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ORIGINAL ARTICLE

Examining the macro-determinants of tourist arrivals in India

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Abstract

The present study analyzes the asymmetric association of exchange rate and world income with inbound tourism demand in India using a recently developed nonlinear autoregressive distributed lag model. For this purpose, the study uses monthly data from January 2003 to December 2020 for inbound tourism demand, real effective exchange rate, and world income as the variables of the model. The study used an asymmetric causality test on the lines of Hatemi-J. The findings confirm the existence of a nonlinear association between exchange rate and tourism demand in the long run. Furthermore, the increases in the world income have a positive and significant effect on tourist arrivals in India. In addition, the findings indicate that exchange rate shocks play a vital role in the long run. The cointegration test is supplemented with nonlinear causality analysis. The causal result depicted positive shocks in the exchange rate and world income sharing a unidirectional causal relationship with tourist arrivals. The result of this research can significantly facilitate the policymakers for devising short-run as well as long-run policies to consolidate the macroeconomic fundamentals such that tourism demand can be enhanced in India.

Keywords Asymmetric causality · Inbound tourism · World income · Real effective exchange rate · Nonlinear ARDL · India

JEL Classification C22 · O11

Abbreviations

UNWTO	United Nations World Tourism Organization
NARDL	Nonlinear autoregressive distributive lag model
GDP	Gross domestic product
WEF	World Economic Forum
TTCI	Travel and tourism competitive index

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WTTC	World Travel Tourism Council
T	Number of tourist arrivals
R	Real effective exchange rate
WI	World income
ECT	Error correction term
ADF	Augmented Dickey–Fuller test
PP	Philips and Perron test

Introduction

The inbound tourism sector is one of the world's fastest-growing export industries. In terms of growth, the tourism industry (5.4%) grew faster than the global GDP growth rate (4.4%) between 2009 and 2019 (UNWTO 2020). There were 1460 million tourist arrivals in 2019. As a result, it is argued that the tourism industry has grown as a rising service sector all over the world (Obi and Ogbeide 2022; UNWTO 2020).

However, the tragic COVID-19 epidemic has had a catastrophic impact on the world, with tourism being one of the worst damaged sectors. Forecasts predict a 78% drop in foreign visitor visits, resulting in US$1.2 trillion in lost tourism export income and the loss of 120 million direct tourism employment, which is seven times the number lost in the aftermath of 9/11 (UNWTO 2021).

Barring the COVID-19 phase, the tourism sector has been considered a reliable source of economic growth. The important benefits of inbound tourism are employment generation, foreign exchange earnings, and promotion of transport and construction activities and having a spillover effect on the other sectors of the economy thereby fostering GDP growth (Lee and Chang 2008; Karimi et al. 2019). Subsequently, the foreign exchange earnings can be used for the import of machinery and technology which enhances the productive capacity of the economy and hence economic growth (Mckinnon 1964).

Given the linkages the tourism sector share with other sectors, it generates positive externalities in the economy (Croes 2006). Acknowledging the positive linkage between tourism and economic growth a good number of studies have confirmed tourism induced growth for many economies in the world (Cárdenas-García and Pulido-Fernández 2017; Tang and Tan 2015; Adnan Hye and Ali Khan 2013; Ohlan 2017; Balaguer and Cantavella-Jordá 2002; Mishra et al. 2011).

Due to the existence of benefits of the tourism sector, numerous studies have attempted to identify the determining factors of tourism demand. The major variables that influence the tourism demand are exchange rate, inflation and world income (Dhariwal 2005; Martins et al. 2017), human capital (Blake et al. 2006), distance (Adeola and Evans 2019), security and conflicts (Dhariwal 2005), institutional quality (Ghalia et al. 2019), terrorism (Fareed et al. 2018), and infrastructure development (Barman and Nath 2018).

The most commonly used variables in the tourism demand model are inflation, exchange rate in the destination economy, and the income of the tourists (Bashagi and Muchapondwa 2009; Dincer et al. 2015; Forsyth et al. 2014; Gani and Clemes

2016; Parida et al. 2017; Salleh et al. 2008; Tavares and Leitao 2017). In most of the studies, income has emerged as a significant factor in determining tourism demand (Campus 2005; Gasmi and Sassi 2015; Yazdi and Khanalizadeh 2017; Martins et al. 2017). Further, domestic currency appreciation has a detrimental effect on tourists as it increases expenditure.

On the other hand, as the domestic currency appreciates, it becomes relatively cheaper and alluring for the tourists and thus increasing the number of tourist arrivals in the destination country (Karimi et al. 2018; Martins et al. 2017; Meo et al. 2018). The exchange rate comes out as a crucial determinant of tourism demand (Dincer et al. 2015). It is considered in terms of the relative cost of visiting other countries and acts as an important factor in deciding between foreign destinations or domestic trips (Rosselló et al. 2005).

In addition, it is generally perceived as a cost of living rather than the actual living cost in the destination country and it has more influence than advertising or any other promotional activity (Gil-Pareja et al. 2007; Ledesma Rodríguez et al. 2011; Ming Cheng et al. 2013).

Given the scenic beauty, proficient English-speaking population, and rich cultural and historical heritage (Sharma et al. 2021), India commands a great advantage both in case of inbound and domestic tourism (Jauhari and Jauhari 2009; Ohlan 2017). Numerous international visitors visit the country, creating new job opportunities and considerable tax money. It also increased by 3.2% from 2018, with 10.8 million overseas visitors visiting India and earning USD 29.9 billion in foreign exchange profits in 2019 (UNWTO 2020).

However, the recent epidemic has brought the tourism industry to a halt, and India is no exception. The number of international tourists to India in March 2020 is down 66.4% from the previous year. India is estimated to lose around 40 million direct and indirect employment in this sector (FICCI 2020). Figure 1 depicts the tourism industry's trend in India.

According to the latest report, India had a remarkable improvement from 40th rank to 34th from 2017 to 2018 in the Travel and Tourism Competitive Index (TTCI). India is among the top 25% or top 35 nations in the TTCI list (Calderwood and Soshkin 2019). India has achieved remarkable progress in the field of environmental sustainability and Business travel but yet it has to improve its tourism service infrastructure (Calderwood and Soshkin 2019). As it is clear from Fig. 1 there is an

Fig. 1 International tourism in India. Data source Ministry of Tourism (2021), India

increasing trend in the number of foreign tourist arrivals in the tourism sector during the last 2 decades in India (barring the COVID-19 period).

Keynes (1936) in his famous work of General theory of Employment, Interest, and Money emphasized the nonlinear nature of macroeconomic variables. The author further added that there are different reactions to a variable's upward and downward tendencies. Similarly, Shin et al. (2014) argue that asymmetry is very latent in social sciences and can be used to fathom many different facets of the field in empirical studies. In the field of Economics and Finance in particular, many studies have stressed the need to model nonlinearities that are closer to reality (Kahneman and Tversky 1979; Shiller 2000).

Based on the above discussion, the main objective of the present research is to evaluate the empirical link between exchange rate, world income, and tourism using nonlinear ARDL cointegration and a nonlinear causality approach using monthly data from January 2003 to December 2020. Since the exchange rate, tourist arrivals, and world income are volatile and seasonal, the study has utilized high-frequency monthly data. The volatile nature of the variables is a major reason for choosing the monthly frequency data. Furthermore, the study seeks to explore an asymmetric relationship as a result of the dynamic nature of the variables under consideration.

The rest of the study is divided into the following sections. The next section describes the review of literature, the third section describes the variables, data, and methodology, the fourth section provides the empirical results and discussions, and lastly, the final section is related to the conclusion.

Review of the literature

The dominant role of the exchange rate in determining tourism demand is evident in the literature. The studies on tourism demand and exchange rate are very diverse and reached varied conclusions (Brida et al. 2016; Crouch 1994). While some studies find exchange rate significantly affects tourism demand on another hand, some studies have failed to register any association of exchange rate with tourism demand (Tang et al. 2014). The use of a real effective exchange rate (REER) is found to be appropriate (Witt and Witt 1995). Li et al. (2005) while analyzing tourism demand for South Korea from eight major countries using annual data from 1970 to 1989 found that the exchange rate and income of the tourist both affect the tourism demand significantly. Webber (2001) concludes that exchange rate fluctuations have a great impact on tourists in planning for overseas destinations. The exchange rate should be used as a separate factor for estimating the tourism demand function (Martin and Witt 1988).

Reinhart and Rogoff (2004) in a panel study of OECD countries highlighted the importance of having a common currency and fixed exchange rate regime having a positive impact on tourist arrivals. They emphasized that having lesser fluctuations in the exchange rate has a good and significant impact on tourist arrivals. Vogt (2008) states that exchange rate fluctuations and the income of the tourists have a strong impact on tourism demand. Ming Cheng et al. (2013) in the context of the US emphasize the crucial role of the exchange rate in determining tourism demand.

Thompson and Thompson (2010) carried out in Greece and found that after switching to the common currency Euro the tourism sector in the country has registered remarkable growth. Using daily data for tourist arrivals in Taiwan from the USA, Japan, and the rest of the world from 1st January 1990 to 31 December 2008, Chang and Mcaleer (2012) applied a heterogeneous autoregressive model to find the influence of the exchange rate volatility on tourism demand. Findings indicate that the exchange rate has a negative impact on tourist arrivals.

While analyzing the impact of exchange rate volatility for New Zealand using annual data for 1992–2007, Schiff and Becken (2011) find a varied country-specific response to exchange rate fluctuation, while Asian countries were found to be more sensitive in contrast to the USA and Australia to exchange rate changes. Martins et al. (2017) while conducting a panel study of 218 countries find that exchange rate depreciation of the domestic currency, and rise in GDP per capita of the world, have a promising effect on tourism demand. Karimi et al. (2019) analyzing tourism demand for Malaysia applying asymmetric ARDL in contrast to general findings ascertain that both appreciation and depreciation of the Malaysian ringgit negatively act on tourist arrivals. While modeling tourism demand for Pakistan Meo et al. (2018) using a nonlinear autoregressive distributed lag model find exchange rate depreciation of the Pakistani rupee has a positive and significant effect in the long run on tourist arrivals in Pakistan.

In the Indian context, there are very few studies that analyze tourism demand. Dhariwal (2005) while analyzing the role of internal and external disturbances on tourism demand in India finds that disturbances and conflicts lower the tourism receipts. Further, it is also concluded that nominal devaluation of the currency has a negative effect on tourism and though world income has a positive effect on tourism, however, not found to be significant. Barman and Nath (2018) using annual data from 2000 to 2015 applied generalized methods of moments for analyzing tourist arrivals in India. The authors find that income of the origin country has a strong and positive influence on tourism demand in India. In addition, infrastructure development boosts inbound tourism in India while inflation negatively affects tourist arrivals. Analyzing tourism demand in the Indian context, Sharma and Pal (2019) find that exchange rate fluctuations create uncertainties and negatively affect tourism demand both in the short and long runs.

Obi and Ogbeide (2022) examined the currency valuation, economic growth, and tourist arrivals nexus using quarterly data from 1996 to 2019 for the USA. The authors revealed that tourist arrivals expand growth. In addition, the study stated that a rise in real GDP is associated with a rise in tourist arrivals. Further, the study supports the concept that a weak dollar promotes overseas tourists, particularly those coming on a budget. Similarly, Aslanoğlu et al. (2021) for Turkey analyzed a tri-variate study between tourism demand, world income, and exchange rate. The study utilized quarterly data and applied panel cointegration. The research revealed the importance of world income and exchange rate while modeling tourism demand.

Likewise, Chaudhry et al. (2021) analyzed the impact of the real exchange rate on the tourism demand in the East Asia and Pacific region. The authors also addressed the issue of cross-sectional dependence by employing a robust panel methodology of dynamic common correlated effects (DCCE). The authors reported a positive and

significant association between tourism demand and the real exchange rate. The authors unraveled that the low exchange rate is a crucial determinant of tourism demand. Consequently, a low exchange rate offers a cheaper package for tourists.

However, other studies support the policy of exchange rate appreciation to increase tourism receipts in the nations (Irandoust 2019; Karimi et al. 2015). High-budget tourists may not be reluctant to travel based on the relative price such as exchange rate only, but rather they may opt for quality tourism services (Irandoust 2019). Karimi et al. (2015) considered the tourism demand to be dependent on various macroeconomic variables such as price level, foreign direct investment, trade openness, and real exchange rate for ASEAN countries. The authors revealed that trade openness and FDI significantly increase tourist arrivals. However, the findings of the study indicated a negative and significant relationship between the price level and real exchange rate with tourist arrivals.

Linear techniques have dominated the existing literature in tourism modeling. In addition, ignoring the intrinsic nonlinearity of the macroeconomic variables may give misleading outcomes as rightly pointed out by Brida et al. (2016) and Webber (2001). The study aims to find the nonlinear causality and cointegration in the short and long-run dynamics. The present study models asymmetries of exchange rate and world income in the short-run and long-run. Therefore, the present study extends the literature by applying the nonlinear method to account for a possible asymmetrical relationship between exchange rate, world income, and tourism demand which may exist. Furthermore, the study also tests the asymmetric causal link among the variables with insights from Hatemi-J (2012). The empirical investigation will throw light on the impact of exchange rate fluctuations and world income on the tourism demand in the Indian context which can be further helpful for planning an adequate and comprehensive tourism policy for the country.

Methods

Data for this study have been compiled from various sources. Data on inbound tourist arrivals have been collected from the Ministry of Tourism of India. CPI-based real effective exchange rate (REER) has been taken from the Reserve bank of India (RBI). The industrial production index of the advanced countries is taken as a proxy for world income (Karimi et al. 2018) and the data has been compiled from the International monetary fund. The frequency of the data is monthly from January 2003 to December 2020. The data are dictated by the data availability.

The following general specification has been used in the study to empirically examine the relationship between exchange rate, world income, and tourism. The series is transformed into a logarithm form.

$$\ln T = f(\ln R, \ln \mathrm{WI}). \tag{1}$$

The linear specification of the relationship in the regression format:

$$\ln T_t = \alpha_0 + \alpha_1 \ln R + \alpha_2 \ln \mathrm{WI} + \mu_t, \tag{2}$$

where T refers to tourism, R represents real effective exchange rate, WI denotes world income, and μ_t represents error term. For analyzing the asymmetries, we have to take into account the exchange rate in a decomposed manner, i.e., through its partial sums of the positive and negative changes:

$$R_t^+ = \sum_{i=1}^{t} \Delta R_t^+ = \sum_{i=1}^{t} \max(\Delta R_i, 0) \tag{3}$$

$$R_t^- = \sum_{i=1}^{t} \Delta R_t^- = \sum_{i=1}^{t} \min(\Delta R_i, 0). \tag{4}$$

Transforming the initial regression equation in the asymmetric long-run specification as proposed by Shin et al. (2014):

$$\Delta T_t = \alpha_0 + \alpha_1 T_{t-1} + \alpha_2 R_{t-1}^+ + \alpha_3 R_{t-1}^- + \alpha_4 \mathrm{WI}_{t-1}, \tag{5}$$

where R^+ and R^- are the partial sum of decomposed positives and negatives. But as the specification takes into account only long run, we have to transform the equation into error correction form. Thus, by doing so, we get

$$\begin{aligned} \Delta T_t = {} & \beta_0 + \beta_1 T_{t-1} + \beta_2 R_{t-1}^+ + \beta_3 R_{t-1}^- + \beta_4 \mathrm{WI}_{t-1} + \sum_{i=1}^{m} \delta_{1i} \Delta T_{t-1} \\ & + \sum_{i=0}^{n} \delta_{2i} \Delta R_{t-1}^+ + \sum_{i=0}^{o} \delta_{3i} \Delta R_{t-1}^- + \sum_{i=0}^{p} \delta_{4i} \Delta \mathrm{WI}_{t-1} + u_i. \end{aligned} \tag{6}$$

Here, β_1, β_2,β_3, and β_4 are the long-run coefficients of exchange rate and world income and δ_{1i}, δ_{2i}, δ_{3i}, and δ_{4i} are the coefficient for short runs and u_i is the error correction term, where $m\ n\ o\ p$ are the lags of the regressors.

The analysis is done in the following manner. The requirement of the model is none of the variables should be stationary at $I(2)$. Unit root has to be performed. Augmented Dickey–Fuller (ADF) and Philips–Perron (PP) have been used for the unit root test. In the second step, the lag selection is done on AIC information criteria. As the frequency of the analysis is monthly, 12 lags of dependent and independent variables have been used. In the next step, the Bound test (Pesaran et al. 2001) is used to ascertain the cointegration among the variable. Finally, asymmetric ARDL (Shin et al. 2014) is applied and the nonlinear cumulative multiplier effect is calculated through the following formula:

The dynamic multiplier effect for R_{t-1}^+ and R_{t-1}^- is calculated from the following formula:

$$M_h^+ R = \sum_{i=0}^{n} \frac{\partial T_{t+1}}{\partial R_{t-1}^+} \tag{7}$$

$$M_h^- R = \sum_{i=0}^{n} \frac{\partial T_{t+1}}{\partial R_{t-1}^-}. \tag{8}$$

Asymmetric causality

Following Alper and Oguz (2016) and Hatemi-J (2012), nonlinear causality among tourism demand, exchange rate, and world income are examined by integrating the partial decomposition mentioned in Eqs. (3) and (4) in the augmented VAR model advanced by Toda and Yamamoto (1995). The approach is flexible with the level, first difference, and second difference of the variables. It can work even when there is no cointegration among the variables in contrast with VECM which requires all variables to be of $I(1)$ order and cointegrated. We extend Eq. (5) in the augmented asymmetric VAR in the following manner:

$$\begin{aligned}\ln t_t = \alpha_0 &+ \sum_{i=1}^{k} \alpha_{i1} \ln t_{t-i} + \sum_{j=k+1}^{d_{\max}} \alpha_{2j} \ln t_{t-j} + \sum_{i=1}^{k} \alpha_{3i} \ln R_{t-i}^+ + \sum_{j=k+1}^{d_{\max}} \alpha_{4i} \ln R_{t-j}^+ \\ &+ \sum_{i=1}^{k} \alpha_{5i} \ln R_{t-i}^- + \sum_{j=k+1}^{d_{\max}} \alpha_{6i} \ln R_{t-j}^- + \sum_{i=1}^{k} \alpha_{7i} \ln \mathrm{WI}_{t-i} + \sum_{j=k+1}^{d_{\max}} \alpha_{8i} \ln \mathrm{WI}_{t-j} + \gamma_{1t}\end{aligned} \tag{9}$$

$$\begin{aligned}\ln R_t^+ = \beta_0 &+ \sum_{i=1}^{k} \beta_{i1} \ln R_{t-i}^+ + \sum_{j=k+1}^{d_{\max}} \beta_{2j} \ln R_{t-j}^+ + \sum_{i=1}^{k} \beta_{3i} \ln R_{t-i}^- + \sum_{j=k+1}^{d_{\max}} \beta_{4i} \ln R_{t-j}^- \\ &+ \sum_{i=1}^{k} \beta_{5i} \ln t_{t-i} + \sum_{j=k+1}^{d_{\max}} \beta_{6i} \ln t_{t-j} + \sum_{i=1}^{k} \beta_{7i} \ln \mathrm{WI}_{t-i} + \sum_{j=k+1}^{d_{\max}} \beta_{8i} \ln \mathrm{WI}_{t-j} + \gamma_{2t}\end{aligned} \tag{10}$$

$$\begin{aligned}\ln R_t^- = \sigma_0 &+ \sum_{i=1}^{k} \sigma_{i1} \ln R_{t-i}^- + \sum_{j=k+1}^{d_{\max}} \sigma_{2j} \ln R_{t-j}^- + \sum_{i=1}^{k} \sigma_{3i} \ln R_{t-i}^+ + \sum_{j=k+1}^{d_{\max}} \sigma_{4i} \ln R_{t-j}^+ \\ &+ \sum_{i=1}^{k} \sigma_{5i} \ln t_{t-i} + \sum_{j=k+1}^{d_{\max}} \sigma_{6i} \ln t_{t-j} + \sum_{i=1}^{k} \sigma_{7i} \ln \mathrm{WI}_{t-i} + \sum_{j=k+1}^{d_{\max}} \sigma_{8i} \ln \mathrm{WI}_{t-j} + \gamma_{3t}\end{aligned} \tag{11}$$

$$\begin{aligned}\ln \mathrm{WI}_t = \rho_0 &+ \sum_{i=1}^{k} \rho_{i1} \ln \mathrm{WI}_{t-i} + \sum_{j=k+1}^{d_{\max}} \rho_{2j} \ln \mathrm{WI}_{t-j} + \sum_{i=1}^{k} \rho_{3i} \ln R_{t-i}^+ + \sum_{j=k+1}^{d_{\max}} \rho_{4i} \ln R_{t-j}^+ \\ &+ \sum_{i=1}^{k} \rho_{5i} \ln R_{t-j}^- + \sum_{j=k+1}^{d_{\max}} \rho_{6i} \ln R_{t-j}^- + \sum_{i=1}^{k} \rho_{7i} \ln t_{t-i} + \sum_{j=k+1}^{d_{\max}} \rho_{8i} \ln t_{t-j} + \gamma_{4t}.\end{aligned} \tag{12}$$

The analysis is performed using the lag length used in NARDL estimation and the maximum order of integration to gauge the causal inference among the series.

Table 1 Unit root test

Series	In levels		In first difference	
	ADF	PP	ADF	PP
LNT	− 1.80	− 1.96	− 12.43***	− 12.39***
LNR	− 0.35	− 0.03	− 10.33***	− 10.28***
LNW	− 4.10***	− 2.96*	− 3.65***	− 15.58***

*** and * refer to level of significance at 1% and 10%, respectively

Table 2 Bound test for nonlinear cointegration

Test statistic	Value	Significance (%)	Lower bound	Upper bound
Calculated *F*-statistic	5.482***	1	4.4	5.72
		5	3.47	4.57
		10	3.03	4.06

***The level of significance at 1%

If p values are less than the conventional 10% level, the no causality null hypothesis is rejected. For instance, as in Eq. (9), the causality running from $\ln R_t^+$ and $\ln R_t^-$ is ascertained if α_{3i} and α_{5i} are not equal to zero.

Results and discussion

In this section, the empirical estimation of the tourism demand is assessed with modern economic techniques. For this purpose, NARDL cointegration analysis is adopted as proposed by Shin et al. (2014). Prior to the cointegration analysis, the level of integration (stationarity) is examined by ADF and PP unit root tests.

The novelty of ARDL estimation is that it can be applied in the case of a mixture of $I(0)$ and $I(1)$ that is the order of stationarity can be different, Whereas the conventional methods required the stationarity of the series at the same order (Engle and Granger 1987). However, the limitation of the ARDL approach is that it cannot be applied where any variable is stationary of $I(2)$ order. If $I(2)$ is ignored in the analysis, the value of the F-statistic becomes void. Therefore, the two most renowned time series techniques ADF and PP have been applied to check for the stationarity of the series (Phillips and Perron 1988; Dickey and Fuller 2012). The results indicate all the variables are stationary at the first difference except world income (Table 1). The present study has opted for AIC criteria for the choice of lags in the model estimation.

The next step is to check the long-run cointegration among the selected variables. The result of Wald's test F test proposed by Pesaran et al. (2001) in Table 2 indicates that the calculated value is higher than the upper band at a 1% significance level. Thus, it can be concluded that asymmetric cointegration exists between tourism demand, exchange rate, and world income.

Bounds test results are shown in Table 2. The result depicts the value of the F-statistic is greater than the upper bounds critical value at a 1% level of significance. Result states the existence of a nonlinear long-run relationship among the variables.

Table 3 presents long-run and short-run results. The lagged variable of tourism demand states the word-of-mouth impact of tourists. The result indicates a significant association of previous tourist arrivals with the present arrivals. Further, the finding shows that exchange rate depreciation (partial sum of the positive decomposed real effective exchange rate) is positively related to tourist arrivals. On the contrary, exchange rate appreciation (partial sum of the negative decomposed real effective exchange rate) is negatively impacting tourist arrivals. The different sizes of the coefficients are a clear indicator of the presence of the asymmetrical effect of the exchange rate on tourist arrivals. The results are logical in the sense that the exchange rate is perceived in terms of the relative cost of visiting any nation. Exchange rate depreciation makes it affordable to visit the country and thus boosts tourism demand in the long run. The results are in line with the previous studies (Martins et al. 2017; Meo et al. 2018). The hypothesis of income elasticity is greater than zero holds in our result. Inbound tourism is a normal or luxury good. World income has a significant positive long-run relationship with tourist arrivals. Just like exports of any economy depend on other economies. The prosperity in the world brings a desirable impact on exports so is the case with the tourism demand.

Table 3 Estimation results of the NARDL model

Variable	Coefficient	Std. error	*t*-statistic	Prob
Long-run estimates				
LNT (− 1)	0.98***	0.07	14.07	0.00
LNR_POS	2.13***	0.71	3.01	0.00
LNR_NEG	− 5.05***	1.36	− 3.71	0.00
LNW_POS	6.38***	0.63	10.12	0.00
LNW_NEG	0.64	0.45	1.41	0.16
Short-run estimates				
ΔLNT (− 1)	0.01	0.09	− 0.03	0.98
ΔLNR_POS	7.12**	2.82	2.52	0.01
ΔLNR_NEG	− 3.70	2.52	− 1.47	0.14
ΔLNW_POS	8.76***	1.90	4.62	0.00
ΔLNW_NEG	− 3.89**	1.86	− 2.09	0.04
ECT (− 1)	− 0.41***	0.06	− 7.13	0.00
Diagnostics				
Adjusted R-squared				0.88
S.E. of regression				0.27
Sum squared resid				14.15
F-statistic				94.54
Prob (*F*-statistic)				0.00

*** and ** refer to the level of significance at 1% and 5%, respectively. Δ denotes first difference of the variable

However, the negative shocks in the world income are not found to be significant in the long run. Again, the size of the coefficients for world income is different. The result again states the nonlinear behavior of world income with tourist arrivals.

In order to estimate short-run asymmetric dynamics, the error correction approach is followed. Apparently, as Table 3 (lower panel) indicates the coefficients of the positive components of the REER (exchange rate depreciation) and the negative composition of REER (exchange rate appreciation) have the expected signs. However, only positive shocks are having a significant impact on tourism demand in the short run. On the other hand, world income (both components) has a significant impact in the short run as well. The error correction term is negative and significant. Providing further support to the cointegration, lagged coefficient of error correction term (ECT) represents the speed of adjustment. For instance, it states that if any shock comes how much time is taken to get back to the equilibrium path. Figure 2 demonstrates the nonlinear effect of the exchange rate on tourist arrivals.

The results come in support of unidirectional causality running from exchange rate (positive shocks) and world income (positive shocks) to tourist arrivals. Similarly, unidirectional causality is noted from world income (negative shocks) to exchange rate (negative shocks). This highlights that changes in the world income have implications for the exchange rate fluctuations (Table 4).

Finally, in Fig. 5, we depict the dynamic multipliers for the NARDL model to explain the unequal changes from an initial long-run equilibrium to a new long-run equilibrium following a negative or positive unit shock. The asymmetry curves illustrate the linear combination of dynamic multipliers associated with positive and negative exchange rate shocks. The positive and negative change curves show the asymmetric adjustment of tourist arrivals to positive and negative exchange rate shocks over a particular forecasting horizon. The bottom and upper bands for asymmetry (the dotted red lines) represent the 95% confidence range. Overall, it appears that positive exchange rate shocks (exchange rate depreciation) have a greater long-term impact on tourist arrivals than negative exchange rate shocks.

The black-dashed line of the dynamic multiplier plots (Fig. 2) shows that a 1% increase in exchange rate improves short-run tourist arrivals by more than 1%, and

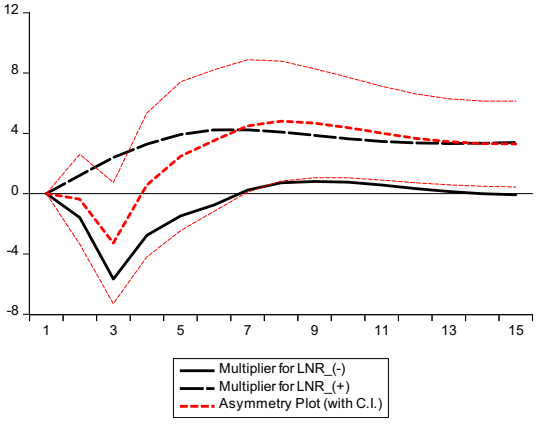

Fig. 2 Dynamic asymmetric multiplier

Table 4 Causality estimations

Causal analysis	Dependent variable				
Excluded variables	LNT	LNR_POS	LNR_NEG	LNW_POS	LNW_NEG
LNT	–	1.72	4.43	4.41	1.93
LNR_POS	21.12***	–	1.53	3.45	0.72
LNR_NEG	2.45	2.57	–	1.98	0.74
LNW_POS	26.46***	2.94	2.88	–	0.97
LNW_NEG	1.39	3.49	6.23**	21.17***	–

The table shows the Chi-square values of the variables

*** and ** represent levels of significance at 1% and 5%, respectively

this converges to roughly 3% in the long run. Similarly, the black solid line shows that a 1% fall in exchange rate reduces short-term tourist arrivals by more than 1%, and this converges to roughly 0 in the long run. Surprisingly, the net effect of the exchange rate (thick, red-dotted line) is positive in both the short and long run, grows in the short run, and eventually converges around 3% (Fig. 2).

Various diagnostic tests have been applied to ensure that model is free from estimation problems. In Table 5, the diagnostic results are shown. The results depict, that the model is free from autocorrelation, and heteroscedasticity also follows a

Table 5 Diagnostic tests

Test	Problem	Chi-square (*p* value)	Inferences
Breusch–Pagan Godfrey	Heteroscedasticity	1.90 (0.55)	Free from heteroscedasticity
LM test	Autocorrelation	2.20 (0.12)	Free from autocorrelation
Jarque–Bera	Normality	1.02 (0.10)	Normal distribution
Ramsey test	Model misspecification	0.21(0.12)	Correctly specified
CUSUM	Stability		Stable (Fig. 3)
CUSUMSQ	Stability		Stable (Fig. 4)

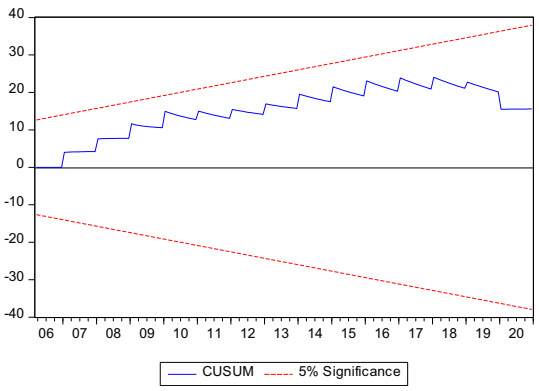

Fig. 3 CUSUM test for stability

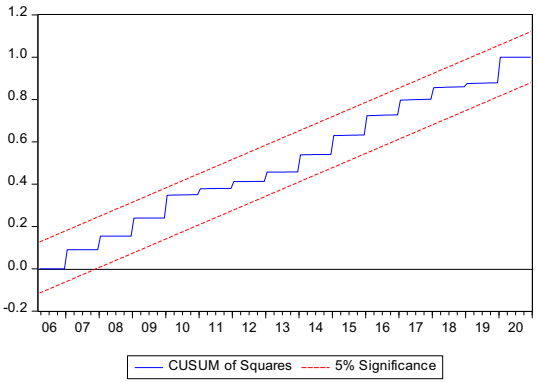

Fig. 4 CUSUM square test for stability

normal distribution. Furthermore, for checking the robustness of the model CUSUM and CUSUMSQ tests have been applied (Brown et al. 1975).

Following the study of Kumar et al. (2019) and Kumar and Stauvermann (2021), the inverse roots of the autoregressive characteristic polynomial graph are used to examine the stability of the VAR models. The computed VAR models pass these diagnostic tests, as shown in Fig. 5.

Conclusion

Tourism is a thriving industry, and many Asian economies have recognized its potential. Despite the fact that India has enormous tourist potential, the sector remains untapped. Since it is a labor-intensive business, it can be a benefit to emerging countries that have recently faced severe unemployment and poverty.

The present study makes an attempt to analyze the unexplored asymmetrical dynamic association between tourism and exchange rate and world income, using

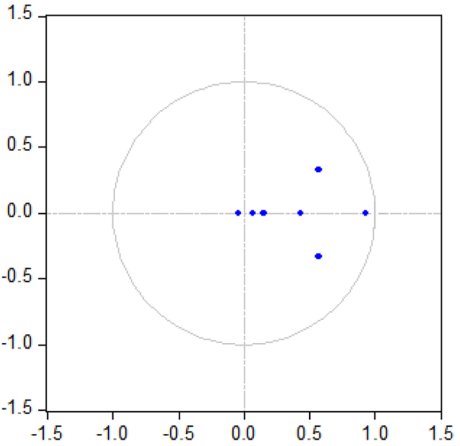

Fig. 5 Inverse roots of AR characteristic polynomial asymmetric VAR. The stability of the VAR model is confirmed when the inverse roots of the characteristic polynomial lie within the positive and negative unit circle. Roots lie within the circle

monthly data from January 2003 to December 2020. The contribution of the present study is the extension of the literature related to the nonlinear modeling of tourism demand in the Indian context. In this context, the literature found that linear techniques have dominated the research in explaining tourism demand in many countries. However, our study attempts a nonlinear technique in modeling tourism demand in the Indian scenario. The analysis will provide deeper insight into the nature of tourism demand and will help in making better policy formulation for India.

The present study which aims to analyze the asymmetric association of exchange rate and world income with tourism demand in India employed a recently developed nonlinear autoregressive distributed lag model by Shin et al. (2014). Further, asymmetric causality is carried out with the help of an augmented vector autoregressive model with insights from Hatemi-J.

The findings come in support of the asymmetrical association of exchange rate in the long run with tourism demand. The study supports the earlier findings of Obi and Ogbeide (2022) for USA and Aslanoğlu et al. (2021) for Turkey. The authors emphasized the crucial role of exchange rate and world income for analyzing tourism demand. However, the study contradicts few studies that support the policy of exchange rate appreciation to increase tourism receipts in the nations (Irandoust 2019; Karimi et al. 2015). The authors stated that high-budget tourists may not be reluctant to travel based on the relative price such as exchange rate only, but rather they may opt for quality tourism services (Irandoust 2019).

Furthermore, positive shocks in world income and exchange rate have unidirectional causality to tourism demand. Ignoring the nonlinearity can lead to misleading results. The nonlinear models have more explanatory power and are more efficient in the case of forecasting and thus more appropriate for policy framework. The study found that the coefficient size for positive and negative shocks of the independent variables (world income and exchange rate) have a different size effect on the dependent variable (tourism demand). In contrary to the linear ARDL model where it is assumed that the magnitude of the positive and negative shocks remains the same. Thus, the explanatory power of the NARDL model is greater than the ARDL model.

A significant implication of this study is the direct influence of the exchange rate on the economic advantage of incoming tourism. Understanding how the purchasing power of a tourist's home currency influences their decision to visit India is critical in marketing Indian tourism abroad. There is more evidence that macroeconomic shocks influence travel decisions. As a result, building a tourism brand that emphasizes the positives, such as the Indian currency's exchange rate benefits and the well-known vibrancy of many Indian towns, should be useful.

Importantly, the discovery that the exchange rate has a direct impact on tourist growth calls attention to the monetary policy goal of maintaining currency stability. While systemic risks such as international conflicts, economic crises, natural disasters, and pandemics are frequently unavoidable, an early and effective response is required. Maintaining sufficient planning highlights the need of focusing on economic growth and tourism-enabling infrastructure.

Finally, because the tourism sector's profits make for a significant portion of Indian exports, a proactive approach to the tourism sector is essential. This is especially relevant given how much tourism contributes to domestic employment, particularly at the low- to middle-income levels. Prompt financial assistance to critical businesses such as hospitality and entertainment should help to reduce the long-term detrimental effects of any crisis.

However, the study has the following limitations. Since the study considered only two independent variables, a comprehensive study that incorporates other macro-variables would be more exhaustive in the case of tourism demand models. In addition, the study did not include the post-COVID era in its analysis. The research's future focus should be on aspects that might aid in the resurgence of tourism demand. Environmental changes also have a significant impact on travel demand. The research, on the other hand, made use of variables with a monthly frequency. As a result, numerous possible factors were ruled out. As a result, future studies should attempt to bring to light other relevant factors that may impact visitor arrivals in the country. Since the study's findings are nation-specific, the findings cannot be generalized to countries that have different characteristics. As a result, the future study can also focus on panel studies.

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Data availability statement Data can be provided based on reasonable requests. In addition, the data are sourced from the International monetary fund and the Ministry of Tourism (India) official website which are open data sources.

Availability of data and materials Data will be shared on reasonable request.

Declarations

Conflict of interest There is no competing interest. We confirm that the manuscript has no actual or potential conflict of interest with any parties, including any financial, personal or other relationships with other people or organizations that could inappropriately influence or be perceived to influence.

Ethical approval and consent to participate Not applicable.

Consent for publication Not applicable.

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