is only significant at the 10th, 20th, and 90th quantiles; while the growth in tourism in boosting economic growth is shown in 20th and 90th quantiles. On the other hand, governance and foreign direct investment only impacted economic growth positively in the 10th and 20th quantile, and 40th, 50th and 90th quantiles, respectively. Lastly, the importance of the growth in urbanisation as an important contributor to economic growth is demonstrated in quantile 30th to quantile 90th. Figure 3 displays the graphical presentations of the quantile estimates of all regressors in our study. We observe that the slope estimates at different quantiles show nonlinear patterns. These results suggest the existence of parameter heterogeneity across quantiles. Furthermore, the impact of holiday, growth in productivity and growth in urbanisation on economic growth is clearly evidence from 30th to the 90th quantiles.

5. CONCLUSION

In this study, we investigate the impact of public holidays on economic growth in 2019, using a sample of 101 countries worldwide. It is known that public holidays can have an adverse effect on economic growth if firms' productivity is affected due to lost in working hours. On the other hand, public holidays can be beneficial to economic growth, if people increase their private consumption and expenditure in the recreational and/or tourism sectors. Thus, the effects of public holidays on economic growth can be ambiguous.

Our results indicate that the relationship between public holidays and economic growth is nonlinear, and in fact exhibit an inverted U-shaped curve. This nonlinear relationship implies that as the number of public holiday increases, economic growth will increase as well, however, until to a certain optimal point, thereafter, further increase in public holidays will ultimately reduce economic growth. This relationship is robust with respect to the three estimators (namely, OLS-robust, Robust regression M-estimation, and Quantile regression) that we used in uncovering the nonlinear relationships.

We can conclude from this study that the "optimal" number of public holidays can be increase if economic growth is persistence upwards. Our quantile regression analysis suggest that 9 days of public holidays is optimal for countries in the 30^{th} and 40^{th} quantiles; 10 days for 50^{th} and 60^{th} quantiles; 11 days for 70^{th} quantile; and 12 days for countries in the 80^{th} and 90^{th} quantiles. Other macroeconomic factors that contribute in boosting economic growth include the growth in labour productivity, investment in capital, growth in tourism, good governance, foreign direct investment, and growth in urbanisation.

Results of our study can be translated into some practical implications. First, a government or companies should consider the concept of "optimal" number of public holidays to strike the balance between the amount of leisure time and working hours, so as to sustain economic growth. A country with strong economic growth able to increase the number of public holidays, as well as to raise the income level, in turn, increase the well-being and keep the public/workers happy. Secondly, the government or companies should set up leisure (recreational) facilities in public areas and workplaces to enhance the variety of leisure activities and promote active and healthy leisure participation.

We have provided a simple analysis in establishing the causal effects of public holidays on economic growth by using a cross-country growth model for 2019. Nonetheless, our results imply that a government can play a role in balancing between the number of public holidays and the loss of working time by providing avenue for the people to increase their consumption during holidays. To further ascertain our findings, future research should make an effort to provide more richer time series data and countries, say in a panel data setting.

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TABLE 1. Lists of countries included in the study

Argentina	China	Hungary	Mexico	Saudi Arabia
Aruba	Colombia	Iceland	Mongolia	Sierra Leone
Australia	Costa Rica	India	Morocco	Singapore
Austria	Cyprus	Indonesia	Mozambique	Slovenia
Azerbaijan	Czechia	Iran, Islamic Rep.	Namibia	South Africa
Bahamas	Denmark	Ireland	Netherlands	Spain
Bahrain	Dominican Rep	Israel	New Zealand	Sri Lanka
Barbados	Ecuador	Jamaica	Nicaragua	Sweden
Belarus	Egypt, Arab Rep.	Jordan	Niger	Switzerland
Belgium	Estonia	Kazakhstan	North Macedonia	Tajikistan
Benin	Eswatini	Kenya	Norway	Thailand
Bolivia	Fiji	Korea, Rep.	Oman	Togo
Brazil	Finland	Kuwait	Panama	Trinidad and Tobago
Burkina Faso	France	Kyrgyz Republic	Paraguay	Tunisia
Cabo Verde	Georgia	Lao PDR	Peru	Turkiye
Cameroon	Germany	Lesotho	Philippines	United Kingdom
Canada	Greece	Luxembourg	Portugal	United States
Central African Rep	Guatemala	Macao	Qatar	Uruguay
Chad	Honduras	Malaysia	Russian Federation	Uzbekistan
Chile	Hong Kong	Malta	Rwanda	Zambia
				Zimbabwe

Source: Authors' compilation.

TABLE 2. Descriptive statistics

Variables	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Obs
growth (%)	2.40	9.46	-6.33	2.52	-0.25	3.87	4.3	101
$initial_{1960}$ USD	$1.22x10^{11}$	$3.46x10^{12}$	$1.94x10^{8}$	$4.60x10^{11}$	6.70	48.73	5581.4***	59
$initial_{1970}$ USD	$1.84x10^{11}$	$5.19x10^{12}$	$3.18x10^{8}$	$6.48x10^{11}$	6.76	51.74	7568.8***	71
$initial_{1980}$ USD	$2.40x10^{11}$	$7.08x10^{12}$	$1.72x10^{8}$	$8.35x10^{11}$	7.15	58.01	10769.1***	80
$initial_{1990}$ USD	$2.97x10^{11}$	$9.81x10^{12}$	$2.87x10^{8}$	$1.07x10^{12}$	7.75	68.19	17400.1***	93
$initial_{2000}$ USD	$3.93x10^{11}$	$1.38x10^{13}$	$8.45x10^{8}$	$1.44x10^{12}$	8.10	74.35	22530.0***	101
holiday (days)	13.34	26.00	5.00	3.97	0.92	4.49	23.7***	101
productivity (%)	0.74	6.21	-8.62	2.62	-0.65	4.59	17.6***	100
capital (index)	1.07	1.33	0.93	0.06	1.58	6.65	97.9***	101
tourism (%))	2.67	52.88	-29.16	11.18	0.44	7.07	72.1***	100
governance (index)	0.13	1.66	-1.82	1.00	-0.25	1.89	6.3**	101
fdi (%GDP)	2.44	203.65	-11.68	21.36	8.13	74.40	22565.4***	101
urban (%pop)	1.78	4.80	0.14	1.13	0.72	2.88	8.7**	101

Notes: Asterisks ***, **, * denote statistically significant at 1%, 5% and 10% level, respectively. Variables are defined as: growth is percentage growth in real GDP; $initial_{1960}$, $initial_{1970}$, $initial_{1980}$, $initial_{1990}$, and $initial_{2000}$ are initial conditions, measured as real GDP for year - 1960, 1970, 1980, 1990, and 2000, respectively; holiday is the number of public holidays; productivity is growth in labour productivity; capital is capital services; tourism is proxy using the growth in the number of tourist arrivals; governance is proxy using voice and accountability; fdi is foreign direct investment net inflows; and urban is growth inurbanisation.

TABLE 3. Correlation matrix

	growth	$initial_{1960}$	$initial_{1970}$	$initial_{1980}$	$initial_{1990}$	$initial_{2000}$	holiday	productivity	capital	tourism	governance	fdi	urban
$initial_{1960}$	-0.0835	1											
	(-0.6326)												
$initial_{1970}$	-0.1077	0.9958***	1										
	(-0.8180)	(81.930)											
$initial_{1980}$	-0.0880	0.9866***	0.9938***	1									
	(-0.6672)	(45.722)	(67.622)										
$initial_{1990}$	-0.0581	0.9749***	0.9833***	0.9942***	1								
	(-0.4391)	(33.080)	(40.843)	(69.769)									
$initial_{2000}$	-0.0509	0.9631***	0.9729***	0.9868***	0.9965***	1							
	(-0.3851)	(27.010)	(31.786)	(46.050)	(89.409)								
holiday	0.0461	-0.0175	0.0000	0.0130	0.0500	0.0738	1						
	(0.3486)	(-0.1319)	(0.0002)	(0.0979)	(0.3776)	(0.5589)							
productivity	0.8080***	-0.0184	-0.0410	-0.0218	0.0106	0.0145	0.1257	1					
	(10.352)	(-0.1387)	(-0.3100)	(-0.1643)	(0.0803)	(0.1094)	(0.9562)						
capital	0.4893***	-0.3487***	-0.3700***	-0.3441***	-0.3085**	-0.2725**	0.2415*	0.4516***	1				
	(4.2354)	(-2.8086)	(-3.0070)	(-2.7671)	(-2.4482)	(-2.1380)	(1.8786)	(3.8209)					
tourism	0.2378*	0.1009	0.1245	0.1080	0.1273	0.1242	0.1264	0.2058	-0.0068	1			
	(1.8480)	(0.7654)	(0.9476)	(0.8198)	(0.9686)	(0.9446)	(0.9618)	(1.5874)	(-0.0515)				
governance	0.0001	0.4865***	0.4848***	0.4791***	0.4478***	0.4392***	-0.3935***	-0.1318	-0.3565***	-0.0629	1		
	(0.0004)	(4.2040)	(4.1850)	(4.1211)	(3.7812)	(3.6905)	(-3.2318)	(-1.0038)	(-2.8808)	(-0.4761)			
fdi	0.0773	-0.2927**	-0.2847**	-0.2765**	-0.2613**	-0.2511*	-0.0660	-0.0482	0.0639	-0.0388	-0.1413	1	
	(0.5852)	(-2.3107)	(-2.2423)	(-2.1721)	(-2.0437)	(-1.9582)	(-0.4996)	(-0.3646)	(0.4831)	(-0.2932)	(-1.0773)		
urban	0.2741	-0.4967***	-0.5131***	-0.5179***	-0.5015***	-0.4955***	0.2894**	0.1668	0.4998***	0.0747	-0.6225***	0.18721	1
	(2.1517)	(-4.3206)	(-4.5129)	(-4.5706)	(-4.3769)	(-4.3066)	(2.2825)	(1.2769)	(4.3569)	(0.5659)	(-6.0047)	(1.43886)	

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables in logarithm. Variables are defined as: growth is growth in real GDP; $initial_{1960}$, $initial_{1970}$, $initial_{1980}$, $initial_{1990}$, and $initial_{2000}$ are initial conditions, measured as real GDP for year - 1960, 1970, 1980, 1990, and 2000, respectively; holiday is the number of public holidays; productivity is growth in labour productivity; capital is capital services; tourism is proxy using the growth in the number of international tourist arrivals; governance is proxy using voice and accountability; fdi is foreign direct investment net inflows; and urban is growth in urbanisation.

TABLE 4. Results of OLS-robust on the impact of holiday on economic growth

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	1.1895	1.9756	1.3704	1.7487	1.7516*
	(0.8938)	(1.5839)	(1.1462)	(1.5699)	(1.6791)
$initial_{1960}$	-0.0236				
	(-0.6518)				
$initial_{1970}$		-0.0210			
		(-0.5277)			
$initial_{1980}$			-0.0102		
			(-0.2714)		
$initial_{1990}$				-0.0091	
				(-0.2651)	
$initial_{2000}$					-0.0108
					(-0.3206)
$holiday_i$	-0.1112	-0.4177	-0.3338	-0.4287	-0.4103*
	(-0.4310)	(-1.5859)	(-1.3701)	(-1.5820)	(-1.6364)
$productivity_i$	0.6401***	0.6061***	0.5699***	0.6017***	0.6008***
	(9.1020)	(8.1360)	(7.8930)	(9.2428)	(10.269)
$capital_i$	3.2747*	2.5500	4.4895***	3.5465**	3.3889**
	(1.6819)	(1.3564)	(2.9315)	(2.5073)	(2.5574)
$tourism_i$	0.0540	0.0718*	0.0843**	0.0679*	0.0630**
	(1.2903)	(1.6738)	(2.0650)	(1.9738)	(2.0342)
$governance_i$	0.4989***	0.4790***	0.3827***	0.2719**	0.2782**
	(2.7852)	(2.8920)	(2.6381)	(2.2893)	(2.5883)
fdi_i	0.0992*	0.0786	0.1185***	0.0972**	0.0936***
	(1.6823)	(1.4851)	(2.6124)	(2.3588)	(2.6609)
$urban_i$	0.3849**	0.4689***	0.3717***	0.2759**	0.2848**
	(2.5569)	(3.1077)	(2.6326)	(2.2117)	(2.5613)
$adjR^2$	0.724	0.689	0.669	0.646	0.661
BPG test, $X^2(1)$	***[0.1064]***	***[0.0073]***	***[0.0013]***	***[0.0003]***	***[0.0001]***
Jacque-Bera, $X^2(1)$	[0.8573]	[0.6365]	[0.5387]	[0.3444]	[0.2745]
Obs	59	71	80	93	101

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables are in logarithm and the estimated coefficients are elasticities. Dependent variable is growth in real GDP (%). $adjR^2$ denotes adjusted R-squared. Figures in round bracket (…) are t-statistics, while figures in square bracket […] are p-values. BPG (Breusch-Pagan-Godfrey) is the test for heteroskedasticity, and Jarque-Bera is the test for the normality of the residuals.

TABLE 5. Results of OLS-robust on the nonlinear impact of holiday on economic growth

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-3.1547	-3.2085	-4.1322*	-5.5854***	-5.1865***
	(-0.9505)	(-1.1276)	(-1.9344)	(-2.8497)	(-2.6514)
$initial_{1960}$	0.0009				
	(0.0230)				
$initial_{1970}$		$1.06x10^{-5}$			
		(0.0002)			
$initial_{1980}$			0.0131		
			(0.3474)		
$initial_{1990}$				0.0186	
				(0.5368)	
$initial_{2000}$					0.0145
					(0.4174)
$holiday_i$	3.0518	3.4178*	3.7931***	5.0616***	4.7966***
	(1.2460)	(1.7427)	(2.6795)	(3.9762)	(3.8309)
$holiday_i^2$	-0.6476	-0.7697*	-0.8424***	-1.1106***	-1.0521***
	(-1.2539)	(-1.8886)	(-2.7723)	(-4.0653)	(-3.9330)
$productivity_i$	0.6379***	0.6070***	0.5734***	0.5962***	0.5994***
	(8.9704)	(8.3177)	(8.0522)	(9.6478)	(10.600)
$capital_i$	3.3609*	2.7202	4.5105***	3.5847**	3.2960**
	(1.7539)	(1.4711)	(2.9100)	(2.5245)	(2.5021)
$tourism_i$	0.0515	0.0633	0.0783*	0.0623*	0.0560*
	(1.2005)	(1.4491)	(1.9162)	(1.8386)	(1.8365)
$governance_i$	0.4036*	0.4081**	0.3171**	0.2170*	0.2234**
	(1.7067)	(2.1814)	(2.0470)	(1.8976)	(2.1270)
fdi_i	0.1038*	0.0804	0.1181***	0.0973**	0.0912**
	(1.7965)	(1.5392)	(2.7095)	(2.4363)	(2.5220)
$urban_i$	0.3288*	0.4183***	0.3317**	0.2528**	0.2652**
	(1.9917)	(2.6685)	(2.3263)	(2.2481)	(2.6094)
$adjR^2$	0.726	0.695	0.679	0.667	0.679
BPG test, $X^2(1)$	***[0.0334]***	***[0.0097]***	***[0.0054]***	***[0.0038]***	***[0.0017]***
Jacque-Bera, $X^2(1)$	[0.4367]	[0.2099]	[0.1236]	***[0.0556]***	***[0.0491]***
Obs	59	71	80	93	101
Optimal point	-	9 days	10 days	10 days	10 days

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables are in logarithm and the estimated coefficients are elasticities. Dependent variable is growth in real GDP (%). $adjR^2$ denotes adjusted R-squared. Figures in round bracket (…) are t-statistics, while figures in square bracket […] are p-values. BPG (Breusch-Pagan-Godfrey) is the test for heteroskedasticity, and Jarque-Bera is the test for the normality of the residuals. The optimal point is calculated as $-\beta_1/2\beta_2$.

TABLE 6. Results of OLS-robust and Robust regression on the impact of holiday on economic growth, without the initial condition

Independent variabl s	OLS-robust: Linear	Nonlinear	Robust regression M-estimation: Linear	Nonlinear
Constant	1.5038**	-4.5776***	0.8257*	-4.5467**
	(2.2908)	(-3.5477)	[1.6612]	[-2.3268]
$holiday_i$	-0.4197*	4.5816***	-0.0215	4.6175***
	(-1.6677)	(3.9922)	[-0.1142]	[2.9431]
$holiday_i^2$	-	-1.0063***	-	-0.9773***
		(-4.0883)		[-3.1167]
$productivity_i$	0.6020***	0.5980***	0.4359***	0.4898***
	(10.535)	(10.811)	[10.827]	[12.689]
$capital_i$	3.3639**	3.3309**	1.9954*	1.8155*
	(2.5846)	(2.5751)	[1.7764]	[1.6868]
$tourism_i$	0.0614**	0.0582**	0.0619***	0.0347
	(2.0465)	(1.9927)	[2.6423]	[1.5443]
$governance_i$	0.2714***	0.2342**	0.1210	0.0948
	(2.6607)	(2.4183)	[1.6341]	[1.3180]
fdi_i	0.0970***	0.0872**	0.1109***	0.1062***
	(2.7881)	(2.4581)	[2.9265]	[2.9142]
$urban_i$	0.2947***	0.2539***	0.2802***	0.2562***
	(2.8144)	(2.6602)	[3.5393]	[3.3318]
$adjR^2$ /Rw^2	0.664	0.682	0.714	0.772
Optimal point	-	10 days	-	11 days

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables are in logarithm and the estimated coefficients are elasticities. Dependent variable is growth in real GDP (%). Figures in round brackets (…) and square brackets […] are t-statistics and z-statistics, respectively. $adjR^2$ denotes adjusted R-square measures goodness of fit in the OLS; while Rw^2 measures goodness of fit for the Robust regressions. The optimal point is calculated as $-8_1/28_2$.

Table 7: Results of the quantile regressions

Independent variables	Q(0.10)	Q(0.20)	Q(0.30)	Q(0.40)	Q(0.50)	Q(0.60)	Q(0.07)	Q(0.80)	Q(0.90)
Constant	-1.2476***	-1.7570	-3.9485*	-3.4089	-4.1403*	-4.6758**	-4.8747**	-4.4111**	-4.4607***
	(-0.3060)	(-0.7338)	(-1.7830)	(-1.5115)	(-1.7837)	(-2.0807)	(-2.1197)	(-2.4506)	(-2.8446)
$holiday_i$	1.1048	1.3204	3.9844**	3.7744**	4.4096**	5.0093**	5.1313**	4.6062***	4.7027***
	(0.2992)	(0.6551)	(2.1208)	(2.0094)	(2.2485)	(2.5844)	(2.5947)	(2.8928)	(3.3041)
$holiday_i^2$	-0.3305	-0.2751	-0.8876**	-0.8654**	-0.9718**	-1.0790**	-1.0755**	-0.9213**	-0.9407***
	(-0.3969)	(-0.6733)	(-2.3176)	(-2.2725)	(-2.3859)	(-2.5834)	(-2.5292)	(-2.5972)	(-2.9037)
$productivity_i$	0.7041***	0.6783**	0.7046***	0.6579***	0.5890***	0.4765***	0.4505***	0.3971***	0.3460***
	(7.0006)	(6.9822)	(8.3230)	(8.9671)	(5.2143)	(5.8285)	(5.9997)	(5.1281)	(4.7204)
$capital_i$	5.0113**	5.7195**	2.2321	1.9729	1.7542	2.0386	1.6585	1.8652	2.1706*
	(2.1336)	(2.0382)	(1.4040)	(1.5441)	(1.3369)	(1.5962)	(1.5012)	(1.3846)	(1.7401)
$tourism_i$	0.0581	0.1177**	0.0200	-0.0089	0.0057	0.0502	0.0163	0.0249	0.0658**
	(0.8652)	(2.2988)	(0.4744)	(-0.2729)	(0.1541)	(1.5548)	(0.5437)	(0.7587)	(2.0361)
$governance_i$	0.6247**	0.3654*	0.1575	0.1172	0.1079	0.0357	0.0835	0.0846	0.0088
	(2.4270)	(1.9760)	(1.3015)	(1.3116)	(1.0906)	(0.3862)	(0.9549)	(0.7916)	(0.0798)
fdi_i	0.0929	0.0553	0.0553	0.0972**	0.1150**	0.0504	0.0567	0.0487	0.0628**
	(0.8584)	(0.7300)	(0.7935)	(2.1363)	(2.4980)	(1.2797)	(1.5470)	(1.3924)	(2.2356)
$urban_i$	0.4101	0.0698	0.2853*	0.2797***	0.2496***	0.2061**	0.2379***	0.2713***	0.2630***
	(1.4971)	(0.4277)	(1.9686)	(2.6347)	(2.7333)	(2.4120)	(2.9426)	(3.0929)	(4.1023)
$adjR^2$	0.577	0.519	0.474	0.439	0.413	0.414	0.416	0.395	0.331
Optimal pt.	-	-	9 days	9 days	10 days	10 days	11 days	12 days	12 days

Notes: Asterisks ***, ** and * denote statistically significant at 1%, 5% and 10% level, respectively. All variables are in logarithm and the estimated coefficients are elasticities. Dependent variable is growth in real GDP (%). Figures in round brackets (…) are t-statistics. $adjR^2$ denotes adjusted R-square measures goodness of fit in the quantile regressions. The optimal point is calculated as $-\delta_1/2\delta_2$.

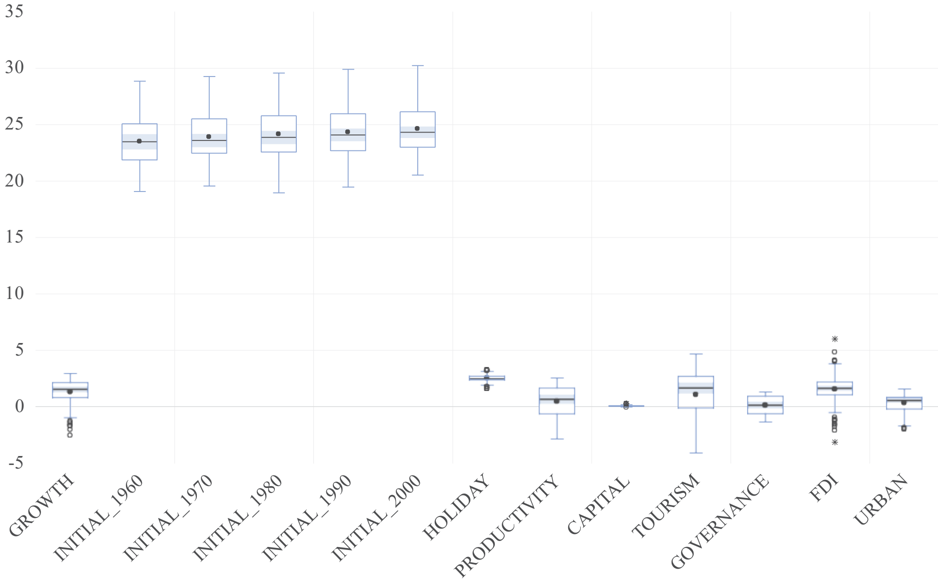

FIGURE 1. Boxplots of all series in the study

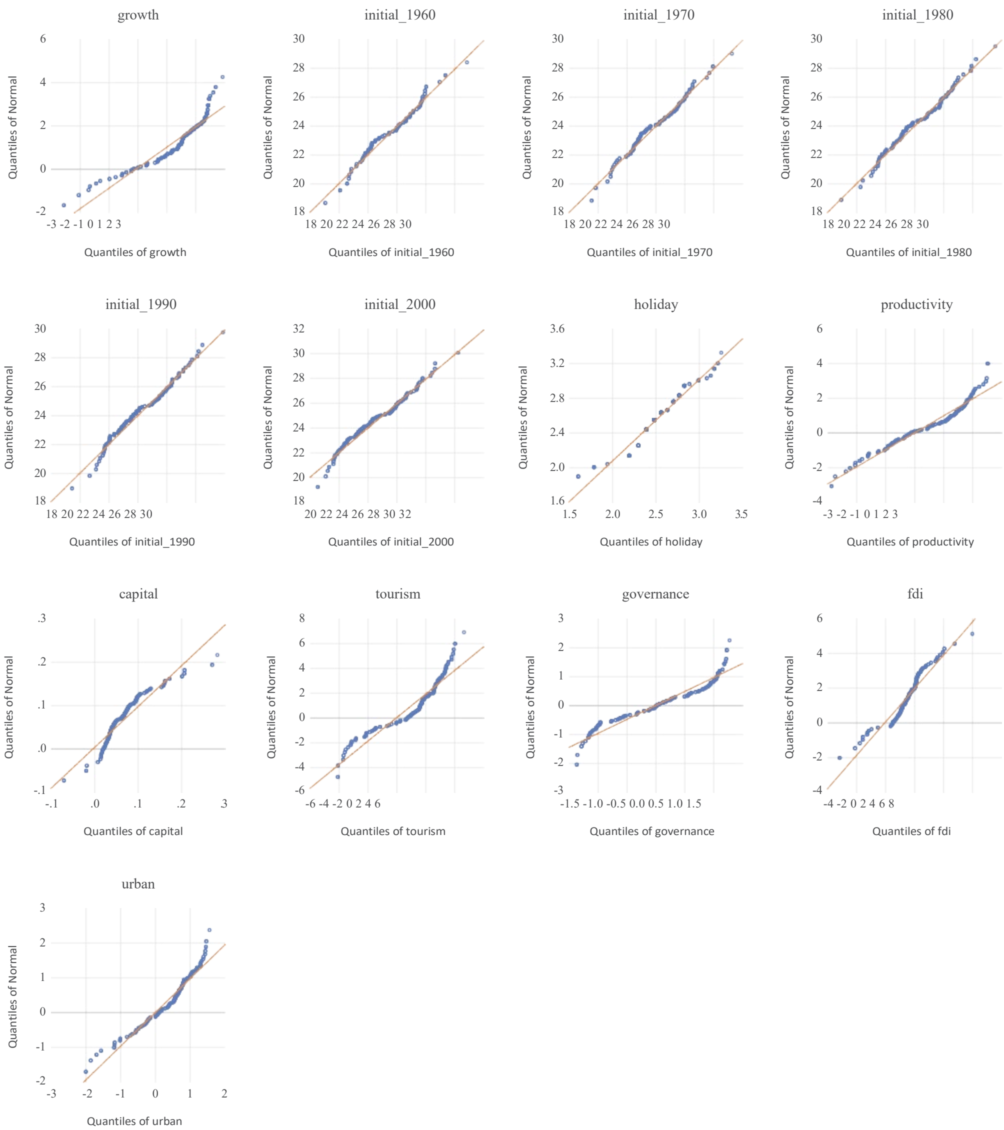

FIGURE 2. Quantile-quantile (Q-Q) plots of all series in the study

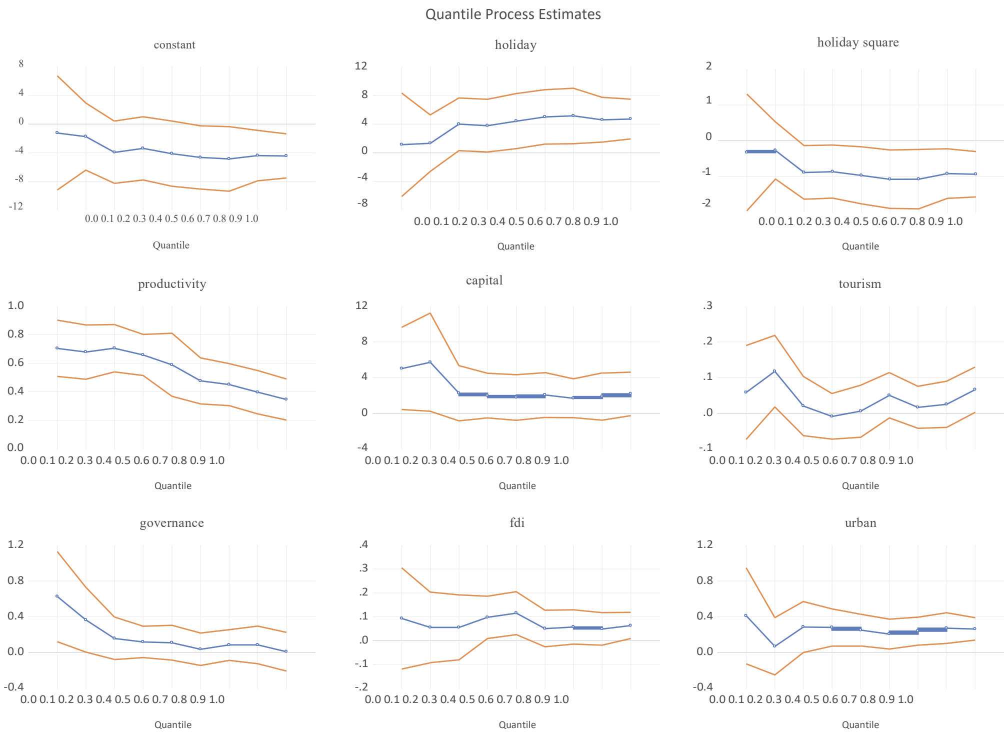

FIGURE 3. The quantile process estimates of all regressors in the study

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