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Does exchange rate always affect the number of inbound tourists significantly in China?

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Abstract. *This investigation examines the time-varying causality between the exchange rate and the number of the inbound tourism of China using the rolling window estimation. The full-sample causality test suggests no causality between the exchange rate and the number of inbound tourists. However, the parameter stability test revels that this causality is unstable, which suggests that full-sample causality tests cannot be relied upon. Then, we use a time-varying rolling window approach to revisit the dynamic causality, and the results show that the exchange rate has an increasing impact on the number of inbound tourism since 2009, which is consist with the continuous market process of the Renminbi exchange rate. Our result proves that inbound tourists will be more concern about the exchange rate with the expansion of the currency's trading band. The rolling window test reveals that inbound tourism factors should be taken into consideration by China's government with the development of the tourism industry and the marketization of the exchange rate.*

Keywords: exchange rate; inbound tourism; rolling window; time-varying.

JEL Classification: C32; L83.

1. Introduction

Tourism has long been known as “sunrise industry” and “smokeless industry”, as one who has a huge development potential of industry groups and an increasingly position in national economy (Craik, 2001; Leiper, 2008). By continued development, expansion and diversification, tourism has become one of the world’s largest and faster growing economic sectors in the past few decades. According to the world tourism organization, the international tourism transactions has become the largest service industry in international trade. Based on the World Tourism Economic Trends Report (2017), international tourist arrivals firstly reached a record of 10 billion (1.4 times the size of the global population) in 2016, which shows an increase of 4.8% over 2015. Global tourism revenue reached 5 trillion and 170 billion dollars in 2016, which shows an increase of 3.6% over the previous year, and equivalent to 7% of global gross domestic product (GDP). The growth rate of global tourist population and total tourism revenue is significantly higher than the global GDP growth rate. Furthermore, according to Tourism Towards 2030, international tourist arrivals worldwide will reach 1.8 billion by 2030. Tourism is one of the most important driving forces of socio-economic development, through export revenues, the creation of jobs and enterprises, and infrastructure development to promote socio-economic progress (Paramati et al., 2017). The above information fully demonstrates that tourism can bring huge business opportunities to a country and promote its economic growth (Chiu and Yeh, 2017). As a result, the economic impact of the tourism has attracted an increasing attention by governments. Researches about the tourism and other macroeconomic variables are increasing in recent years (De Vita and Kyaw, 2013; Falk, 2015; Tang et al., 2016a, 2016b). Webber (2001) points out that tourism is one particular commodity, which is likely to be affected by the exchange rate. Theoretically, the exchange rate could affect the international tourism in two different ways. First, exchange rate fluctuations may affect international tourist destination choice (Akar, 2012; Webber, 2001), since tourists tend to choose countries in which the exchange rate is more favourable (Wang et al., 2008). Second, the variations of exchange rates are likely to alter visitors’ intended length of stay and expenditure. When the destination’s currency depreciates, international tourists have more money to spend and, thus, may prolong the length of stay and increase spending (Crouch, 1993). It seems that the devaluation of a country's currency is conducive to increasing the number of inbound tourists however, the researches about this topic shows strong inconsistency (Vanegas and Croes, 2000; Croes and Vanegas, 2005; Quadri and Zheng, 2010; Quadri and Zheng, 2010). As a result, it is important to study the specific relationship between the exchange rate and the number of inbound tourists.

According to the world tourism organization, China has become the world's third largest inbound tourist destination after the European Union and the US, and it will become the world's largest tourist destination in 2020. China has abundant natural and human tourism resources. In especial, the number of inbound tourists in China rises substantially with the rapid development of the economy in recent years. Data from People's Republic of China National Bureau of statistics shows that China receives 133.82 million inbound tourists, which shows an increase of 4.14% over 2014, and creates 113.65 billion dollars in foreign exchange earnings. The increasing number of inbound tourists directly reflects the recognition of China's political, economic and cultural environment. In addition, China cancels the fixed exchange rate system against the dollar and begin to implement a managed floating exchange rate system with reference to a basket of currencies in 2005:07. Since then, China continues to introduce a series of exchange rate system reforms in order to promote the exchange rate market. In this context, the RMB exchange rate floating range continues to expand. In 2007, the Central People's Bank expands the exchange rate floating range from 0.3% to 0.5%. In 2012 and 2014, the floating range is further expanded to 1% and 2%, respectively. China's exchange rate flexibility is continuously enhanced with the constant development of the exchange rate market. Santana-Gallego et al. (2010) point that the exchange rate arrangement is a major factor in the determination of inbound tourists. The gradual evolution of China's exchange rate provides us with a good sample to examine the dynamic relationship between the exchange rate and inbound tourism.

Crouch (1994a, 1994b) points out that researches on the effect of the exchange rate on tourism demand can be divided into two groups. First, some empirical studies have found that exchange rate does not have significant effects on tourism demand (Vanegas and Croes, 2000; Quadri and Zheng, 2010). Vanegas and Croes (2000) apply the linear and the double log linear models and find that exchange rate is not statistically significant for tourism demand from the US to Aruba. In addition, Quadri and Zheng (2010) apply a regression approach to examine relationship between exchange rates and international arrivals and find that exchange rates have no effect on 11 out of the 19 nations being examined. On the contrary, other empirical studies find strong significant effects of the exchange rate on tourism demand (Webber, 2001; Wang et al., 2008; Kuo et al., 2009; De Vita and Kyaw, 2013). Webber (2001) studies the cointegration between the exchange rate and the tourism demand in Australian applying both the Johansen and Engle and Granger procedures, and find that fluctuation in the exchange rate is a significant decisive factor that determines 50% of the long-run tourism demand. Wang et al. (2008) adopt a copula approach to study the correlation between tourism demand and exchange rates for some Asian Countries and find that currency appreciation had a greater effect on tourism demand than the currency depreciation. Kuo et al. (2009) use panel data techniques to research the effect of the exchange rate on tourism demand in eight Asian countries and find that the currency of the destination country depreciating relative to the currency of the origin country is advantageous for international tourism business of the destination country, and vice versa. De Vita and Kyaw (2013) test the impact of the exchange rate on Turkey's tourist arrivals from Germany and find that exchange rates are significant determinants of tourism arrivals. Some literatures argues that effects of exchange rate show differences in nationals. Croes and Vanegas (2005) specify a dynamic econometric model and document that exchange rate had a positive effect on tourist arrivals to Aruba from the US, the Netherlands and Venezuela, but the coefficient of exchange rate variables is not significant in other countries. All the above studies mostly focus on the full-sample analysis without considering the pervasive structural changes. However, in fact, the policy and the regime of a country's exchange rate are in constant changes. Unfortunately, only a small amount of literature has examined it (Santana-Gallego et al., 2010; De Vita, 2014). Santana-Gallego et al. (2010) apply panel data techniques to analyze the effect of exchange rate arrangements on international tourism and find that that it is a major factor in the determination of tourist arrivals. De Vita (2014) test the effect of exchange rate regime on international tourism flows of Economic Co-operation and Development (OECD) and non OECD countries using a system generalized methods of moments (SYS-GMM) estimation and find that it is important to maintain a relatively stable exchange rate to attract international tourist arrivals. However, these studies are more likely to use panel data for inter country comparisons without considering heterogeneity among countries.

Researches about the tourism on China rarely mention the effects of exchange rate. Yang et al. (2010) utilize the annual provincial panel data over the 2000-2005 period to test the determinants of international tourist arrivals in China and find that key determinants include the relative income, population in the original country, cost of travel, and tourism infrastructure. Within the sample range of Yang et al. (2010), China implements a fixed exchange rate system pegged to the dollar, and the effect of the exchange rate is not included in the scope of this study. Most literatures research on China about the tourism demand mainly relate to the trade (Shan and Wilson, 2001), the forecasting of the tourism demand (Goh and Law, 2002; Chen and Wang, 2007; Zhou-Grundy et al., 2014) and the economic contribution (Pratt, 2015). Only a few of studies research on the impact of exchange rate on the tourism demand and draw the opposite conclusion (Kuo et al., 2009; Tang et al., 2016). Kuo et al. (2009) investigate the impact of namely exchange rate on the international tourism demand in China and find that currency of destination country depreciated relatively to currency of origin country is helpful to the international tourism business in destination country. However, Tang et al. (2016) investigate the dependence between tourism demand and exchange rate in China and find the volatility of exchange rate is not a determinant factor in fluctuation of China's inbound tourism demand. Inconsistencies in these results may stem from differences in data and methodological. As discussed above, China's exchange rate regime has gone through a process from fixed exchange rate to continuous marketization in the past decade. This constant change of the RMB exchange rate is not taken into account in the previous literatures.

Different from previous literatures, this paper makes a contribution that taking into account structural changes. The existing literatures exclusively utilize the conventional methods and the full-sample time series, which may suffer from inaccurate results (Balcilar et al., 2010). With the opening up of China’s economy and high degree of the dependence on trade in the past few decades, China speeds up the reform of RMB exchange rate system, such as the exchange rate system reform in 2005:07, the expansion of the floating range of the exchange rate in 2007, 2012 and 2014. The series of institutional changes may cause structural changes of the causality between exchange rate and the number of inbound tourism. Structural changes is identified and incorporated into the estimation using several techniques such as sample splitting and the use of dummy variables in most literature. However, these techniques impose a disadvantage of pre-test bias since the specific timing of structural changes cannot be detected intuitively. In order to overcome the parameter non-constancy and avoid pre-test bias, this study proposes the rolling-window sub-samples Granger causality test based on the modified bootstrap estimation. Instead of just testing for causality on the full-sample which assumes a permanent causal relationship, we test for causality on the rolling sub-sample with a fixed -size window to capture structural changes in the model and the evolution of causality across sub-periods. Though the full-sample test suggests no causality between the exchange rate and the number of inbound tourists, the rolling window approach shows a more complex result. We find an undirectional causality from the exchange rate to the number of tourists in some sub-periods. Specifically, there is no causality before 2009. However, the time interval of causality shows an increasing trend since 2010, which is consist with China's marketization of exchange rate. China begins to expend its exchange rate fluctuation interval since 2007 (0.3-5% in 2007, 0.5-1% in 2012; 1-2% in 2014). This suggests that the flexibility of the exchange rate can effectively strengthen the causal relationship between the number of inbound tourism and the exchange rate. The influence of changes in the value of RMB cannot be ignored since 2013. With the continuous development of the exchange rate market, the RMB exchange rate floating range will be further expanded. By then, inbound tourists will be more concerned about changes in the value of RMB. Tourism is an important pillar of the third industry, and our results also show that tourism factor should be taken into account in the future exchange rate policy formulation of China.

This study structures as follows. Section 2 explains the theoretical model. Section 3 introduces the methodology. Section 4 describes the corresponding data and empirical results. Section 5 concludes.

2. Interaction of tourism and exchange rate

We reference a dynamic model from Morley (1998) to revel the dynamic relationship between the number of inbound tourists and the exchange rate. Potential tourists will determine the destination of the travel based on the information they have that include the exchange rate and other factors. These will depend on previous tourism patterns, in that a greater number of tourists from source f to destination d in the past will increase the spread of information about f and d. Suggest that the number of past tourists is a function of exchange rate and other factors which also have an influence on the current tourism level. As a result, current tourism flows are determined by the relevant variables indirectly. The effect of information flows in a population is an aggregate effect and modeled as such over the relevant population at a tourist source, so the lag structure is appropriate for aggregate level models of numbers of tourists between an origin and destination, and not for modeling individuals' choice of holiday. The model of aggregate demand will be dynamic as it incorporates the inherently dynamic concept of information flows. In the following discussion the dependence of the argument on a particular source, f, and destination, d, is suppressed in the notation but a model with subscripts f and d is implicit.

In application to tourism, a population is posited to have a number of potential tourists for whom choosing a particular destination is part of their utility maximizing consumption (Morley, 1992). Not all of these have the tour in their consideration set (Woodside and Lysonski, 1989) from which their choice of destination is actually made. The information flows are means by which an unevoked destination becomes a considered destination, and hence is chosen by these agents. Three channels are proposed as important for tourism information. Let $TOUR^*$ be the number of potential choosers of a particular destination, and $TOUR_\tau$ denotes the number of tourists who have visited the destination at time τ.

Restricting attention, at first, to those who have not previously visited a particular destination, if potential tourists deliberately search for information and access the relevant information about the tour as Bernoulli trials, then the number of new tourists who take the tour at time τ due to deliberately searched out information is $c_1 \cdot (TOUR^* - TOUR_\tau)$ for some constant of proportionality c_1. If information is propagated essentially randomly with respect to the potential tourists, then it will be encountered unsought by a proportion c_2 of the potential new tourists, and the number of new tourists who take the tour at time τ due to unsought encounter with the information is $c_2 \cdot (TOUR^* - TOUR_\tau)$. The parameter c_2 may be dependent on marketing and advertising of the tour.

Personal communication of information about the destination requires the meeting of a past visitor to the destination and a potential tourist. Assuming independent mixing of past and potential visitors, the probability of such a meeting is the product of the proportion of past visitors $\frac{TOUR_\tau}{TOUR^*}$ and the proportion of potential new visitors $\frac{TOUR^* - TOUR_\tau}{TOUR^*}$, so the expected number of meetings is $\frac{TOUR_\tau}{TOUR^*} \cdot \frac{TOUR^* - TOUR_\tau}{TOUR^*}$. $TOUR^*$ and the flow of new tourists resulting will be proportional to this expected number. So there will be $b \cdot TOUR_\tau (TOUR^* - TOUR_\tau)/TOUR^*$ new tourists at time τ due to word of mouth information spread. Combining the three channels, the number of new takers of the tour at time τ is as follows:

$$A_t = (c_1 + c_2) \cdot (TOUR^* - TOUR_\tau) + \frac{b \cdot TOUR_\tau (TOUR^* - TOUR_\tau)}{TOUR^*} \tag{1}$$

The assumptions made with respect to tourism information flows are very similar to those underlying diffusion models and the form of equation derived is equivalent to a mixed influence diffusion model. The model has an identification problem; it is not possible to distinguish the deliberate search effect (c_1) and the unsought encounter effect (c_2) which are both external influences contributing to the parameter $a = c_1 + c_2$.

The diffusion model derived above is for first time visitors, paralleling diffusion models' concentration on new adopters. Most tourism data do not allow differentiation of first time and repeat visitors, so it is necessary to augment Equation (1) with a term for repeat visitors. Let Z_t be the number of repeat visitors at time τ. Z_t is a function of $TOUR_\tau$. If the simplifying assumption of a constant proportion (m) of repeat visitors is made then $Z_t = m \cdot TOUR_\tau$.

The number of tourists from a population visiting a certain destination is as follows:

$$Y_\tau = A_\tau + Z_\tau \ = a(TOUR^* - TOUR_\tau) + \frac{b \cdot TOUR_\tau (TOUR^* - TOUR_\tau)}{TOUR^*} + m \cdot TOUR_\tau \tag{2}$$

As tourism data are available in discrete time periods, to develop an estimable model requires a discrete time form of Equation (2). In the information flows arguments, $TOUR_\tau$ is the number of previous visitors in the population (i.e., not including Y_τ), so in discrete time the relevant term is the cumulative number of visitors up to and including in the previous time period, $TOUR_{\tau-1}$. A straightforward re-arrangement of Equation (2) in discrete time gives the equation for Y_τ as a quadratic function of $TOUR_{\tau-1}$:

$$Y_\tau = aTOUR^* + (b + d - a)TOUR_{\tau-1} - bTOUR_{\tau-1}^2/TOUR^* \tag{3}$$

Economic utility theory has led economists to specify tourism demand as a function of explanatory variables such as incomes and prices faced by tourists (Crouch, 1994 reviews such specifications and models). For estimation purposes, models specified in log-linear form have been favored. In the notation of Equation (1) to Equation (3), these models are of $TOUR^{*}$, which varies over time in response to changes in the explanatory variables and random shocks (and so will henceforth be given a time period subscript). The standard theory, by assuming perfect information about destinations, identifies Y_{τ} and $TOUR_{\tau}^{*}$, whereas the theory developed above interposes a diffusion model form between them.

Microeconomic theory (Morley, 1992) indicates that the independent variables in the models should include measures of exchange rate and other factors. Therefore, with the exchange rate and other main factors as the relevant explanatory variables let $\ln(TOUR_{\tau}^{*}) = b_0 + b_1 \cdot \ln(ER_{\tau}) + \sum_{k=1}^{n} b_k \ln\left(Others_{\tau}^{k}\right)$, then the model is as follows:

$$\ln(Y_{\tau}) = \ln(a) + \ln(b_0) + b_1 \cdot \ln(ER_{\tau}) + \sum_{k=1}^{n} b_k \ln\left(Others_{\tau}^{k}\right) \tag{4}$$

Such a model can be expected to be most relevant and useful with cases in which diffusion is important; that is, where information about a destination is initially not widespread but becomes more so in an origin population.

3. Methodology

3.1. Bootstrap full-sample causality test

The Granger-causality statistics assume that the underlying time series are stationary and they may not have standard asymptotic distributions when the stationarity assumption does not hold. In this condition, there will be difficulties in the estimation levels of vector autoregression (VAR) models (Sims et al., 1990; Toda and Phillips, 1993, 1994). Shukur and Mantolos (1997) use Monte Carlo simulations to evaluate power and size properties of the modified Wald test. However, the result indicates that the Wald test does not have the correct size in small- and medium-size samples. Nevertheless, Shukur and Mantalos (1997) indicate that as a result of using the residual-based bootstrap (RB) method, critical values are improved in power and size. Moreover, the excellent performance of the RB method over standard asymptotic tests, regardless of cointegration, has been confirmed in a number of Monte Carlo simulation studies (Mantalos and Shukur, 1998; Shukur and Mantalos, 2000; Mantalos, 2000; Hacker and Hatemi-J, 2006; Balcilar et al., 2010). In particular, Shukur and Mantalos (2000) prove that small sample corrected likelihood ratio (LR) tests exhibit relatively better power and size properties, even in small samples. Their results indicate that in the absence of cointegration, all standard tests that do not use the RB method perform inadequately, particularly in small samples. As a consequence, this article resorts to the RB-based modified-LR statistic to examine causality between the exchange rate and the number of inbound tourists. To show the RB-based modified-LR causality test, the bivariate VAR (p) process is considered as follows:

$$\begin{bmatrix} \Delta\, ER_{1t} \\ \Delta\, TOUR_{1t} \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \end{bmatrix} + \begin{bmatrix} \varphi_{11}(L)\varphi_{12}(L) \\ \varphi_{21}(L)\varphi_{22}(L) \end{bmatrix} \begin{bmatrix} \Delta\, ER_{1t} \\ \Delta\, TOUR_{2t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{1t} \end{bmatrix} \tag{5}$$

where $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$ is a zero mean, independent, white noise process with nonsingular covariance matrix Σ. The optimal lag length p is determined by the Schwarz information criteria (SIC) in this study. ∆ER and ∆TOUR indicate the changes of the exchange rate and the changes of the number of inbound tourists, respectively. $\phi_{ij}(L) = \sum_{k=1}^{p+1} \phi_{ij.k} L^k$, $i, j = 1, 2$ and L denotes the lag operator, which is defined as $L^k x_t = x_{t-k}$. Based on equation (5), the null hypothesis that the ∆ER does not Granger cause ∆TOUR is tested by imposing the restriction $\varphi_{12.k} = 0$, for $k = 1, 2, \dots, p$. Similarly, the null hypothesis that ∆TOUR does not Granger cause ∆ER is tested by imposing the restriction $\varphi_{21.k} = 0$, for $k = 1, 2, \dots, p$. As discussed, the full-sample causality tests in this paper rely upon RB-based p-values and modified-LR statistics. If the first null hypothesis $\varphi_{12.k} = 0$ is rejected, there is a significant causality running from ∆ER to ∆TOUR, which means that ∆ER can predict movements in ∆TOUR. If ∆ER can cause ∆TOUR, the government can increase the number of inbound tourism by implementing a series of exchange rate policies.

3.2. Parameter stability test

To make sure the empirical result is valid; the full-sample causality tests usually assume that parameters of the VAR model used in testing are constant over time. However, the structural changes of underlying full-sample time series may violate the assumption. The results from the full-sample causality tests would become invalid, and hence, the causal links between series would show instability (Balcilar and Ozdemir, (2013). Granger (1996) stresses the issue of parameter non-constancy as one of the most challenging issues faced by many empirical studies. To overcome parameter non-constancy, this paper conducts short-run parameter stability tests. Andrews (1993), as well as Andrews and Ploberger (1994) developed the Sup-F, Mean-F and Exp-F tests to investigate short-run parameter stability. We apply the L_c test (Nyblom, 1989; Hansen, 1992) to test for all parameters in the overall VAR system. We use these tests to check the stability of parameters to solve the problem of the alternative of a single structural break at an unknown time. The tests are calculated from the sequence of LR statistics. Moreover, because these tests exhibit nonstandard asymptotic distributions, critical values and p-values are proposed by means of the parametric bootstrap procedure (Andrews, 1993; Andrews and Ploberger, 1994). Specifically, the critical values and p-values are obtained using asymptotic distribution constructed by means of Monte Carlo simulations using 10,000 samples generated from a VAR model with constant parameters. In addition, the Sup-F, Mean-F and Exp-F are required for 15% trimming from both ends of the sample (Andrews, 1993). Therefore, apply the fraction of the sample in (0.15, 0.85) to these tests. With respect to the L_c tests, they are calculated in the current paper for equations and the VAR system separately.

3.3. Sub-sample rolling-window causality test

To overcome the parameter non-constancy and avoid pre-test bias, we apply the rolling-window bootstrap estimation (Balcilar et al., 2010). There are two important reasons for using the rolling estimation. First, the causal relationship between variables can change over time in the rolling-window method. Second, rolling estimation can observe instability across different sub-samples owing to structural change, and the rolling-window estimation captures this process. The rolling-window techniques rely on fixed-size sub-samples rolling sequentially from the beginning to the end of the full sample (Balcilar et al., 2010). In this premise, setting a fixed-size rolling window including l observations, the full sample is converted to a sequence of $T-l$ sub-samples, that is $s-l+1$, $s-l$, ... , T for $s=l,l+1,\dots,T$. Then, it can apply the RB-based modified-LR causality test to each sub-sample, instead of estimating a single causality test for a full sample. Possible changes in the causal links between ΔER and ΔTOUR are intuitively identified by calculating the bootstrap p-values of observed LR statistics rolling through $T-l$ sub-samples. The impact of ΔER on ΔTOUR is defined as the average of the entire bootstrap estimates derived from the formula with N_b representing the number of bootstrap repetitions; similarly. The impact of ΔTOUR on ΔER is obtained from the formula are bootstrap estimates from the VAR models in equation (5). The 90% confidence intervals are also computed, for which the lower and upper limits equal the 5th and 95th quantiles of each of the respectively (Balcilar et al., 2010). There are two conflicting objectives in the rolling-window estimation accuracy of the parameter estimates and the representativeness of the model over the subsample period. The window size is the precision of estimations and it controls the number of observations. A large window size may improve the accuracy of estimates but may reduce the representativeness in the presence of heterogeneity. On the contrary, a small window size may improve the representativeness and reduce accuracy. Consequently, we must select a suitable window size to balance the trade-off between representativeness and accuracy. Pesaran and Timmerman (2005) demonstrate that optimal window size depends on persistence and size of the break by assessing the window size under structural change, which is according to square root mean square error. More importantly, based on Monte Carlo simulations, they propose that the minimum limit of window size is 20 when there are frequent breaks. A large window size is needed to ensure the precision of parameter estimates, but a window size that is too large may increase the risk of including some of these multiple shifts in the window sample claims for a smaller window size. As a result, we choose a small window size of 24 months in this study. As for the issue of inaccurate estimates as a result of the selected small window size, it can be addressed by the bootstrap technique employed in the rolling estimation for better precision.

4. Data and empirical results

In order to ensure sufficient sample size, we choose the monthly data covering the period of 2006:01 to 2015:12. Furthermore, China abandoned the pegged exchange rate system against the dollar since 2005:07 in order to mitigate the imbalance of international payments, and began to implement a managed floating exchange rate policy with reference to a basket of currencies. The RMB nominal exchange rate is utilized in this paper in order to fully reflect the exchange rate changes in the process of institutional change. Data of exchange rate (ER) and the number of inbound tourists (TOUR) both source from the National Bureau of statistics of People's Republic of China. Data of TOUR is seasonally adjusted, and we transform all original data into natural logarithms to correct for potential heteroscedasticity and dimensional differences between series. The trend of ER and TOUR is shown in Figure 1.

Figure 1. *Trend of ER and TOUR*

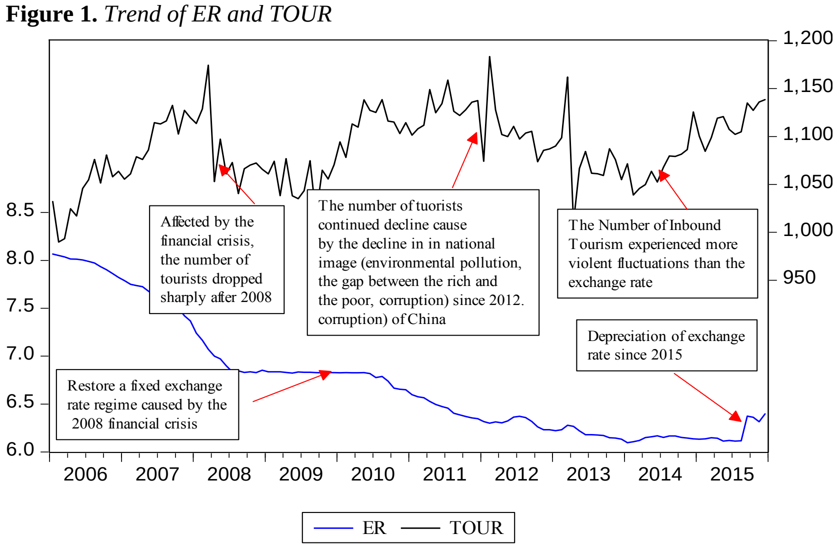


Figure 1 indicates that ER and TOUR both experienced a series of fluctuations across the full-sample interval. First, in the period of 2006-2008, the RMB shows a sustained appreciation. During this period, China just implemented a managed floating exchange rate system, and the large trade surplus is the main reason to cause the appreciation of the RMB (Thorbecke and Smith, 2010). Furthermore, the number of inbound tourists has also fluctuated and the general trend is increasing. Since Beijing successfully applied for the Olympic Games, the Chinese government is committed to promote the image of this country (Gibson et al., 2008). Second, the number of inbound tourists falls sharply since the 2008 financial crisis, and it remains at a low level until 2010:06, when the world economy begin to recover. In this period, the RMB exchange rate enters a relatively stable stage. In order to stimulate the economy and maintain export competitiveness, Chinese government restore a fixed exchange rate peg to the dollar (McKinnon and Schnabl, 2014). During 2008-2010, the number of inbound tourists is relatively stable that is affect by the long-term downturn of the world economy. During 2010-2012, the RMB maintained a relatively stable trend of appreciation. After 2010, the People's Bank of China resumed a managed floating exchange rate regime in order to control inflation (McKinnon and Schnabl, 2012). The number of inbound tourists become shows a long-term downward trend since 2012. The RMB exchange rate begins to devaluation since 2015:07, and the number of inbound tourists maintains an upward trend. Overall, the number of inbound tourists shows greater volatility compared with the exchange rate. It seems that the change of TOUR is not always caused by changes of the exchange rate. However, common trends still exist in some sub-periods. As discussed before, some literatures find the exchange rate can significantly influence the tourism demand (Webber, 2001; Wang et al., 2008; Kuo et al., 2009), however, there still exist other literatures that suggest no significant impact from the exchange rate to the tourism demand (Vanegas and Croes, 2000; Croes and Vanegas, 2005; Quadri and Zheng, 2010). The inconsistence of these results may suggest the causality between the exchange rate and the number of inbound tourists may varying over time.

We use the Augmented Dickey-Fuller test (ADF test) proposed by Dickey and Fuller (1981) and the Phillips-Perron test (PP test) proposed by Phillips and Perron (1988) to test the stability of ER and TOUR. Table 1 shows the corresponding result. Both the ADF test and the PP test accept the null hypothesis of non-stationarity for ER and TOUR of China in levels. As a result, we further test their stability in first difference, and the result shows that both of them are stationary, which suggests both ER and TOUR are I(1) process. As a result, the first difference of ER (△ER) and TOUR (△TOUR) are utilized for the next investigation. We can test the full-sample causal relationship between the two variables using the VAR model. The bivariate VAR model of △ER and △TOUR is constructed as in Equation (5). The optimal lag length based on Schwarz information criterion (SIC) of the VAR model is 1. The full-sample causality results based on the RB-based modified-LR causality tests are reported in Table 2. According to the bootstrap *p*-values, the results of the sample causality test show that there is no causal relationship between the two variables. This finding is inconsistent with some of the existing literature (Falk, 2015) and argues that the exchange rate has a positive effect on inbound tourism.

Table 1. *Univariate unit root tests*

Variable	Levels		First differences	
	ADF	PP	ADF	PP
ER	1.671 [0]	0.837 (6)	-8.773 [0]***	-9.034 (6)***
TOUR	-2.885 [2]	0.597 (2)	-12.732 [1]***	-22.447 (4)***

Notes: *** indicates significance at the 1%.
[ ] indicates the lag length in the ADF test equation based on SIC and ( ) indicates bandwidth in the PP test using the Bartlett kernel.

Table 2. *Full-sample Granger causality test*

Tests	H_0: △ER does not Granger cause △TOUR		H_0: △TOUR does not Granger cause △ER	
	Statistics	*p*-values	Statistics	*p*-values
Bootstrap LR Test	0.111	0.780	0.084	0.800

Note: All statistics are calculated with using 10,000 bootstrap replications.

However, there is a default assumption in the previous literature that in time series structural changes do not exist and there is only a single causal relationship across the whole sample period (Chen, 2006). In the presence of structural changes, the parameters in the above VAR model estimated using full-sample data will shift with time. The causal relationship between △ER and △TOUR will accordingly be unstable. Therefore, the full-sample causality tests with assumptions of parameter constancy and a single causal relationship across the whole sample period are no longer reliable and the ensuing results prove to be meaningless (Chen, 2007). For this reason, this paper proceeds to test for parameter stability and to determine whether structural changes exist. As mentioned before, we use the Sup-*F*, Mean-*F* and Exp-*F* tests (Andrews, 1993; Andrews and Ploberger, 1994) to investigate the temporal stability of parameters in the above VAR model. The L_c test developed by Nyblom (1989) and Hansen (1992) is also utilized to test for all parameters in the overall VAR system. The corresponding results are reported in Table 3. The Sup-*F* tests under the null hypothesis of parameter constancy against a one-time sharp shift in parameters are reported in the first row. The Mean-*F* and Exp-*F* tests under the null hypothesis that parameters follow a martingale process against the possibility that the parameters might evolve gradually are reported in the second and third rows, respectively. The Sup-*F* test suggests that a one-time sharp shift exists in △ER equation at the 1% level and exists in the VAR system at the 5% level. The Mean-*F* test and the Exp-*F* test suggest that equations from the △ER and the VAR system may evolve gradually with time. The L_c statistics test against the alternative that the parameters follow a random walk process proposed by Gardner (1969), indicative of parameter non-constancy in the overall VAR models estimated. As a consequence, these results provide robust evidence that the parameters of the estimated VAR model using full-sample data show short-run instability.

Table 3. *Parameter stability tests*

	△ER Equation		△TOUR Equation		VAR (1) System	
	Statistics	Bootstrap *p*-value	Statistics	Bootstrap *p*-value	Statistics	Bootstrap *p*-value
Sup-*F*	18.617***	0.007	9.886	0.220	20.661**	0.040
Mean-*F*	9.350***	0.004	3.443	0.307	12.449**	0.013
Exp-*F*	5.839**	0.013	2.626	0.223	7.780**	0.026
L^c_b					2.155***	0.009

Notes: We calculate *p*-values using 10,000 bootstrap repetitions.
** and *** denote significance at 5% and 1%, respectively.
Hansen-Nyblom parameter stability test for all parameters in the *VAR* (1) jointly.

Based on the above parameter stability tests, we can conclude that models estimated using full-sample data are unstable because of the presence of structural changes. This means that the result of absence of any full-sample causality between △ER and △TOUR is not credible. To take into account structural changes, we employ rolling-window estimation to test their causality. Unlike the full-sample causality test, this approach tests the causal relationship between two variables more accurately for the reason of time varying across different sub-samples. In the sub-sample causality test of the rolling window, we use the RB bootstrap-based modified-LR causality test to check the causal relationship between △ER and △TOUR. The null hypothesis of the tests indicates that △ER does not Granger cause △TOUR and vice versa. The bootstrap *p*-values of LR statistics can be estimated from the VAR models in Equation (5) using the rolling sub-sample data including 24-month observations(1). After trimming 24 months observations from the beginning of the full sample, these rolling estimates move from 2008:01 to 2015:12.

Figure 2 shows the time-varying causality from △ER to △TOUR. The causality does not significant in most periods at 10% significance. However, different from the full-sample causality test, there do exist causality in some sub-periods (2010:02-2010:04, 2011:08-2011:11; 2013:06-2014:02; 2014:10-2015:08). Figure 3 shows the coefficient that △ER impact on △TOUR. During the time periods that the causality is significant, we find that △ER positively cause △TOUR in 2010:02-2010-04 and 2011:08-2011:11, which suggests that △TOUR will increase when the RMB devaluates. Furthermore, we find that △ER negatively cause △TOUR in 2013:06-2014:02, which suggests that △TOUR will increase when the RMB appreciates. The impact of △ER on △TOUR is significantly negative in 2014:10-2015:05, and it turns to positive in 2015:06-2015:08, which further proves the complexity of this causality. In 2010, countries gradually recovered from the 2008 financial crisis. During this period, the trade between China and Vietnam has increased markedly, and further cause an increase of business contacts between China and Vietnam (Nasreen and Anwar, 2014). Based on the China tourism industry analysis report in 2011, there is a large amount of inbound tourists concentrate in the border area in 2010, and most of them are business travel. Furthermore, in 2010, China successfully hosted the world exposition in Shanghai and the Asian Games in Guangzhou, which also plays a certain role in attracting foreign tourists. In 2011:11, China successfully holds the “2011 Chinese culture tour” that attracted foreign tourists to some extent. Furthermore, the largest earthquake in the northeastern region of Japan, the ensuing tsunami and the Fukushima Daiichi nuclear power plant leaks changed the tourist pattern of European and American tourists in Asia to a great extent. Before 2015, though the RMB has maintained a steady trend of long-term appreciation, tourism industry continues to flourish and inbound tourism continues to grow. In 2013, the exchange rate still maintains a downward trend, and China's inbound foreign tourist market dropped slightly. Based on the Statistics Bulletin of China tourism industry in 2013, the total number of foreign tourists entering the country is about 26 million, which is 3.3% lower than that in 2012. The main reason is that the details of the city environment (such as the natural environment, barrier free facilities, water supply and water quality) has declined. The appreciation of the RMB exchange rate is also likely to decline of the tourism industry affected to a certain degree. However, the RMB has maintained a long-term appreciation trend since 2010, which indicates that ΔER is not the main factor of reduction of ΔTOUR. In 2015, the RMB has strong devaluation expectations caused by the tapering of quantitative easing policy in the U.S. and the downward trend of China’s economy (Yu et al., 2017). The uncertainty of exchange rate changes intensifies the cost of inbound tourism. Furthermore, it reflects the shock of the national economy in the transition period, and is not conducive to the steady growth of ΔTOUR. We also test the time-varying causality from ΔTOUR to ΔER, the result is shown in Figure 4 that ΔTOUR does not Granger cause ΔER in most periods. It is obvious that ΔTOUR has smaller impact on ΔER. As an important macroeconomic variable, the exchange rate is more affected by international payments, foreign exchange reserves, the interest rate, the inflation and the political situation (Hooper and Kohlhagen, 1978; Meese and Rogofp, 1988; Calvo et al., 1993; Taylor, 2001; Fischer, 2001).

Figure 2. *Bootstrap p-value of Rolling Test from ΔER to ΔTOUR*

Null Hypothesis: ΔER does not Granger Cause ΔTOUR

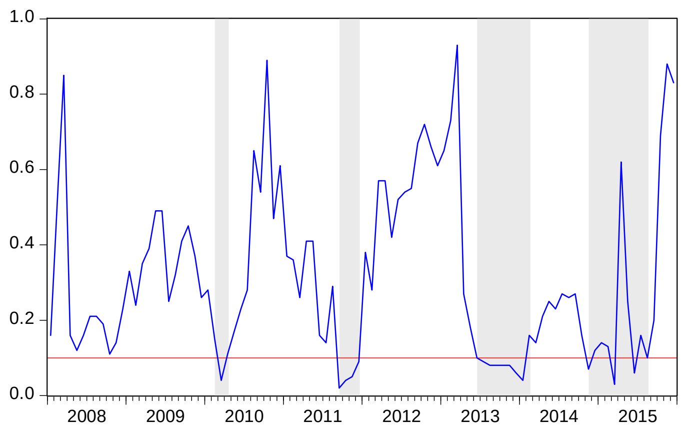


Figure 3. *Bootstrap Estimates of the Sum of the Rolling Window Coefficients for the impact of ⊿ER on ⊿TOUR*

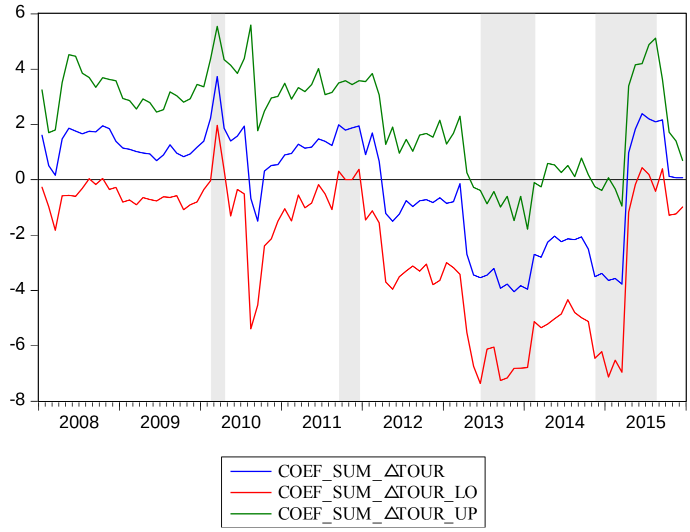
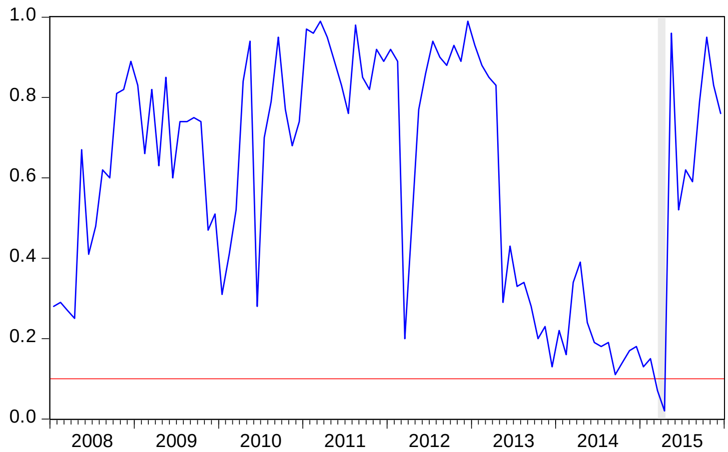


Figure 4. *Bootstrap p-value of Rolling Test from ⊿TOUR to ⊿ER*

Null Hypothesis: ΔTOUR does not Granger Cause ΔER



In this paper, the bootstrap Granger full-sample causality test and sub-sample rolling-window estimation provide additional insight into the dynamic relationship between ΔER and ΔTOUR in China. In general, this relationship is not always consistent with the view that the number of inbound tourism changes with the exchange rate movement in the same direction. Although many literatures have made some differential conclusions in horizontal cross-country comparisons (Kuo et al., 2009; De Vita, 2014), this paper still finds some more profound conclusions in the longitudinal temporal dimension. The most obvious is the time-varying property between ΔER and ΔTOUR, which suggests that the changes of the exchange rate is not always the main factor for inbound tourists. In fact, as the parameter stability test shows, there exist a series of structural changes prevalent in the full sample VAR model. Many accidental factors (major infectious diseases, major sporting events, and sudden international political events) can lead to abrupt structural changes and the time-varying causality between ΔER and ΔTOUR is the embodiment of these structural changes. These structural mutations are common in China, however, their impact on tourist arrivals is generally temporary (Chen and Hong, 2012). For example, the outbreak of the severe acute respiratory syndrome (SARS) during 2002-2003 in China leads to inbound tourists falling sharply. The damage caused by the SARS virus to China's tourism industry does not begin to recover until 2004. TOUR increases considerably during the 2008 Olympic Games in Beijing and quickly backs to normal levels after 2008:10. These short-term events are more random and often have great impacts on tourism, but do not have lasting impacts. In addition to sudden structural changes, the mean-*F* test shows that the parameters in the exchange rate equation also exist long-term gradual changes. This kind of gradual change is more likely to continue to influence the relationship between ΔER and ΔTOUR, and then the time-varying nature caused by these may show a certain regularity with the gradual change of these parameters. In fact, as can be seen in Figure 2, the time-varying relationship between ΔER and ΔTOUR shows a certain regularity. Specifically, It was not until 2010 that the impact of ΔER on ΔTOUR begins to appear (2010:02-2010:04), but only for 3 months. This impact extends to 4 months in 2011 (2011:09-2011:12). As discussed above, China pursues a fixed exchange rate system pegged to the US dollar since 1994. It was not until 2005:07 that a managed floating exchange rate system is introduced with reference to a basket of currencies. Though the RMB exchange rate fluctuation range is expended from 0.3% to 0.5% in 2007, the exchange rate flexibility is still insufficient to attract enough attention of inbound tourists. The time range of ΔER affecting ΔTOUR further increases to 9 months (2013:06-2014:02) since the People's Bank of China expands RMB exchange rate fluctuation range is expended to 1%. It can be inferred that the time range of ΔER affecting ΔTOUR is increasing synchronously with the development of the exchange rate regime. This regularity is further confirmed after 2014 when the RMB exchange rate is further expanded (1% to 2%). At the end of 2014, the time range of this effect further increases to 10 months (2014:11-2015:08). In fact, inbound tourists will be more concerned about changes in travel costs resulting from exchange rate changes when its flexibility continues to increase (Santana-Gallego et al., 2010). Although Tang et al. (2016) suggests that exchange rate volatility is not the main reason for the change in inbound tourism of China, our research shows that the impact of exchange rate is increasing as its flexibility continues to increase.

5. Conclusions

This study investigates the causal relationship between the exchange rate and the inbound tourism using a bootstrap full-sample Granger-causality test and sub-sample rolling window-causality estimation in China. The full-sample Granger-causality test provides no evidence that the changes of the exchange rate can cause the change of inbound tourist arrivals. However, taking the presence of structural changes in full-sample data into consideration, parameter stability tests find that the short-run relationships is unstable. Then, we use the bootstrap rolling window method and we do find there exist unidirectional causal relationship from the changes of the exchange rate to the changes of inbound tourist arrivals. Specifically, the impact of the exchange rate to inbound tourist arrivals shows a regular time-varying property. The influence of exchange rate on the number of inbound tourists is increasing with the increase of China's exchange rate flexibility. The result suggests that government policies need to increase the role of the exchange rate in promoting tourism with the marketization of RMB. On the other hand, the result also helps to make tourism agents pay more attention to exchange rate and to re-evaluate the changes in tourism costs resulting from changes in RMB in the future.

Note

(1) We also test the causal link using 20-, 30-, and 36-month window widths, and the results are similar to those from the causality test based on the 24-month window, which further indicates that the results in this paper are robust. The details are available upon request from the authors.

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