ON TESTS FOR LONG-TERM DEPENDENCE: INDIA'S INTERNATIONAL TOURISM MARKET

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ABSTRACT: *There has been growing interest in studying behaviour of long memory process in tourism market. In this research examine the behaviour of India's international tourism market based on long-memory analysis. The international tourism market of India combined with nine countries. For example, tourists from USA, tourists from UK, tourists from Canada, tourists from Germany, tourists from France, tourists from Japan, tourists from Malaysia, tourists from Australia and tourists form Sri Lanka. Moreover, three statistical test for long-memory process such as R/S test, Modified R/S test and GPH-test are employed to test in these markets. The empirical findings in general provide more support for no long memory process or no long-term dependence in international tourism market of India.*

KEY WORDS: *India; Long-memory process; Long-term dependence; International; Tourism Market*

JEL CLASSIFICATION: *C53, L83*

1. INTRODUCTION

The international tourism industry in India is more importance positive impact on India's economy. Fore example, contributing to the nation's gross domestic product is 6-7% in during period of 2003-2004, India's foreign exchange earnings through tourism is 5,731 million USD in 2005 and contributing to labour market is 9% of India's employment in during period of 2003-2004. Tourists to India spent $ 372 on their visa cards in the year of 2005. This is a 25% rise from the year 2004 thereby, making India the fastest growing Asia-Pacific market for the International tourist

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spending. According to the World Travel and Tourism Council, the Indian tourism demand will grow at an annual 8.8% over the next ten years, fuelled by higher incomes and lower air fares. Moreover, In 2005 India earned US $6.9 billion from inbound foreign tourists, which is more than twice the US $3.1 billion earned during the year 2002. According to the latest balance of payments figures released by the Reserve Bank of India, 2005 was the year of fastest growth in forex inflows from foreign travel, during which inflows went up 36%. From information above has motivated to understand the international tourism market behaviour more by research study. Time series with long memory process was appeared in many contexts such as in financial economics, macroeconomics series, hydrology, cardiac dynamics, networks traffic, meteorology. Evidence of long memory process was first proposed by E. Hurst in 1951 when he testing the behaviour of water levels in the Nile River. In 1971, Mandelbrot was among the first to consider the possibility of long range dependence or long memory process in asset returns. And in 1998, Wright, J. studied about the detection evidence of long memory in emerging market stock returns in many countries such as in Korea, Philippines, Greece, Chile and Colombia. Caporale & Gil-Ala, 2002, studied about S&P 500 daily returns and they found that the degree of dependence remains relatively constant overtime, with the order of integration of stock returns fluctuating slightly above or below zero. In 2002, H. Olan studied about the finding long memory in stock returns from an international market perspective and also the results from this topic found that no evidence of long memory in UK stock market, USA stock market, Hong Kong stock market, Singapore stock market and Australia stock market. Furthermore, this topic also found evidence of long memory appears in the German stock market, Japan stock market, South Korean stock market and Taiwan stock market. In terms of international tourism market based on long memory process analysis was begun by Gil-Alana (2005). He examines forecasting properties of short-term arrivals at Auckland international airport and finds that the ARFIMA models outperform the non-ARFIMA ones in practically all case. After that Chu (2008) incorporates ARFIMA models into Singapore's tourism forecasting and compares the accuracy of forecasts with those obtained by earlier studies. Recently, Songsak, Prasert Jittaporn and Chukiat (2009, 2010) used forecasting method based on both ARFIMA models and ARFIMA-FIGARCH to forecast the number of international tourists arrival to Thailand and they also found that the long-memory process behaviour in their model to forecast. From many articles were found that they have not yet testing the long memory process in international tourism market based on R/S Test, Modified R/S Test and GPH Test. For this reasonable, this paper would like to test for Long-memory process in international tourism market of India based on data during period of 1981-2007.

2. RESEARCH AIM AND OBJECTIVE

This research aim to test long memory behaviour in international tourism market of India during period of 1981-2007.

3. SCOPE OF THIS RESEARCH

The scope of this research covers during period of 1981-2007 and mostly the data was secondary data. The countries were used for testing the long memory behavior are all the countries have impact on the international tourism industry of India such as USA, UK, Canada, Germany, France, Japan, Malaysia, Australia and Sri Lanka (Source of Data: Ministry of Tourism, Govt of India). And the variable was used in this research as the numbers of international tourist arrivals to India from 1981-2007.

4. THE RESEARCH FRAMEWORK OF LONG MEMORY TESTS

In terms of long memory process concept was developed by Harold Edwin Hurst since 1906. He is a young English civil servant, came to Cairo, Egypt, which was then under British rule. As a hydrological consultant, Hurst's problem was to predict how much the Nile flooded from year to year. He developed a test for long-range dependence (Long Memory Test) and found significant long-term correlations among fluctuations in the Nile's outflows and described these correlations in terms of power laws. This statistic is known as the rescaled range, range over standard deviation or R/S statistic. From 1951 to 1956, Hurst, then in his seventies, published a series of papers describing his findings (Hurst, 1951). Hurst's rescaled range (R/S) statistic is the range of partial sums of deviations of a time series from its mean, rescaled by its standard deviation. The definition of long memory process can explain by autocovariance function $\gamma(k)$. And also define a process as long-memory if in the limit $k \to \infty$: $\gamma(k) \sim k^{-\alpha} L(k)$, where $0 < \alpha < 1$ and $L(x)$ is a slowly varying function at infinity. Because $L(x)$ is a slowly function if $\lim x \to \infty \; L(tx)/L(x) = 1$ (see Embrechts et al., 1997). The degree of long memory is given by the exponent α; the smaller α, the longer memory. The long memory is also discussed in terms of the Hurst exponent *H*, which is simply related to α. For a long memory process $H = 1 - \alpha/2$ or $\alpha = 2 - 2H$. The short memory processes have $H = 1/2$, and the autocorrelation function decays faster than k^{-1}. A positively correlated long-memory process is characterized by a Hurst exponent in the interval (0.5, 1).

4.1. Test for Long Memory: R/S Test

The Long Memory test based on R/S test has developed by Harold Edwin Hurst in 1960 and Mandelbrot & Wallis (1969) method allows computing parameter *H*, which measures the intensity of long rang dependence (long memory process) in a time series. The time series of length T is divided into *n* sub-series of length *m* and for each sub-series. For each sub-series m = 1,…,n, to find the mean (E_m) and standard deviation (S_m). And also subtract the sample mean $Z_{i,m} = X_{i,m} - E_m$, for i = 1,…..,m.

After that produce a time series taking form of $W_{i,m} = \sum_{j=1}^{i} Z$ where i = 1,..,m and to find the range $R_m = \max\{W_{1,m,\ldots,}W_{n,m}\} - \min\{W_{1,m,\ldots,}W_{n,m}\}$. The rescale of range R_m by $\frac{R_m}{S_m}$ as well as in case of time series can define *R*, *S* and *H* follow formula

below that: R is the distance covered by the variable, *k* is a constant and T is the length of the time $R = k \times T^{0.5}$; R/S is the rescaled range, m is the number of observation, k is the constant and *H* is the Hurst exponent, can be applied to a bigger class of time series $\frac{R}{S} = k \times m^{H}$; the Hurst exponent can be found as: log(*R/S*)m = log k + H log m, and define that:

- If *H* value = 0.5 then time series follow a random walk and are independent.
- If *H* value = (0, 0.5) then time series are anti-persistent, process covers only a small distance than in the random walk case.
- If *H* value = (0.5, 1) then time series are persistent series, process covers bigger distance than a random walk(long memory process).

4.2. Test for Long Memory: Modified R/S Test

The modified R/S test is developed from the classical R/S test which was proposed by Hurst (1951) while studying hydrological time series of the River Nile. For a return series { x1, x2,…, xT), Lo (1991) refined the classical test by defining $Q_T = \hat{R} / \hat{\sigma}_T(q)$, where: $\hat{R} = \max_{0<i\le T} \sum_{t=1}^{i}(x_i - \overline{X}) - \min_{0<i\le T} \sum_{t=1}^{i}(X_i - \overline{X})$, $\hat{\sigma_T^2}(q) = \hat{\sigma^2} + 2\sum_{j=1}^{q} w_j(q)\hat{\gamma_j}$,

$w_j(q) = 1 - |j/q|$, $\hat{\sigma^2}$ - the usual sample variance of data, $\overline{x}$ - the mean of data, $\hat{\gamma_j}$ - lag - j autocovariance for the data and the truncation lag q is determined by equation $q = \text{int}\left[((3T)/2)^{1/3}((2\hat{\rho})/1-\hat{\rho^2})^{2/3}\right]$. Where $\hat{\rho}$ is the first-order sample autocorrelation coefficient and int [ ] is the integer function. Under the null hypothesis of no long memory or no long rang dependence, Lo (1991) presented that the limiting distribution of the Q_T statistics in equation (1) is given by the distribution function of the difference between maximum and minimum of Brownian bridge on a unit interval. Therefore, it can easily obtain the p-value of the test.

4.3. Test for Long Memory: GPH Test

The GPH Test for Long Memory process was developed by Geweke, J. and S. Porter-Hudak(1983) and they proposed to estimate of the OLS estimator of *d* from the regression: $\ln[I(\xi)] = a - \hat{d}\ln[\sin^2(\frac{\xi_\lambda}{2})] + e_\lambda$, $\lambda = 1,...,V$, where

$I(\xi) = \frac{1}{2\pi T}\left|\sum_{t=1}^{T} e^{it\xi}(x_t - \overline{x})\right|^2$. And this equation is Periodogram (estimator of spectral density) of x at a frequency (ξ) as well as the bandwidth v is chosen such that for $T \to \infty$, $v \to \infty$, but $\frac{v}{T} \to 0$. The Geweke and Porter-Hudak consider that the power of T has to be within (0.5,0.6) and the null hypotheses of no long memory process, the slope of regression d equal zeros and also the usual t-statistics can be employed to perform the test.

4.4. Data Description

In table (1a) to present the number of international tourists arrival to India during period 2003-2007. In 2003 the number of international tourists arrival to India was 2.7 million people and after that in 2004 they came to India grew up while compare with last year. However, as the same year they came to India were 3.4 million people. Moreover, in 2005 the number of international tourists arrival to India also have increased continuously. In this year the number of them came to India were 3.9 million people. From table (1a) has already presented that the number of international tourist arrival to India growth up every year. Based on these data have already confirmed that international tourism of India will become to be more interesting. (see more detail of data in table (1a)).

Table 1a. To present the number of international tourists' arrival to India during period 2003-2007

	2003	**2004**	**2005**	**2006**	**2007**
January	274,215.00	337,345.00	385,977.00	459,489.00	532,088.00
February	262,692.00	331,697.00	369,844.00	439,090.00	498,806.00
March	218,473.00	293,185.00	352,094.00	391,009.00	444,186.00
April	160,941.00	223,884.00	248,416.00	309,208.00	333,945.00
May	141,508.00	185,502.00	225,394.00	255,008.00	267,758.00
June	176,324.00	223,122.00	246,970.00	278,370.00	310,104.00
July	225,359.00	272,456.00	307,870.00	337,332.00	377,474.00
August	204,940.00	253,301.00	273,856.00	304,387.00	360,089.00
September	191,339.00	226,773.00	257,184.00	297,891.00	325,893.00
October	260,569.00	307,447.00	347,757.00	391,399.00	440,715.00
November	290,583.00	385,238.00	423,837.00	442,413.00	510,987.00
December	319,271.00	417,527.00	479,411.00	541,571.00	575,148.00
Total	**2,726,214.00**	**3,457,477.00**	**3,918,610.00**	**4,447,167.00**	**4,977,193.00**

From: Ministry of Tourism, Govt of India

In table (2a) to present the foreign exchange earning from international tourists arrival to India during period of 2005-2007. In 2005 Indian economy received foreign exchange earning from international tourists industry was 1.5 thousand million USD.

Table 2a. To present the foreign exchange earnings from international tourists' arrival to India during period of 2005-2007

Unit: US $ Million

Months	**2005**	**2006**	**2007**
January	532.19	632.43	744.58
February	536.07	594.67	680.41
March	505.74	547.17	636.05
Total	1,574.00	1,774.24	2,061.04

From: Ministry of Tourism, Govt of India

Moreover, in 2006 the India's economy received foreign exchange earning from this industry equal to 1.7 thousand million US Dollar. Finally, the foreign exchange earning from this industry still grew up from 1.7 thousand million USD in

2006 would be 2.06 thousand million USD in 2007. Based on these data have already confirmed again that the international tourism industry of India will become to be the potential industry for future year definitely.

5. THE RESULTS OF VARIOUS TESTS FOR LONG MEMORY PROCESS OR LONG-TERM DEPENDENCE PROCESS

Table 1 shows the results of various tests for long memory process based on R/S Test, Modified R/S Test and GPH Test of India's international tourism market during period of 1981-2007. These countries are international tourism market of India. Fore example, USA, UK, Canada, Germany, France, Japan, Malaysia, Australia and Sri Lanka (These countries are major market of India's international tourism: Ministry of Tourism, Government of India)

Table 1. Results of Various Tests for Long Memory based on R/S Test, Modified R/S Test and GPH Test

Country	R/S Test	Modified R/S Test	GPH Test
USA	2.010*	1.2659	1.4874
UK	2.0402*	1.2838	1.3577
Canada	2.0219*	1.2784	1.5063
Germany	1.1541	1.1392	0.6048
France	1.7879	1.1729	1.0971
Japan	2.1268**	1.3809	1.2209
Malaysia	2.0735*	1.294	1.6528
Australia	2.0369	1.323	1.2145
Sri Lanka	2.1529**	1.4117	1.3119

Form: computed

Null Hypothesis: no long-term dependence or no long memory process. For GPH test, Null Hypothesis: $d = 0$ ** :significant at 5% level, ** : significant at 1% level*

The test results are summarised in Table 1. For each test, the test statistics and its corresponding statistics significant are given. If the statistics value of R/S Test, Modified R/S Test and GPH Test are significance at 1% level or at 5% level then rejected Null Hypothesis of no long-term dependence or no long memory process in time series data. Otherwise, if the statistics value of R/S Test, Modified R/S Test and GPH Test are not significance at 1% level or at 5% level then accepted Null Hypothesis of no long-term dependence or no long memory process in time series data. The empirical results of long memory process analysis based on both Modified R/S Test and GPH Test can be found that all of international tourism markets of India have not a long-term dependence process in themselves or have not a long memory process in themselves. Otherwise, based on R/S Test can be found that most of international tourism markets of India have a long memory process in themselves except Germany, France and Australia. From various test for long memory process based on R/S Test, Modified R/S Test and GPH Test of India's international tourism market during period of 1981-2007 can not conclude of these test into the same direction. However, the Modified R/S Test and GPH test have already confirmed that the international tourism markets of India have not a long-term dependence process in themselves or have not a

long memory process in themselves. But only one test is R/S Test has already confirmed that the international tourism markets of India have a long-term dependence process in themselves or have a long memory process in themselves except Germany, France and Australia.

6. THE CONCLUSIONS OF RESEARCH, POLICY RECOMMENDATIONS

The research provides various tests for long memory process based on R/S Test, Modified R/S Test and GPH Test to test the India international tourism market during period 1981-2007. The empirical results conclude that most countries in India international tourism market have not a long memory process in among of them. The Long Memory or Long range dependence is meaning that the information from "to day" is not immediately absorbed by the price in the market and investors react with delay to any such information (Bardos, 2008). From above meaning, imply that the international tourism market of India is affected by any information immediately or the international tourism market of India is affected by any information quickly. This result was difference from the results of previous empirical studies of long memory process in international tourism market (Gil-Alana, 2005; Chukiat & Prasert, 2009). If these results can be generalized for future years, then it suggests that both the Indian government sector and the private tourism industry sector of India need to protect the bad information of this industry can not go outside from India to other country. Otherwise, most of them should both develop tourism market of India more and also develop tourism product in India more too. In terms of the tourism market development need to launch an active marketing campaign, promoting India's exclusive culture and natural beauty through every channel especially the internet, keep high quality of accommodation, restaurants, services in tourism market of India as well. In terms of tourism product development need to keep on improving both the quality and management of tourist products in India. Fore example, to develop tourist destinations in India, provide educational of tourism to people in the tourism industry of India and decrease the negative image of tourist destinations in India. Moreover, keeping tourist destinations clean, keeping tourist destinations beautiful, keeping tourist destinations safety and to protect the environment of tourist destinations. The private tourism sector and the India government tourism sector should maintain good management of tourist destinations in India. Such as maintaining the amenities of the tourism products, keeping good accessibility to the tourism products, keeping a good image of tourism products, keeping the right price of tourism products and keeping the competitiveness of tourism products (Chaitip & Chaiboonsri, 2009).

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