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Tourism Development and Real Effective Exchange Rate Revisited by Wavelet based Analysis: Evidence from France

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Abstract: *This research scrutinizes the empirical association of tourism development (TD) and real effective exchange rate (ER) in high tourist arrival economy; France by wavelet transform context. This innovative technique allows the decomposition of time-sequence at diverse time frequencies. We applied continuous wavelet, wavelet coherence power spectrum and wavelet based Granger causality analysis to explore the connection between TD and ER by using the monthly data from 1996(1)-2015(8). Outcomes show that there is a unidirectional causal impact from TD to ER in short run and also a bidirectional causal influence of TD on ER in medium and long run in France. Thus, it can be recommended that government needs to increase and promote tourism demand and further nurturing and providing the expansion of tourism resources.*

Keywords: Wavelet analysis, continuous wavelet transform, wavelet coherence, tourism development, France.

Introduction

Tourism is an occurrences of travel, travel for leisure, recreation, exploration, religious, family or business purpose for a limited time period. In present world, tourism is the main cause of income for different countries that enhances the economy of both guest and host countries. Tourism statistics have witnessed the increase in international arrivals and departures especially in previous era. The quantity of international tourist arrival trips is improved from 675 million to 1,004 million during the period of 1999 to 2011. Likewise, international tourist departure trips improved from 590 million to 858 million over the same period of time (Euromonitor International, 2013). In 2008, tourism sector contributes 9.9% of the world gross domestic product and is expected to increase to 10.5% by the completion of 2018 (World Tourism Organization, 2013).

There exist many factors that may influence international travels. The critical ones are growth in the relationship between countries, enhancement in the consumer confidence across the emerging nations, increasing level of travel discounts and promotions, rise in the level of disposable income, reduction in hotel prices, surge in tourism packages, political stability, removal of the monetary taxes on tourist departure and the availability of information regarding travel products via Internet and social media.

Tourism brings large sum of money in a domestic economy in the form of payment given by tourists for the goods and services. It also generates employment opportunity in the service sector linked with tourism. The most common beneficiary in this regard is the service industry. These

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includes transportation services, such as taxicabs, cruise ships and airlines etc, the hospitality service like hotels and resorts, entertainment venues like theaters, shopping malls, amusement parks, casinos etc. Benefits of the tourism bring growth in these industries which ultimately are reflected in increased income levels of the host country.

The importance of Exchange rate has been conversed massively in the literature due to its dominant role in economic prosperity and desirable acceptance from the outer world. Exchange rate of any nation indicates its afford-ability in global economy and strengthens the inward stability of a country. The under and over estimation of home currency is primarily represented by the movement of exchange rates. It exhibits the value of the domestic currency in comparison of foreign currencies.

Exchange rates are found to have enormous instability from the culmination of Bretton-Woods regime. Several researchers discussed exchange rates due to its global significance and influence on the economic stability, productiveness, trade patterns and investments (Meese & Rogoff, 1983; Frankel & Rose, 1996; Hau, 2002; Algieri, 2013). Studies have been directed to forecast the results of steady and unsteady exchange rates. Stability in exchange rates resulted in improved foreign investments, boost of exports and favorable change in balance of trade of the country (Edwards, 1988; Berka & Devereux, 2010). Unsteadiness in the trend of exchange rates enlarges the country's trade deficit, increases inflation and cut down the investment level (Xiaopu, 2002; Eichengreen, 2007).

What determines exchange rate is an unsettled matter in the literature. Balassa (1964) propose that the growth of an economy is supplemented with the appreciation of its home currency. Better economic growth and domestic production exhibit prosperity of a country. Rise of production indicates that the country is receiving their anticipated revenues. This improvement in revenues generates demand for the local currency and brings appreciation in it (Bleaney, 1996).

Many studies in the past have shown that tourism enhancement has encouraging influence on the economic development for both developing and developed countries (Cortes-Jimenez & Pulina, 2010; Tang, 2011; Tang & Abosedra, 2014). Tourist arrival and departure have positive influence on employment, government income and production in the tourist purposes. The connection between worldwide tourism and economic development has long been of notice and explored in the tourism-led foreign exchange literature. The influence of tourist arrivals on developing and emerging nations has also been of attention of both policy makers and scholars as well (Clancy, 1999). Global tourism and trade are the foremost foundations of foreign exchange for both developing and developed countries. There are numerous studies which explore connection among global trade and economic development (exclusively import, export and trade-led-growth theories), but on the other hand, it cannot be assumed about the practical examination between global tourism and foreign exchange rate. Genuinely, the outcomes for the connection among global tourism and exchange rate are quiet unconvincing and dubious.

So, the question is still unanswered that whether international tourism really causes foreign exchange rate or vice versa. Various works on the association concerning global tourism and exchange rate have been thorough in the tourism literature (Belloumi, 2010). Along with this, International tourism receipts are the key basis of producing export revenues as well as merely a source of foreign exchange earnings. In some occasions they are essential in counterweighting negative balance of payments and current account deficits (Oh, 2005). Initially, McKinnon (1964) reasons, international tourism can reflect foreign exchange in the host country that could be taken to import capital goods and intermediate to yield services and goods, which ultimately boast to economic development in the country.

The core focus of the current study is to apply the continuous wavelet transmute to reexamine the association among tourist arrivals and exchange rate. Precisely, the current study applies three cross-wavelet tools and the continuous wavelet power spectrum. The three cross wavelet tools included wavelet transform, cross-wavelet power spectrum and coherency of cross-wavelet to identify fleeting impacts. The method we utilize can support to exhume few economic time-frequency associations that have not been apprehended so far. In simple and easy words, the continuous wavelet transforms strength to identify causality at various measures, and our outcomes give provision to equally the portfolio approach (Dominguez & Frankel, 1993) besides the traditional method (Dornbusch & Fischer, 1980). Present study explores the causal and converse causal association among tourist arrivals and exchange rate in France. The evidence gives provision to mutually cyclical and anti-cyclical association among the series. The current study finds tourist arrivals to lag and receive cyclic effect from real effective exchange rate at advanced time scales over the study age.

The outcomes are therefore pioneer attempt and may give a new understanding about the causal linkage among tourist arrivals and exchange rate in France. The methodologies we utilize have prospered in seizing the instantaneous effect of the two models and then, support to identify the bidirectional causality at various time span. Along with this, the current study gives to the existing works in more than two different aspects. Primarily, this is the pioneer attempt which has utilized the procedure to the certain economic time sequence. Furthermore, the acceptance of sophisticated approach, in retreat from taking the old-fashioned tools, has been involved to the results. Finally, this is the initial work on France. In the light of international interest in France economy, educational investigation into the association among the series is not simply appropriate, but possibly long overdue.

Finally, the remaining of the study is ordered as follows: Section 2 elaborates the empirical studies covered on tourism and exchange rate. Section 3 explains the framework model while, Section 4 discuss the outcomes and findings. In the end, Section 5 advises the conclusion and strong policy implications.

Review of Related Literature

There are very limited studies have been done in the past to investigate the connection among exchange rate and tourism. These studies provided very contrasting evidence on the correlation among exchange rate and tourism.

Past studies showed that in Malaysia, tourist arrivals have a negative and substantial influence on exchange rate in Malaysia (Hanafiah & Harun, 2010). Along with this, Dritsakis (2004) examine the encouragement of exchange rate on tourist arrivals in Germany and Great Britain by taking time series data from 1963 to 2000. By applying VECM, results suggested that exchange rate has negatively associated with tourist arrivals in both the countries. All of the results discussed above have concluded that tourism worse exchange rate in the long run. Balaguer and Cantavella-Jorda (2002) argued that tourism development is a factor of economic development in a long run. This study taken a time series quarterly data of Spain from 1975 to 1997. The variables were used in this study are tourist arrival, real effective exchange rate and economic progression. The outcomes of granger causality confirm that there is a bi-directional causality exists between tourist arrivals and real effective exchange rate in Spain. Additionally, Chadeeand and Mieczkowski (1987) identify the effect of exchange rate on tourist arrivals of US resident to Canada by taking time series data from 1976(1) to 1985(4). The outcomes of OLS regression recommend that the depreciation of the exchange rate did have encouraging impact on the tourism industry in Canada.

Dritsakis (2004) empirically examines the influence of tourism on economic improvement in Greece by taking quarterly data from 1960 to 2000. The variables used in this research were real exchange rate and international tourist. The outcomes of Granger causality explained that there is simply causal connection exists among global tourism and real exchange rate. Furthermore, Kaplan and Çelik (2008) explored the association among tourism exploration, economic development and real effective exchange rate of Turkey during the period of 1963 to 2006. The outcomes of Granger causality suggested that there is uni-directional causality exists among tourism exploration and exchange rate which is running from tourism to real effective exchange rate. Likewise, Belloumi (2010) empirically investigate a tri-variate model of tourism, economic development and exchange rate of Tunisia from the era of 1970 to 2007. The results suggested that there is a uni-directional causality exists among tourism and real effective exchange rate. Additionally, Webber (2001) explored the relationship among exchange rate volatility and tourism demand by taking quarterly data of Australia since 1983 to 1997. The results suggested that variance of exchange rate volatility is significantly determine long run tourism demand in Australia. Along with this, Santana-Gallego, Ledesma-Rodríguez, and Pérez-Rodríguez (2010) examine the effect of exchange rate on international tourism utilizing panel data of 113 nations over the era of 1995 to 2004. The outcomes suggested that exchange rate regimes are playing assisting role in promoting tourism demand.

Dincer, Dincer, and Ustaoglu (2015) examine the impact of exchange rate volatilities on tourism by taking annual data from 2003-2014. The outcomes of Johansen and Juselius (J.J) cointegration analysis explain there is long run connection among tourism and real effective exchange rate in Turkey. The outcomes also indicate that economic growth of Turkey is enhancing due the increase of amount of investment in tourism sector. Likewise, Falk (2015) argued on the impact of exchange rate on tourism demand in Austria resorts. The outcomes of panel ECM model explain that the elasticity of tourism is significant with real exchange rate. Also, Chi (2015) investigates the impact of exchange rate on tourism in US from 1960 to 2011. Outcomes suggested that exchange rate has a significant on US tourism trade balance. Similarly, Agiomirgianakis, Serenis, and Tsounis (2015) scrutinize the connection of exchange rate volatility and tourism arrivals in Iceland by taking the data from 1990(Q1) to 2014(Q4). The outcomes of ARDL suggested that inverse effect of exchange rate on tourist in Iceland. Moreover, Vita (2014) examines the influence of tourism and exchange rate of 27 organization of OECD and non OECD countries. The data used in this study were starting from 1980-2011 along with the variables of tourist arrivals and exchange rate. The outcomes of GMM estimation explain that exchange rate regime is contributing in order to attract worldwide tourist arrivals.

Data and Methodology

Data

The datasets consider in current study comprises of monthly observation of tourism development (TD), which is measured by number of tourist arrivals and the other variables which is real effective exchange rate(ER) for France. The data for both variables is gathered from Global Economic Monitor (World Bank) and Euro Stats (European Statistics). We have a sample of 236 monthly observations from 1996(1) to 2015(8). The data is converted in the logarithmic difference series to obtain the return-series with the view of making our findings more comparable.

Methodology

We investigate the long run association among TD and ER by opting the two traditional cointegration methods specifically, Autoregressive distributed lag (ARDL) method (M. H. Pesaran

& Pesaran, 1997; M. H. Pesaran & Shin, 1998; M. H. Pesaran, Shin, & Smith, 2000, 2001) for cointegration and (Johansen & Juselius, 1990) cointegration method.(Shah, 2016) The observed equation of the ARDL model is given below.

$$\Delta ER_t = \alpha_o + \alpha_1 \sum_{i=1}^{p} \Delta ER_{t-1} + \alpha_2 \sum_{i=1}^{p} \Delta TD_{t-1} + \beta_1 ER_{t-1} + \beta_2 TD_{t-1} + \mu_t$$

Where α_o is a constant while μ_t is a white noise error term. The error correction dynamic is reserved by the variables related with the summing up symbols, while the further measure of the estimation specifies the long-run association. Schwarz Bayesian Criteria (SBC) is taken to inspect the maximum numbers lags of the model and entirely series. The Johansen and Juselius cointegration technique is created on $trace\lambda$ and $max\lambda$ statistics. The main statistics are assumed by:

$$\lambda_{trace} = -N \sum_{i=r+1}^{n} ln(1 - \lambda_i),$$

$$\lambda_{max} = -N \ \ ln(1 - \lambda_{r+1}),$$

In the above scenario, the null hypothesis is $r = g$ alongside the alternative hypothesis is $r \neq g$. The null hypothesis in the Johansen and Juselius (1990) cointegration approach suggest that there is no long run relationship present between the considered variables.(Nathan, Liew, & Wong, 2016; Bashir, Nasim, Ismail, et al., 2016)

A Concise Essay on Wavelet Approach

The wavelet transform approach was introduced to overcome the limitations of the Fourier transform. (Fan & Gençay, 2010) documented that "The Fourier approach is appealing when working with stationary time series. However, restricting ourselves to stationary time series is not appealing, since most economic/financial time series exhibit quite complicated patterns over time (e.g., trends, abrupt changes, and volatility clustering). In fact, if the frequency components are not stationary such that they may appear, disappear, and then reappear over time, traditional spectral tools may miss such frequency components. Wavelet filters provide a natural platform to deal with the time-varying characteristics found in most real-world time series, and thus the assumption of stationarity may be avoided. The wavelet transform intelligently adapts itself to capture features across a wide range of frequencies and thus is able to capture events that are local in time. This makes the wavelet transform an ideal tool for studying non-stationary time series." The basic requirement for the Fourier transform is to facilitate the time series undergo in the study should be cyclic and presumes that occurrences do not progress in the time etc (Ramsey, Lampart, et al., 1998; Ramsey & Lampart, 1998). In the wavelet transform, its frame is changed regularly from low to high or from high to low frequency. This is due to the presence of short frame at high frequency and on the other hand by developing time wrapping or dilatation, instead of a deviation of frequency in the adjusted signal which is attained by extrication the time axis into a series of consecutively short sectors.

The discrete wavelet transform (DWT) convert a times series data by separating it into sections of time sphere known as "scales" or frequency "bands". These bands explain increasingly high and the biggest band symbolizes improvably low frequency variations (Tiwari, Mutascu, & Albulescu, 2013). The fundamental wavelets in any wavelet family are categorized into two main varieties specifically father wavelets φ and mother wavelet ψ. The equations used to symbolize both of them are expressed as:

$$\int \varphi(t)dt = 1, \tag{1}$$

$$\int \psi(t)dt = 0, \tag{2}$$

First, the father wavelets are taken for the short frequency flat components part of a signal. Secondly, mother wavelets are taken for long frequency features components. In addition, the father wavelet is taken for the trend mechanism and mother wavelets for variation from the trend. The attained wavelet foundation can be present correspondingly by the couple of functions:

$$\varphi_{j,k} = 2^{j/2}\varphi(2^j t - K), \tag{3}$$

$$\psi_{j,k} = 2^{j/2}\psi(2^j t - K), \tag{4}$$

Where, the value of $j = 1, ..., J$ indicates the measure and $k = 1, ..., 2^j$ indicates the transformation. The factor j is taken as a the factor of expansion of waves' functions. This factor j regulate the maintenance of $\psi_{j,k}(t)$ to locally confine the qualities of low or high frequencies. The factor k is taken to reposition the wavelets in the chronological scale. The optimum amount of measures that could be taken in the technique is based by the count of observation $(T \geq 2^j)$.

One extraordinary features of the wavelet extension is the localization features that the coefficient of $\psi_{j,k}(t)$ discloses the detail context of the role at estimated position $K2^{-j}$ and frequency 2^j. Whereas, the total count of wavelet family units have been established in the literautre, most of the studies is considered on the orthogonal wavelet fot example Coiflets, Symmlets and Daublets. A time series $f(t)$ could be prolonged over the basis of wavelet and articulated as follows:

$$f(t) = \sum_k S_{j,k}\varphi_{j,k}(t) + \sum_j \sum_k d_{j,k}\psi_{j,k}(t), j = 1, ..., J. \tag{5}$$

Where $\varphi_{j,k}$ is a measuring function with the analogous common measure coefficients $s_{j,k}$ and $d_{j,k}$ are the feature (excellent measure) coefficients provided correspondingly by $s_{j,k} = \int f(t)\varphi_{j,k}(t)dt$ and $d_{j,k} = \int f(t)\psi_{j,k}(t)dt$. These coefficients provide a measure of the contribution of the resultant wavelet to the function. The fact coefficient, $d_{j,k}$ symbolize enhancing better measure variation starting the smooth trend and $s_{j,k}$ which explains the smooth coefficient and confine the drift. The wavelet sequence estimate of the innovative series $f(t)$ could be articulated as given below:

$$f(t) = S_J(t) + D_J(t) + D_{J-1}(t) + ... + D_1(t) \tag{6}$$

This equation signifies the decomposition of $f(t)$ into orthogonal mechanism at various decisions and composes the so-called wavelet multi-resolution analysis (decomposition) (MRA); where the series $S_J(t) = \sum_k S_{J,K}\varphi_{J,K}(t)$ gives a smooth of original time series $f(t)$ and explains the estimation that detains the long run characteristics (i.e., the low-frequency dynamics), and the series $D_j(t) = \sum_k d_{j,k}\psi_{j,k}(t)$ refer to wavelet details and capture local fluctuations (i.e., the higher-frequency characteristics) over the whole period of $f(t)$ at each scale.(Raza, Sharif, Wong, & Karim, 2016)

The Continuous Wavelet Transform

This type of wavelet transform $W_(x)(m,n)$ is acquired by analyzing a definite wavelet $\varphi(.)$ against the time sequence $x(t) \in L^2\mathbb{R}$, i.e.

$$W_x(m,n) = \int_{-\infty}^{\infty} x(t)\frac{1}{\sqrt{n}}\varphi(\frac{t-m}{N})dt$$

An essential characteristic of the continuous wavelet transform is the capability to decompose and after that consequently seamlessly recreate a time series $x(t) \in L^2\mathbb{R}$:

$$x(t) = \frac{1}{C\psi}\int_{0}^{\infty}\left[\int_{-\infty}^{\infty} W_x(m,n)\psi_{m,n}(t)du\right]\frac{dn}{N^2}, N > 0$$

Moreover, the continuous wavelet transform reserve the power of the observed time sequence,

$$\parallel x \parallel^2 = \frac{1}{C_\psi}\int_{0}^{\infty}\left[\int_{-\infty}^{\infty}|W_x(m,n)|^2 dm\right]\frac{dn}{N^2}$$

In the current study, we use this characteristic for the description wavelet coherence, which quantify the size of the native connection among two time framework (Arif & Suleman, 2017).

Wavelet Coherence

For analyzing the association among two time series, we require presenting a bivariate structure termed as wavelet coherence. In support of the appropriate description of wavelet coherence, we have to describe the cross wavelet transform and cross wavelet power first. According to (Torrence & Compo, 1998) cross wavelet transform can be explained by two time sequence $x(t)$ and $y(t)$ as:

$$W_{xy}(m,n) = W_x(m,n)W_y^*(m,n)$$

Where, $W_x(m,n)$ and $W_y(m,n)$ are two continuous wavelet transform of $x(t)$ and $y(t)$, separately, m is location index, and n represents the measure, whereas the sign $*$ signifies a composite conjugate. The cross wavelet power could simply be calculated by the cross wavelet transform as $|W_x(m,n)|$. Furthermore, the cross wavelet power spectra discloses regions in the time sequence frequency space where the time sequence display a massive mutual power that is it symbolizes the confined covariance among the time sequence at every measure.

The wavelet coherence can identify areas in the time-frequency gap where the observed time series change simultaneously, but don't essentially have a massive mutual power. According to (Torrence & Webster, 1999) the equation of adjusted wavelet coherence coefficient is as follows:

$$R^2(m,n) = \frac{|N\left(N^{-1}W_{xy}(m,n)\right)|^2}{N\left(N^{-1}|W_x(m,n)|^2\right)N\left(N^{-1}|W_y(m,n)|^2\right)}$$

Where, S is a smoothing mechanism. The range of squared wavelet coherence coefficient is $0 \leq R^2(m,n) \leq 1$. If the value is found close to zero means there is a weak correlation, whereas, if the value is close one indicates a powerful correlation. Therefore, the squared wavelet coherence dealings with the local linear association among stationary series of two variables at every scale and is corresponding with the squared correlation coefficient in linear regression.

Meanwhile, the hypothetical allocation for the wavelet coherence is not identified, so in the current study we examine it with the help of Monte Carlo methods. In the examining process, current study focuses the method of (Torrence & Compo, 1998; Grinsted, Moore, & Jevrejeva, 2004).

The usage of wavelet carries with it the trouble of dealing with edge situation on a data with predetermined interval. This is a mutual difficulty face when transforming base on filters. In current study, we overcome this complexity by filling the time sequence with an enough digit of zeroes. The regions where the errors affected by breaks and gaps in the wavelet transform can be overlooked, i.e. where boundary impacts become essential, is called the shaft of control (Grinsted et al., 2004).

Empirical Analysis

Figure 1: Real difference series of TD for France

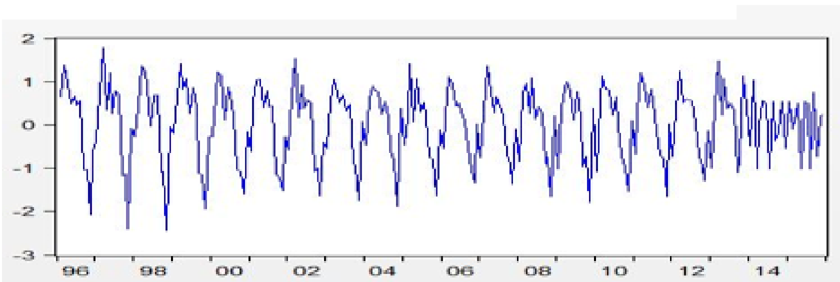
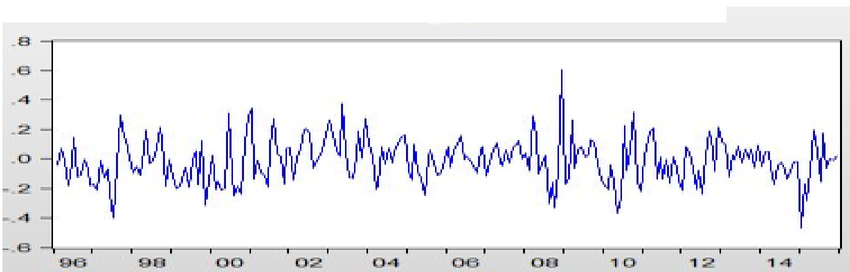


Figure 2: Real difference series of ER for France



As mentioned earlier, the current work is aimed to inspect the influence of tourism development on exchange rate in one of the leading tourist destination of the world.

In figure 1 & 2 we plot the difference time series of TD and ER for France.

Table 1
Stationary Test Results

Variables	Augmented Dickey-Fuller				Phillips-Perron			
	I(0)		I(1)		I(0)		I(1)	
	C	**C&T**	**C**	**C&T**	**C**	**C&T**	**C**	**C&T**
TD	1.60	-1.76	-4.68	-4.87	-1.20	-1.80	-4.78	-4.92
ER	-1.30	-1.43	-4.92	-4.90	-1.17	-1.70	-4.92	-4.90

Note: The critical values for ADF and PP tests with constant (c) and with constant & trend (C&T) 1%, 5% and 10% level of significance are -3.711, -2.981, -2.629 and -4.394, -3.612, -3.243 respectively.
Source: Authors' estimation.

Here, it can see the substantial fluctuations in the real difference series of both variables TD and ER. We observe that in monthly observations there are significant changes in both series during the sample. We use Augmented Dickey Fuller (Dickey & Fuller, 1979) and Phillips and Perron (Phillips & Perron, 1988) unit roots tests to evaluate the stationary properties of both series. Results of unit root tests are described in table 1. Outcomes of all unit root tests propose that the series of TD and ER are non-stationary at level and then they become stationary at first difference. These findings recommend that there is no issue of unit root problem in both variables.

Table 2
Lag Length Selection & Bound Testing for Cointegration

Lags Order	AIC	HQ	SBC	F-test Statistics
0	-5.407	-5.331	-5.196	
1	-6.003	-6.545	-6.736	
2	-7.589	-7.754	-7.267	
3	-8.407	-8.331	-8.196	89.105*
4	-8.501	-8.471	-8.314	
5	-8.874	-8.689	-8.543	
6	-9.433	-9.245	-9.135	
7	-10.089*	-9.754*	-9.467*	

* 1% level of significant.
Source: Authors' estimation.

In addition to it, we examine the long run association among TD and ER by using the two co-integration approaches explicitly, Autoregressive distributed lag (ARDL) method (M. H. Pesaran & Pesaran, 1997; M. H. Pesaran & Shin, 1998; H. H. Pesaran & Shin, 1998; M. H. Pesaran et al., 2000, 2001) for cointegration and Johansen and Juselius (1990)) cointegration method. Table 2 and table 3 display the outcomes of ARDL and Johansen and Juselius co-integration methods. Results of both tests establish that there exists a significant long-run association between tourism development and exchange rate in France. After ratifying the valid long run association among both the variables, we move further to examine the relationship between TD and ER through wavelet analysis.

Table 3
Johansen and Juselius Cointegration Test

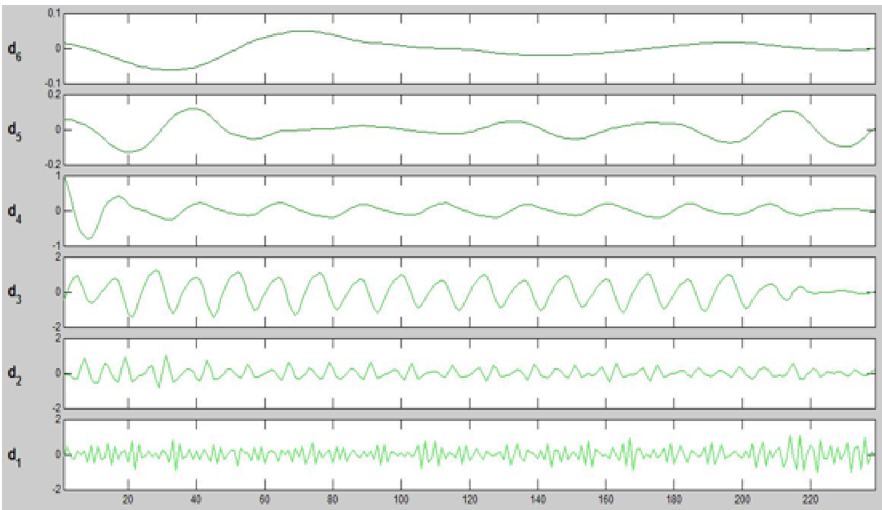
No. of CS(s)	**Trace Statistics**	**5% critical values**	**Max. Eigen Value**	**5% critical values**
None	106.177	79.341	43.928	37.164
At most 1	62.249	55.246	33.034	30.815

Source: Authors' estimation.

Wavelet Decomposition

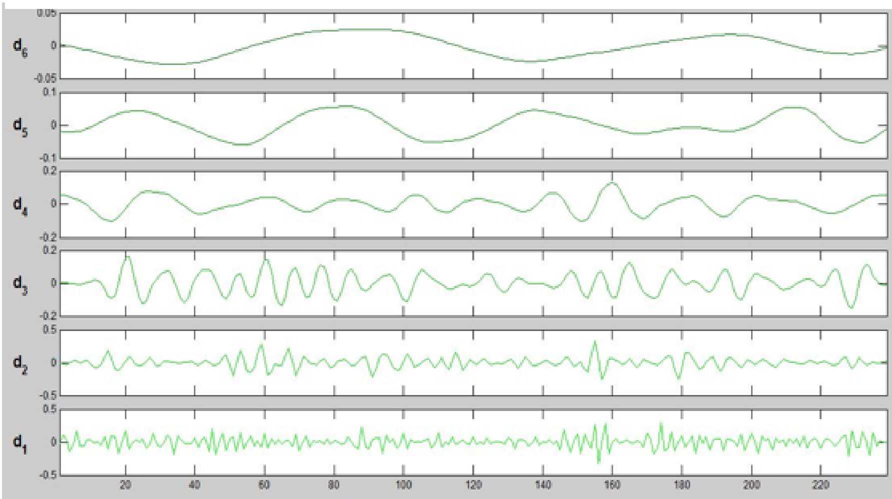
In the current literature, there are very limited researches have been completed to investigate the association among tourism development and real effective exchange rate in developing and developed economics. Along with this, Gallegati, Gallegati, Ramsey, and Semmler (2011) debate that in the data set of various variables there are several periods, and not just the two can explain the proper time scales in the specific analysis. Therefore, we study the relationship between TD and ER by using time frequency based method "Wavelets". In this approach, we study the various time horizon in the time series datasets. Wavelet study the issue of non-stationarity as a basic feature of time series instead an issue to be answered by the pre-processing of the dataset. Figure 3 and 4 demonstrate the multi-resolution analysis (MRA) of pattern J=6 for the both time series i.e. TD and ER by using Daubechies (1992) least asymmetric (LA) wavelet filter. The Daubechies (1992) explains "least asymmetric wavelet filter LA is a widely used wavelet, because it provides the most accurate time-alignment between wavelet coefficients at various scales and the original time-series, and it is applicable to a wide variety of data types".

Figure 3: Orthogonal Component (decomposition series of TD on J=6 wavelet levels)



In both figure, we plot the orthogonal components (D1, D2, . . . D6) to display the diverse frequency components of the original series in particulars. The outcomes display that the high frequencies are established in the short period of both series. Additionally, the deviation in the two series is become further stable in the long periods.

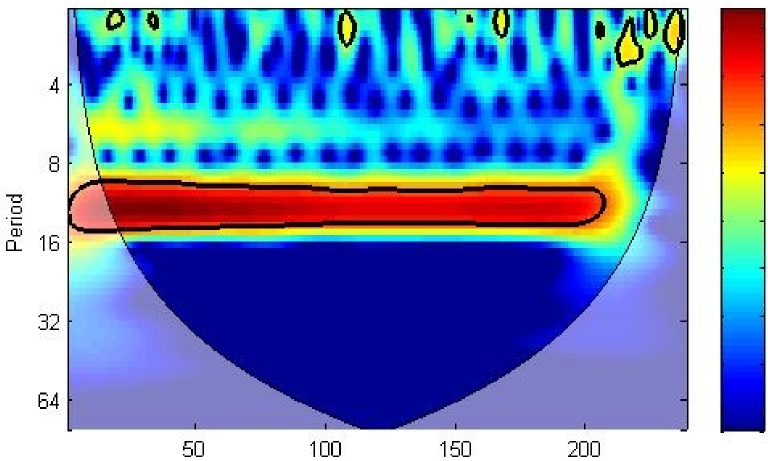
Figure 4: Orthogonal Component (decomposition series of ER on J=6 wavelet levels)



Continuous Wavelets Transform

The main role of wavelet transform analysis is the grouping of time and frequency analysis, but the explanation is not as easy since the frequency information has diverse resolution at each stage. The continuous wavelet analysis is relatively easier to interpret because it is offer more observable and visible frequency evidence.

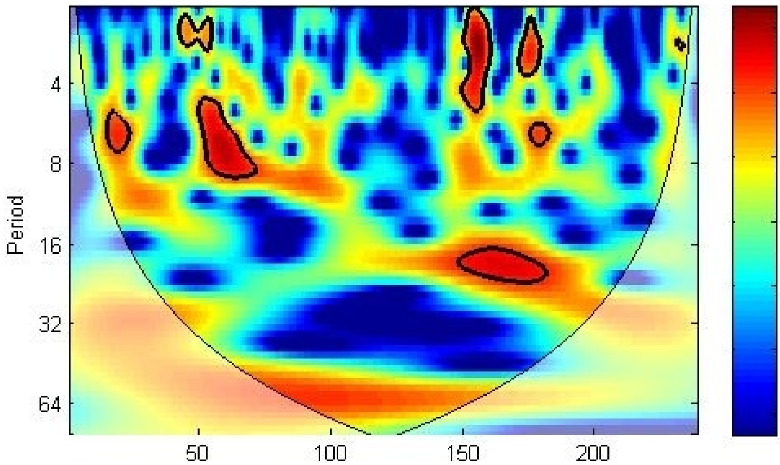
Figure 5: Continuous wavelet power spectra of the TD



25	1998-02-01
50	2000-03-01
75	2002-04-01
100	2004-05-01
125	2006-06-01
150	2008-07-01
175	2010-08-01
200	2012-09-01
225	2014-10-01

Note: The thick black contour represents the 5% significance level against the red noise. The color code for power ranges from blue (low power) to red (high power).

Figure 6: Continuous wavelet power spectra of the ER



25	1998-02-01
50	2000-03-01
75	2002-04-01
100	2004-05-01
125	2006-06-01
150	2008-07-01
175	2010-08-01
200	2012-09-01
225	2014-10-01

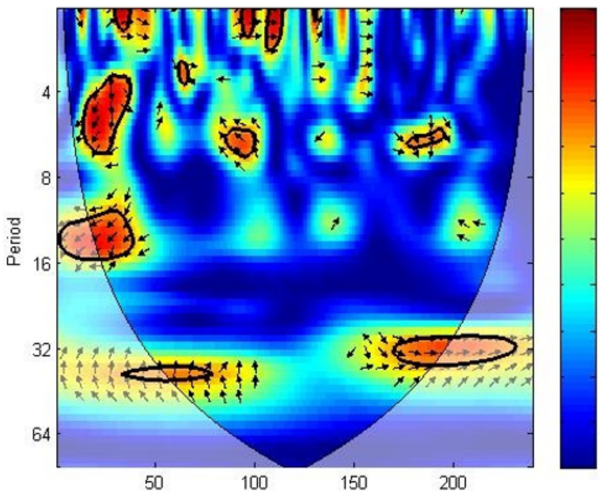
Note: The thick black contour represents the 5% significance level against the red noise. The color code for power ranges from blue (low power) to red (high power)

Consequently, to establish the findings of wavelet transform, we also use continuous wavelet analysis in analyzing the association between tourism development and real effective exchange rate. Figure 5 & 6 displays the continuous wavelet power spectrum of both series. The continuous wavelet power spectrum shows the activities of the series in a three dimensions curve plot: time, frequency and color code. Figure-5 and 6 visibly specifies that in both series of TD and ER have diverse characteristics in different time frequency areas. Results point out that in the case of TD we observe comparatively a quite stable variance in the long and very long run related to the short and medium run. We also notice the strong variance for the medium scale. These findings suggest that the variance in the tourism development occur in the short run a little bit and mostly in the medium run. Moreover, Outcomes display that in the case of ER. We again observe a substantial high variance in the short and medium run. These conclusions propose that the variance in the ER confidently also occur in the short and medium run as well.

Wavelet Coherence Transform

We use wavelet coherence transform to categorize the occurrence of cause and effect connection among TD and ER in France. The wavelet coherence offers the common power (features) and comparative phase of various time sequences in present time-frequency space. The cone of influence (COI) tests is also measured to investigate the anti-cyclical relationship between TD and ER. Figure-7 displays the wavelet coherence power spectrum between tourism development and real effective exchange rate in France.

Figure 7: Wavelet Coherence between TD and ER in France



25	1998-02-01
50	2000-03-01
75	2002-04-01
100	2004-05-01
125	2006-06-01
150	2008-07-01
175	2010-08-01
200	2012-09-01
225	2014-10-01

Note: The thick black contour represents the 5% significance level against the red noise. The color code for power ranges from blue (low power) to red (high power).

We have argued the outcomes of wavelet coherence on the bases of our earlier decided three main periods, namely; (D1+D2) signifies the short run, (D3+D4) denotes the medium run,(D5+D6) in long rum. Results specify that the significant causal relationship exist among TD and ER in short, medium and long run. Initially, we explain the outcomes of very short run; we notice the several different situations of in-phase relationship. From 2000-2007, we see an in-phase situation where TD is leading (TD has a causal influence over ER). In the short and medium, we notice the in-phase relationship between TD and ER, where TD is leading (TD has a causal influence over ER) and ER is leading too (ER has a causal influence over TD) for the period from 1997-2003 and from 2010-2012. In the long run, we observed that there bidirectional causality exists between TD and ER over the period of 1996-2004 and from 2008-2015. These findings of wavelet coherence approach confirm that both variables are majorly having an influence over each other in short, medium and long run. We find the unidirectional influence of TD on ER in short run and bidirectional influence between TD and ER in medium and long run in France.

Wavelet Based Granger Causality Analysis

We use wavelet based Granger causality analysis by using the time frequency band of wavelet transform to investigate the causal relationship between TD and ER. Table 4 explains the results of Granger causality through frequency series and time-scales.

Table 4
Results of Wavelet based Granger causality test at different time scales

TD	Time Domain	Frequency bands (months)					
	ER						
	Raw Series	D1 2-4M	D2 4-8M	D3 8-16M	D4 16-32M	D5 32-64M	D6 64-128M
Ho: Tourism development does not cause real effective exchange rate							
	0.000	0.032	0.010	0.000	0.000	0.000	0.000
Ho: Real effective exchange rate does not cause Tourism development							
	0.001	0.116	0.394	0.079	0.065	0.046	0.027

Note: p-values for the F-test show the rejection of null hypothesis of no causality (i.e., if p-values < 0.10, we accept the causality at 10% significance level).
Source: Authors' estimations.

The wavelet granger causality test offers us the opportunity to examine that each TD cause the change in high, medium and low frequencies of the ER series. The results of table-4 specify that the raw series of tourism development has bidirectional influence over raw series of ER in France. Outcomes also confirm that there is a unidirectional causal influence of tourism development on real effective exchange rate in short and also a bidirectional causal influence of tourism development on real effective exchange rate in medium and long run. These outcomes are consistent with the findings of wavelet coherence transform.

Conclusion and Recommendations

The current literatures specify that the tourism development has substantial influence over the exchange rate of both high tourist arrival and low tourist arrival countries. The outcomes of the earlier studies are very mixed and contrary. Moreover, they also used classical analysis methods based on autoregressive models, linear models or cointegration models are prone to the problems of non-stationary time series. Due to that apprehension, we have used the wavelet transform framework to test the association among tourism development and exchange rate in France. This innovative technique empowers the decomposition of time-series at different time-frequencies and proposes the precise results for the different time-frequencies based on short, medium, long run. In the current study, we have used continuous wavelet power spectrum, wavelet coherence spectrum and wavelet based granger causality analysis to observe the association among TD and ER in France by utilizing the monthly data from 1996(1) to 2015(8).

Results of ADF and PP unit root tests display that there is no issue of stationary in the series for the whole period. Outcomes of ARDL and Johansen-Juselius cointegration propose the significant long run association among TD and ER in France. The results show that in the case of TD and ER, we notice a substantial high variation in the short and medium run. These findings recommend that the variance in the both series occur in the short and medium run as well. Moreover, the findings of wavelet coherence approach confirm that both variables are majorly having an influence over each other in short, medium and long run. We find the unidirectional influence of TD on ER in short run and bidirectional influence between TD and ER in medium and long run in France. Finally, the results of wavelet based granger causality also confirm that there is a unidirectional causal influence of tourism development on real effective exchange rate in short and also a bidirectional causal influence of tourism development on real effective exchange rate in medium and long run.

Since the hypotheses position out at the start of this study has been answered, as a closing statement we can propose that there is bidirectional causal association between tourism and exchange rate in France. Along with this, government of France needs to increasing and promoting tourism demand and further nurturing and providing the expansion of tourism resource. A focus involvement of the country for tourism development, and specifically for the tourist economy, is obvious both straight in the growth of tourism substructure or indirectly by incentives and funds. Commonly, this is an attribute of contemporary progress of tourism, but is also obvious that the country is focusing to increase its tourism prospective, and that tourism is observed as one of the main essential sector of economic movement.

These conclusions are interesting since some questions are left unanswered. Even the exchange rate and tourism have bidirectional causal relationship but, there are also some more variables that might have a relationship with these variables. It should therefore be exciting for future research to categorize these factors. Future modeling and empirical efforts should take these factors into account to attain at additional conclusive results.

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