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Exchange Rate Volatility and Tourism Receipts in Nepal: Evidence from GARCH Models

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Abstract

This study investigates the relationship between exchange rate volatility and tourism receipts, utilizing annual data from 1976 to 2024. While prior studies have focused on multiple determinants of tourism demand, the relationship between exchange rate volatility and tourism receipts has received minimal attention. The literature thus provides policymakers with limited guidance regarding how exchange rate fluctuations impact tourism revenue. Using time series data and various GARCH modeling approaches (standard GARCH, EGARCH, and TGARCH), we find strong evidence that exchange rate movements have a significant impact on tourism receipts. We found that exchange rate changes have a statistically significant impact on tourism receipts across all model specifications, with the EGARCH model showing the best fit based on information criteria. One possible explanation is that currency depreciation

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leads to improved price competitiveness, which can be an important driver of tourism revenue if properly leveraged through targeted marketing strategies.

Introduction

The international tourism industry has emerged as a critical component of the global economy, contributing approximately 10.4% to global GDP and supporting over 334 million jobs worldwide (UNWTO, 2023). As tourism flows continue to expand across international borders, understanding the complex dynamics between macroeconomic variables and tourism receipts has become increasingly paramount for policymakers, industry stakeholders, and academic researchers. Among these macroeconomic factors, exchange rate fluctuations represent one of the most influential determinants of international tourism demand and supply dynamics (Balaguer & Cantavella-Jordá, 2002; Dritsakis, 2004; Lee & Chang, 2008).

The theoretical underpinnings of the exchange rate-tourism nexus are well-established in the economic literature. When a destination country experiences currency depreciation, its tourism products and services become relatively more affordable for international visitors, potentially stimulating both tourist arrivals and per capita expenditure (Crouch, 1994; Lim, 1997; Song & Li, 2008). Conversely, currency appreciation may diminish a destination's price competitiveness, thereby deterring potential visitors and reducing tourism receipts (Dwyer et al., 2002; Forsyth & Dwyer, 2009; Seetaram, 2010).

Despite the theoretical clarity of this relationship, empirical investigations have yielded mixed and sometimes contradictory results, highlighting the complexity of the exchange rate-tourism interface (De Vita, 2014; Dogru et al., 2017; Kumar et al., 2020). Several factors contribute to this empirical heterogeneity, including differences in methodological approaches, sample periods, destination characteristics, and the treatment of exchange rate volatility (Agiomirgianakis et al., 2014; Cheng et al., 2013; Serenis & Tsounis, 2014).

Exchange rate volatility, as distinct from exchange rate levels, introduces an additional layer of complexity to tourism decision-making processes. High volatility creates uncertainty for both tourists planning international travel and tourism businesses engaged in cross-border transactions, potentially leading to suboptimal outcomes even when average exchange rates are favorable (Webber, 2001; Yap, 2012; Chi, 2015). The asymmetric nature of volatility effects further complicates this relationship, as positive and negative exchange rate shocks may elicit differential responses from tourism market participants (Thompson & Thompson, 2010; Vita & Kyaw, 2013; Tang et al., 2016).

The methodological evolution in modeling exchange rate-tourism relationships has progressed from simple regression analyses to more sophisticated econometric techniques capable of capturing time-varying volatility and asymmetric effects (Patsouratis et al., 2005; Falk, 2015; Işık et al., 2019). The family of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models has emerged as particularly well-suited for analyzing these complex dynamics, offering the ability to model conditional volatility and investigate asymmetric responses to exchange rate shocks (Engle, 1982; Bollerslev, 1986; Nelson, 1991).

Previous studies employing GARCH methodologies in tourism research have predominantly focused on forecasting tourism demand or examining stock market volatility in tourism-related industries (Chang et al., 2009; Coshall, 2009; Chen et al., 2012). However, the direct application of various GARCH specifications to investigate the exchange rate volatility-tourism receipts relationship remains relatively underexplored, particularly in terms of comparative analysis across different model specifications.

This study contributes to the existing literature in several significant ways. First, it provides a comprehensive examination of the relationship between exchange rate volatility and tourism receipts using three distinct GARCH modeling approaches: standard GARCH, Exponential GARCH (EGARCH), and Threshold GARCH (TGARCH) models. This multi-model approach allows for a nuanced understanding of volatility dynamics and asymmetric effects that may not be captured by conventional regression techniques (Glosten et al., 1993; Zakoian, 1994).

Second, the analysis of this study focuses specifically on the volatility dimension of exchange rates rather than treating exchange rates as a control variable among many determinants of tourism demand. This targeted approach enables a more detailed investigation of how exchange rate uncertainty influences tourism receipts, addressing a gap identified in recent literature reviews (Song et al., 2012; Peng et al., 2015; Wu et al., 2017).

Third, by employing asymmetric GARCH specifications, this study examines whether positive and negative exchange rate shocks have differential impacts on tourism receipts, contributing to the growing body of literature on asymmetric effects in tourism economics (Sheldon, 1993; Lorde et al., 2016; Martins et al., 2017).

The findings from this research have important implications for tourism policy formulation and industry strategy development. Understanding the magnitude and nature of exchange rate volatility effects can inform decisions regarding currency risk management, pricing strategies, and market diversification initiatives (Sinclair, 1998; Blake et al., 2006; Ridderstaat et al., 2014). Moreover, study results provide empirical evidence that can guide central banks and monetary authorities in assessing the tourism sector implications of exchange rate policies (Eugenio-Martin & Morales, 2004; Santana-Gallego et al., 2010).

The remainder of this paper is organized as follows. Section 2 presents the methodology, including the theoretical framework and specification of the various GARCH models employed. Section 3 presents the results and discussion, including empirical findings and comparative analysis across model specifications. Finally, Section 4 provides conclusions and policy implications, summarizing key findings, limitations, and directions for future research.

Literature review

Theoretical foundations of the exchange rate-tourism relationship

The theoretical relationship between exchange rates and tourism demand has been extensively documented in the economic literature, with early contributions establishing the fundamental mechanisms through which currency fluctuations influence international travel patterns.

Crouch (1994) provided seminal work demonstrating that exchange rate movements affect tourism demand through price competitiveness channels, arguing that currency depreciation enhances destination attractiveness by reducing the relative cost of tourism services for international visitors. This theoretical framework was further developed by Lim (1997), who emphasized the dual nature of exchange rate effects on both tourist arrivals and per capita expenditure patterns.

The price competitiveness hypothesis gained empirical support through numerous studies examining tourism elasticities. Song and Li (2008) conducted a comprehensive meta-analysis revealing that exchange rate elasticities of tourism demand typically range from -0.5 to -1.5, indicating that a 10% currency depreciation generally leads to a 5-15% increase in tourism receipts. However, Dwyer et al. (2002) cautioned that these relationships are not uniform across destinations, noting that the magnitude of exchange rate effects depends on factors such as destination substitutability, tourist income levels, and the structure of local tourism industries.

The theoretical complexity increases when considering exchange rate volatility as distinct from exchange rate levels. Webber (2001) introduced the uncertainty hypothesis, arguing that exchange rate volatility creates planning difficulties for both tourists and tourism businesses, potentially leading to suboptimal travel decisions even when average exchange rates are favorable. This perspective was supported by Yap (2012), who demonstrated that high volatility environments discourage long-term tourism planning and investment, thereby reducing overall tourism receipts despite potentially favorable average exchange rates.

Empirical evidence on exchange rate-Tourism dynamics

The empirical literature examining exchange rate effects on tourism has produced mixed results, reflecting the complexity of this relationship across different contexts and methodological approaches. Balaguer and Cantavella-Jordá (2002) provided early evidence of significant exchange rate effects using Spanish data, finding that real exchange rate depreciation led to substantial increases in tourism receipts. Their findings were corroborated by Dritsakis (2004) in the Greek context, who reported exchange rate elasticities consistent with the price competitiveness hypothesis.

However, subsequent studies have revealed considerable heterogeneity in exchange rate-tourism relationships across destinations and time periods. Lee and Chang (2008) found asymmetric effects in their analysis of Asian tourism markets, with currency depreciations having larger impacts than appreciations of equivalent magnitude. This asymmetry was attributed to tourists' loss aversion and the irreversible nature of many tourism investments, suggesting that the relationship between exchange rates and tourism is more nuanced than simple price elasticity models suggest.

More recent empirical work has increasingly focused on the role of exchange rate volatility. De Vita (2014) conducted a comprehensive study of European tourism markets, finding that exchange rate volatility significantly reduces tourism receipts even after controlling for average exchange rate levels. The study suggested that uncertainty effects can dominate price competitiveness effects when volatility is sufficiently high. Similarly, Dogru et al. (2017)

examined US tourism data and found that exchange rate volatility has persistent negative effects on international arrivals, with impacts lasting several quarters beyond initial shocks. These findings were further supported by the findings, exchange rate volatility contributed as a significant factor in travel flows (Doytch and Nyugan,2023) and had negative and significant impacts on tourism demand (Chi,2020).

The growing recognition of volatility effects has led researchers to investigate the mechanisms through which uncertainty influences tourism decisions. Kumar et al. (2020) identified three primary channels: tourist planning horizons, business investment decisions, and hedging costs. Their analysis revealed that destinations with higher exchange rate volatility experience reduced tourism investment and marketing effectiveness, creating a negative feedback loop that amplifies volatility effects over time.

Methodological evolution in exchange rate-Tourism research

The methodological approaches employed in exchange rate-tourism research have evolved significantly, reflecting advances in econometric techniques and growing recognition of the complex dynamics involved. Early studies primarily relied on simple regression analyses, treating exchange rates as one of many determinants of tourism demand (Patsouratis et al., 2005). While these approaches provided valuable initial insights, they were limited in their ability to capture time-varying relationships and volatility dynamics.

The introduction of GARCH (Generalized Autoregressive Conditional Heteroskedasticity) modeling techniques represented a significant methodological advancement, enabling researchers to explicitly model volatility dynamics and their effects on tourism outcomes. Engle (1982) and Bollerslev (1986) developed the foundational GARCH framework, which was subsequently extended by Nelson (1991) to include asymmetric effects through the EGARCH specification. These methodological innovations have proven particularly valuable in tourism research, where volatility effects are often asymmetric and time-varying.

Chang et al. (2009) were among the first to apply GARCH techniques to tourism forecasting, demonstrating superior predictive performance compared to traditional econometric approaches. Their work was extended by Coshall (2009), who used multivariate GARCH models to examine volatility spillovers between exchange rates and tourism demand. These studies established the foundation for more sophisticated analyses of exchange rate volatility effects in tourism contexts.

The development of threshold GARCH (TGARCH) models by Glosten et al. (1993) and Zakoian (1994) provided additional tools for examining asymmetric volatility effects. Falk (2015) demonstrated the importance of these asymmetric specifications in tourism research, showing that positive and negative exchange rate shocks often have differential impacts on tourist behavior. This finding has important implications for tourism policy and risk management strategies.

Asymmetric effects and behavioral considerations

The recognition of asymmetric effects in exchange rate-tourism relationships has emerged as a key theme in recent literature. Thompson and Thompson (2010) provided early evidence of asymmetric responses, finding that currency depreciations have larger effects on tourism receipts than appreciations of equivalent magnitude. This asymmetry was attributed to reference point effects and loss aversion in tourist decision-making processes.

Vita and Kyaw (2013) extended this analysis by examining the behavioral mechanisms underlying asymmetric responses. Their study revealed that tourists exhibit different risk attitudes when facing potential gains versus losses from exchange rate movements, leading to asymmetric demand responses. The authors found that destinations experiencing currency volatility face disproportionately larger losses during depreciation periods than gains during appreciation periods, suggesting that volatility management should be a priority for tourism-dependent economies.

Tang et al. (2016) provided further evidence of asymmetric effects by examining tourism receipts data from multiple destinations. Their analysis revealed that asymmetry is more pronounced for leisure tourism compared to business tourism, reflecting differences in price sensitivity and planning horizons between tourist segments. This finding has important implications for destination marketing strategies and suggests that volatility effects may vary across tourism market segments.

Sectoral and regional variations

The literature has increasingly recognized that exchange rate effects on tourism vary significantly across sectors and regions. Sheldon (1993) provided early evidence of sectoral differences, showing that accommodation sectors are more sensitive to exchange rate volatility than transportation sectors, reflecting differences in price flexibility and international exposure. This finding was supported by Lorde et al. (2016), who examined Caribbean tourism markets and found that resort-based destinations experience larger volatility effects than urban destinations.

Regional variations in exchange rate sensitivity have also been documented. Martins et al. (2017) compared European and developing country destinations, finding that developing countries exhibit higher exchange rate elasticities and greater volatility sensitivity. The authors attributed these differences to factors such as tourism industry maturity, infrastructure quality, and destination diversification capabilities.

Recent research has also examined the role of tourism specialization in moderating exchange rate effects. Işık et al. (2019) found that highly tourism-specialized economies experience amplified volatility effects, as their limited economic diversification reduces their ability to absorb exchange rate shocks. This finding suggests that tourism diversification strategies may serve as important buffers against exchange rate volatility.

Policy implications and risk management

The literature has increasingly focused on the policy implications of exchange rate-tourism relationships, with particular attention to risk management strategies. Sinclair (1998) provided early insights into hedging strategies for tourism businesses, arguing that exchange rate risk management should be integrated into broader tourism development policies. This perspective was developed further by Blake et al. (2006), who examined the macroeconomic implications of exchange rate volatility for tourism-dependent economies.

Ridderstaat et al. (2014) conducted a comprehensive analysis of policy responses to exchange rate volatility, identifying several effective strategies including currency diversification, forward contracting, and counter-cyclical fiscal policies. Their analysis revealed that proactive risk management can significantly reduce the negative impacts of exchange rate volatility on tourism receipts.

The role of monetary policy in tourism development has also received attention. Eugenio-Martin and Morales (2004) examined the tourism implications of exchange rate regimes, finding that fixed exchange rate regimes may provide stability benefits for tourism development, though at the cost of reduced monetary policy flexibility. Santana-Gallego et al. (2010) provided contrasting evidence, suggesting that flexible exchange rate regimes may be preferable for diversified tourism economies capable of managing volatility through market mechanisms.

Despite the extensive literature on exchange rate-tourism relationships, several important gaps remain. Song et al. (2012) identified the need for more comparative studies across different GARCH specifications, noting that most existing research relies on single-model approaches that may not capture the full complexity of volatility dynamics. Peng et al. (2015) called for more attention to asymmetric effects, arguing that symmetric volatility models may underestimate the true costs of exchange rate uncertainty.

Wu et al. (2017) highlighted the need for research focusing specifically on volatility effects rather than treating exchange rates as control variables in broader tourism demand models. This targeted approach could provide more precise estimates of volatility impacts and better guidance for policy formulation. Additionally, there is growing interest in examining the interactive effects between exchange rate volatility and other macroeconomic variables, as these interactions may significantly modify the relationship between currency fluctuations and tourism receipts.

The literature review reveals that while substantial progress has been made in understanding exchange rate-tourism relationships, important questions remain regarding the optimal modeling approaches for capturing volatility effects and the policy mechanisms most effective for managing exchange rate risks in tourism-dependent economies.

Research methodology

Data description and transformation

The empirical analysis employs annual time series data spanning the period 1976-2024, encompassing 49 observations of tourism receipts (TR) and exchange rates (ER). Following standard practice in tourism economics literature (Song & Li, 2008; Seetaram, 2010), both variables undergo logarithmic transformation to address potential heteroskedasticity and to facilitate interpretation of coefficients as elasticities (Wooldridge, 2013). Subsequently, first differences are computed to ensure stationarity:

DlnTR = Δ ln TRt = ln TRt - ln TRt-1……….(1)

DlnER = Δ ln ERt = ln ERt - ln ERt-1……..(2)

These transformations yield DLNTR and DLNER as the primary variables for analysis.

Given the potential presence of unit roots in macroeconomic time series data (Nelson & Plosser, 1982), we implement comprehensive stationarity testing using both the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979, 1981) and the Phillips-Perron (PP) test (Phillips & Perron, 1988). The ADF test augments the standard Dickey-Fuller regression with lagged difference terms to account for serial correlation:

Δyt = α + βt + γyt-1 + Σδi Δyt-i + εt…………(3)

where yt represents the variable of interest, t denotes the time trend, and the lag length is determined by information criteria to ensure white noise residuals (Ng & Perron, 1995).

The Phillips-Perron test employs a non-parametric correction to the standard Dickey-Fuller t-statistic, accommodating serial correlation and heteroskedasticity through the Newey-West

(1987) estimator of the long-run variance. Both tests examine the null hypothesis of a unit root (H_0: γ = 0) against the alternative of stationarity (H_1: γ < 0).

Table 1: Unit root test results

Variable	Test	Level		First Difference		Order of Integration
		Intercept	Trend & Intercept	Intercept	Trend & Intercept	
lnTR	ADF	-0.2635	-2.2829	-9.6204***	-9.5149***	I(1)
	PP	-0.2744	-2.1243	-9.6122***	-9.5069***	I(1)
lnER	ADF	-1.7256	-0.7346	-5.4680***	-5.5421***	I(1)
	PP	-1.4695	-1.1061	-5.7105***	-5.7621***	I(1)

*Note: *** denotes rejection of the null hypothesis at the 1% significance level. Critical values are obtained from MacKinnon (1996).*

The unit root test results presented in Table 1 conclusively demonstrate that both tourism receipts (lnTR) and exchange rates (lnER) exhibit non-stationary behavior in levels but achieve stationarity upon first differencing. This finding, indicating that both series are integrated of order one I(1), validates the use of differenced logarithmic transformations in our subsequent GARCH modeling framework.

GARCH model specification

To investigate the relationship between exchange rate volatility and tourism receipts while accounting for time-varying conditional heteroskedasticity, the study employs three distinct specifications from the GARCH family of models. These models enable the simultaneous estimation of the conditional mean and conditional variance equations, capturing both the direct effect of exchange rate changes on tourism receipts and the volatility dynamics inherent in the relationship.

Standard GARCH(1,1) model

The baseline GARCH(1,1) model, introduced by Bollerslev (1986), extends Engle's (1982) ARCH framework by incorporating lagged conditional variance terms. The specification consists of:

Mean Equation

$DlnTRt = \alpha + \beta(DlnERt) + \varepsilon t$.......(4)

Variance Equation

$\sigma^2 + = \omega + \alpha_1\varepsilon^2 t\text{-}1 + \gamma_1\varepsilon^2 t\text{-}1It\text{-}1 + \beta_1\sigma^2 t\text{-}1$.......(5)

where, It-1is an indicator function defined as: It-1 = 1 if $\varepsilon t\text{-}1 < 0$ (negative shock) It-1 = 0 if $\varepsilon t\text{-}1 \geq 0$ (positive shock)

The mean equation captures the direct relationship between exchange rate changes and tourism receipts, where α represents the intercept, β measures the elasticity of tourism receipts concerning exchange rate changes, and ε_t denotes the error term conditional on the information set $\Omega t\text{-}1$.

The variance equation models the conditional volatility, where $\omega > 0$ ensures positive variance, α_1 captures the ARCH effect (impact of past squared shocks), and β_1 represents the GARCH effect (persistence of past volatility). The non-negativity constraints ($\alpha_1 \geq 0, \beta_1 \geq 0$) and stationarity condition ($\alpha_1 + \beta_1 < 1$) must be satisfied (Nelson & Cao, 1992).

Exponential GARCH (EGARCH) model

The EGARCH model, developed by Nelson (1991), addresses two limitations of the standard GARCH model: the requirement for non-negativity constraints and the inability to capture asymmetric volatility responses. The EGARCH specification is:

Mean Equation

$DlnTRt = \alpha + \beta(DlnERt) + \varepsilon t$.........(6)

Variance Equation

$\log(\sigma^2 t) = \omega + \alpha_1|zt\text{-}1| + \gamma_1 zt\text{-}1 + \beta_1\log(\sigma^2 t\text{-}1)$...........(7)

where, $zt\text{-}1 = \varepsilon t\text{-}1/\sigma t\text{-}1$ represents the standardized residuals.

By modeling the logarithm of conditional variance, the EGARCH specification ensures positive variance without imposing parameter restrictions. The asymmetric effect is captured by γ_1, where $\gamma_1 < 0$ indicates that negative shocks (depreciations in our context) have a larger impact on volatility than positive shocks of equal magnitude—a phenomenon known as the leverage effect (Black, 1976; Christie, 1982).

Threshhold GARCH(TGARCH) model

The TGARCH model, independently proposed by Zakoïan (1994) and Glosten, Jagannathan, and Runkle (1993), provides an alternative approach to modeling asymmetric volatility:

Mean Equation

$DlnTRt = \alpha + \beta(DlnERt) + \varepsilon t$................(8)

Variance Equation

$\sigma^2 t = \omega + \alpha_1 \varepsilon^2 t\text{-}1 + \gamma_1 \varepsilon^2 t\text{-}1It\text{-}1 + \beta_1 \sigma^2 t\text{-}1$..........(9)

where It-1is an indicator function defined as: It-1 = 1 if $\varepsilon t\text{-}1 < 0$ (negative shock) It-1 = 0 if $\varepsilon t\text{-}1 \geq 0$ (positive shock)

The asymmetric effect is captured by γ_1, where $\gamma_1 > 0$ indicates that negative shocks have a larger impact on conditional variance than positive shocks. This specification allows for differential volatility responses to exchange rate appreciations versus depreciations, which is particularly relevant for tourism receipts given the asymmetric nature of tourism demand elasticities (Crouch, 1994; Song et al., 2009).

Model selection criteria

To determine the most appropriate model specification, this study employs three information criteria: the Akaike Information Criterion (AIC) (Akaike, 1974), the Schwarz Information Criterion (SIC) also known as Bayesian Information Criterion (BIC) (Schwarz, 1978), and the Hannan-Quinn Criterion (HQC) (Hannan & Quinn, 1979). These criteria balance model fit against parsimony:

$AIC = -2\ln(L) + 2k$ $SIC = -2\ln(L) + k\ln(n)$ $HQC = -2\ln(L) + 2k\ln(\ln(n))$......(10)

Where L represents the likelihood function value, k denotes the number of parameters, and n is the sample size. Lower values indicate superior model performance, with each criterion imposing different penalties for model complexity.

Estimation methodology

All GARCH models are estimated using the method of maximum likelihood estimation (MLE) under the assumption of conditionally normal errors. The log-likelihood function for the general GARCH model is:

$L(\theta) = -\frac{1}{2} \Sigma[\ln(2\pi) + \ln(\sigma^2 t) + \varepsilon^2 t/\sigma^2 t]$........(11)

Where θ represents the vector of parameters to be estimated. The Berndt-Hall-Hall-Hausman (BHHH) algorithm (Berndt et al., 1974) is employed for optimization, with robust standard errors computed using the quasi-maximum likelihood (QML) approach of Bollerslev and Wooldridge (1992) to account for potential departures from normality.

Diagnostic tests include the Ljung-Box Q-statistic for residual autocorrelation (Ljung & Box, 1978), the ARCH-LM test for remaining conditional heteroskedasticity (Engle, 1982), and the Jarque-Bera test for normality (Jarque & Bera, 1987). These diagnostics ensure the adequacy of model specifications and the validity of statistical inference.

Findings and discussion

Model estimation results

This section presents the empirical findings from the estimation of three GARCH model specifications examining the relationship between exchange rate volatility and tourism receipts. Table 2 reports the coefficient estimates, standard errors, z-statistics, and probability values for each model.

Table 2: GARCH model estimation results

Panel A standard GARCH(1,1) model results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Mean Equation				
DlnER	1.308148	0.334035	3.916196	0.0001
C	0.062103	0.028941	2.145886	0.0319
Variance Equation				
C	0.000581	0.001799	0.322673	0.7469
RESID(-1)^2	1.068181	0.393591	2.713937	0.0066
GARCH(-1)	0.368928	0.135448	2.723759	0.0065

Log likelihood	AIC	SIC	HQC
-1.398037	0.261144	0.454187	0.334385

The standard GARCH(1,1) model results reveal a strong positive relationship between exchange rate changes and tourism receipts. The DlnER coefficient of 1.308148 is highly significant ($p = 0.0001$), indicating that a 1% depreciation in the domestic currency is associated with a 1.31% increase in tourism receipts. This elasticity exceeds unity, suggesting that tourism receipts are highly responsive to exchange rate movements.

In the variance equation, both the ARCH term (RESID(-1)^2) with coefficient 1.068181 ($p = 0.0066$) and the GARCH term with coefficient 0.368928 ($p = 0.0065$) are statistically significant. The sum of these coefficients (1.437109) indicates high persistence in volatility, though the stationarity condition is violated as this sum exceeds unity. The intercept in the variance equation is not statistically significant ($p = 0.7469$).

Panel B EGARCH model results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Mean Equation				
DlnER	0.629429	0.296997	2.119308	0.0341
C	0.068496	0.017794	3.849292	0.0001

Variance Equation				
C(3)	0.282937	0.331808	0.852714	0.3938
C(4)	-0.203792	0.418164	-0.487349	0.6260
C(5)	-0.564104	0.113424	-4.973412	0.0000
C(6)	1.009612	0.000160	6297.152	0.0000

Log likelihood	AIC	SIC	HQC
13.96582	-0.325135	-0.093484	-0.237247

The EGARCH specification presents a more moderate exchange rate effect, with the DLNER coefficient of 0.629429 significant at the 5% level ($p = 0.0341$). This implies that a 1% currency depreciation leads to approximately a 0.63% increase in tourism receipts, suggesting an inelastic response.

Notably, the leverage parameter C(5) is negative (-0.564104) and highly significant ($p = 0.0000$), providing strong evidence of asymmetric volatility effects. This negative coefficient indicates that negative shocks to tourism receipts generate 56.4% more volatility than positive shocks of equal magnitude. The persistence parameter C(6) is extremely close to unity (1.009612), suggesting very high volatility persistence. The EGARCH model achieves the highest log-likelihood value (13.96582) and the lowest information criteria among all specifications.

Panel C TGARCH model results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Mean Equation				
DlnER	0.744417	0.304454	2.445087	0.0145
C	0.065137	0.032130	2.027284	0.0426
Variance Equation				
C	-0.000348	0.001014	-0.342982 0.7316	
RESID(-1)^2	-0.195279	0.046511	-4.198531 0.0000	
RESID(-1)^2*(RESID(-1)<0) 0.964173		0.258488	3.730043	0.0002
GARCH(-1)	1.052563	0.001035	1017.094	0.0000

Log likelihood AIC		SIC	HQC
13.46874		-0.304846 -0.073195 -0.216958	

The TGARCH model estimates fall between the other two specifications, with a DlnER coefficient of 0.744417 significant at the 5 percent level (p = 0.0145). This suggests that a 1 percent currency depreciation increases tourism receipts by approximately 0.74 percent.

The asymmetry term RESID(-1)²*(RESID(-1)<0) is positive (0.964173) and highly significant (p = 0.0002), confirming that negative shocks have substantially larger impacts on volatility than positive shocks. The negative coefficient on RESID(-1)² (-0.195279) combined with the large positive asymmetry term, indicates that the model captures complex volatility dynamics. The GARCH persistence parameter is extremely high (1.052563), again suggesting near-integrated volatility behavior.

A comparative analysis across the three GARCH specifications reveals substantial variations in both the magnitude and characterization of the exchange rate-tourism receipts relationship. The estimated elasticity of tourism receipts concerning exchange rates exhibits considerable heterogeneity across models, ranging from 0.629 in the EGARCH specification to 1.308 in the standard GARCH model, with the TGARCH model yielding an intermediate estimate of 0.744. Despite these differences in magnitude, all three models demonstrate statistically significant exchange rate effects, with the standard GARCH achieving significance at the 1 percent level while both EGARCH and TGARCH models show significance at the 5 percent level.

Model selection criteria consistently indicate the superiority of the EGARCH specification in capturing the underlying data dynamics. The EGARCH model attains the highest log-likelihood value (13.96582) among all specifications, while simultaneously achieving the lowest values across all information criteria, with an AIC of -0.325135, SIC of -0.093484, and HQC of -0.237247. This unanimous preference across multiple criteria strongly suggests that the EGARCH model provides the most appropriate characterization of the exchange rate-tourism receipts relationship in our data.

Particularly noteworthy is the evidence of asymmetric volatility effects captured by both the EGARCH and TGARCH models, albeit through different parameterizations. The EGARCH model's leverage parameter exhibits a negative and significant value (-0.564), indicating that negative shocks to tourism receipts amplify volatility by approximately 56 percent more than positive shocks of equivalent magnitude. Similarly, the TGARCH model's asymmetry term reveals a large positive coefficient (0.964) that is highly significant, confirming that negative shocks generate substantially greater volatility than positive shocks. This convergent evidence from alternative model specifications reinforces the robustness of the asymmetric volatility finding.

Furthermore, all three models exhibit remarkably high volatility persistence, with parameters approaching or exceeding unity. This pattern suggests that shocks to tourism receipts have extremely long-lasting effects on volatility, indicating near-integrated behavior in the conditional variance process. The persistence is particularly pronounced in the EGARCH and TGARCH

specifications, where the relevant parameters are 1.009612 and 1.052563, respectively, implying that volatility shocks decay very slowly over time. This finding has important implications for risk management and forecasting in the tourism sector, as it suggests that periods of high volatility, once initiated, tend to persist for extended periods.

The empirical findings provide robust evidence supporting the theoretical relationship between exchange rate movements and tourism receipts, as established in the tourism economics literature (Crouch, 1994; Balaguer & Cantavella-Jordá, 2002; Song & Li, 2008). The positive and statistically significant coefficients on DLNER across all three GARCH specifications confirm that currency depreciation enhances tourism receipts, consistent with the price competitiveness mechanism outlined by Dwyer et al. (2002) and Forsyth & Dwyer (2009).

The magnitude of the exchange rate elasticity varies across model specifications, ranging from 0.629 to 1.308. This variation aligns with the heterogeneity documented in previous empirical studies (De Vita, 2014; Dogru et al., 2017). Our EGARCH model estimate of 0.629 closely approximates the meta-analysis findings of Crouch (1994), who reported an average elasticity of -0.6, while the standard GARCH estimate of 1.308 suggests elastic demand, similar to results found by Patsouratis et al. (2005) for Greece.

The significance of ARCH and GARCH terms across all specifications confirms the presence of volatility clustering in tourism receipts, extending the findings of Chang et al. (2009) and Coshall (2009), who documented similar patterns in tourism demand forecasting. The high persistence parameters (approaching or exceeding unity) indicate that volatility shocks have prolonged effects on tourism receipts, supporting the uncertainty channel proposed by Agiomirgianakis et al. (2014).

Perhaps most notably, the analysis reveals strong evidence of asymmetric volatility effects in both the EGARCH and TGARCH models. The negative leverage parameter in the EGARCH specification (-0.564) and the positive asymmetry term in the TGARCH model (0.964) both indicate that negative shocks generate substantially more volatility than positive shocks. This finding extends the work of Thompson and Thompson (2010) and Vita & Kyaw (2013), who suggested differential responses to exchange rate movements but did not formally test for volatility asymmetry.

The asymmetric response patterns have important theoretical implications. They support the notion that tourism markets exhibit loss aversion behavior, responding more dramatically to adverse exchange rate movements than to favorable ones. This aligns with behavioral economics perspectives and the "bad news principle" identified in financial markets (Black, 1976; Christie, 1982).

The superior performance of the EGARCH model, as indicated by all information criteria, suggests that capturing asymmetric effects through the logarithmic variance specification provides the best characterization of the exchange rate-tourism receipts relationship. This finding contributes to the methodological literature on tourism economics by demonstrating the importance of considering alternative GARCH specifications beyond the standard model (Engle, 1982; Bollerslev, 1986).

The violation of stationarity conditions in some specifications (particularly the standard GARCH model) indicates near-integrated behavior in volatility, suggesting that shocks have extremely persistent effects. This finding resonates with the long-memory properties documented in tourism time series by Gil-Alana (2005) and highlights the need for careful model specification in tourism volatility analysis.

The economic significance of our findings extends beyond statistical relationships. The estimated elasticities imply that exchange rate movements have substantial impacts on tourism revenues. For instance, using the EGARCH estimate, a 10 percent currency depreciation would increase tourism receipts by approximately 6.3 percent, while the standard GARCH estimate suggests an even larger 13.1 percent increase. These magnitudes underscore the importance of exchange rate considerations in tourism planning and policy formulation, as emphasized by Sinclair (1998) and Blake et al. (2006).

The asymmetric volatility effects documented in our study have particular relevance for risk management in the tourism sector. The finding that negative shocks generate disproportionately larger volatility implies that tourism stakeholders should implement asymmetric hedging strategies, with greater protection against adverse exchange rate movements. This insight extends the risk management frameworks proposed by Eugenio-Martin & Morales (2004) and Ridderstaat et al. (2014).

Conclusion

This study provides comprehensive empirical evidence on the relationship between exchange rate volatility and tourism receipts using three GARCH model specifications. Our analysis of annual data from 1976 to 2024 yields several significant findings that contribute to both the theoretical understanding and practical management of tourism economics.

First, this study establishes a robust positive relationship between exchange rate changes and tourism receipts across all model specifications. The elasticity estimates range from 0.629 to 1.308, confirming that currency depreciation significantly enhances tourism receipts. This finding supports the price competitiveness channel identified in the tourism economics literature and validates the theoretical frameworks proposed by Dwyer et al. (2002) and subsequent researchers.

Second, the analysis reveals strong evidence of volatility clustering and persistence in tourism receipts, with volatility shocks having long-lasting effects. The high persistence parameters across all models suggest that exchange rate volatility creates sustained uncertainty in tourism markets, supporting the theoretical predictions of Webber (2001) and Agiomirgianakis et al. (2014).

Third, and perhaps most significantly, the document pronounced asymmetric volatility effects in both the EGARCH and TGARCH specifications. Negative shocks to tourism receipts generate substantially more volatility than positive shocks of equal magnitude, indicating that tourism markets exhibit asymmetric responses to exchange rate movements. This finding represents a novel contribution to the literature and has important implications for risk management in the tourism sector.

Fourth, the model comparison analysis demonstrates that the EGARCH specification provides the best characterization of the exchange rate-tourism receipts relationship, as evidenced by superior information criteria across all measures. This methodological finding suggests that future research should consider asymmetric GARCH models when analyzing tourism volatility dynamics.

The study has several limitations that warrant acknowledgment. The annual frequency of data may mask shorter-term dynamics in the exchange rate-tourism relationship. Additionally, the bivariate framework, while focused on the direct exchange rate effect, does not control for other potential determinants of tourism demand such as income levels, relative prices beyond exchange rates, or destination-specific factors.

Future research could address these limitations by employing higher-frequency data to capture intra-year volatility dynamics, incorporating additional control variables to develop more comprehensive models, and examining potential structural breaks or regime shifts in the relationship over time. Cross-country comparative analyses could also provide insights into how the exchange rate-tourism nexus varies across different destination characteristics.

The empirical findings of this study yield several critical policy implications for tourism-dependent economies and industry stakeholders. Given the significant elasticity of tourism receipts to exchange rate movements (ranging from 0.629 to 1.308), policymakers must recognize that monetary policy decisions have substantial ramifications for tourism revenues, necessitating careful consideration of tourism sector impacts in macroeconomic policy formulation. The documented asymmetric volatility effects, wherein negative shocks generate disproportionately larger volatility increases, underscore the need for sophisticated risk management strategies employing asymmetric hedging instruments such as currency options rather than symmetric tools like forward contracts. Tourism destinations should pursue aggressive market diversification strategies to reduce vulnerability to single-currency exposure, while destination marketing organizations should adopt dynamic marketing approaches that intensify promotional efforts in markets experiencing favorable exchange rate movements. The high volatility persistence observed across all models emphasizes the importance of robust crisis management frameworks and contingency planning, as exchange rate shocks tend to have prolonged effects on tourism receipts. Furthermore, central banks should consider tourism sector implications in their communication strategies, as clear forward guidance can reduce exchange rate uncertainty and facilitate more effective planning in the tourism industry. While pursuing these exchange rate-focused strategies, policymakers must simultaneously invest in fundamental competitiveness factors such as infrastructure development and service quality improvements, which can provide buffer effects against adverse currency movements and contribute to sustainable tourism development. The integration of these insights into policy frameworks will better position tourism-dependent economies to navigate the complex dynamics of international currency markets while maximizing the benefits of favorable exchange rate conditions.

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