



Economic, technological, and institutional factors affecting international tourism in MENA countries

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Abstract

This study aims to identify and analyze the key determinants of international tourism in the MENA region, offering empirical insights into how economic, sectoral, and digital factors affect tourism demand. The research utilizes panel data from MENA countries spanning 1990 to 2023 and applies a fixed-effects regression model with Driscoll-Kraay standard errors to address issues of cross-sectional dependence and heteroskedasticity. The independent variables include foreign direct investment (FDI), exchange rates, inflation, internet penetration, agricultural and manufacturing value added, and regulatory quality. The empirical results indicate that FDI, exchange rates, and internet penetration have a statistically significant and positive impact on international tourism arrivals. Conversely, agricultural sector dependence negatively influences tourism inflows. No significant effects were found for inflation, manufacturing, or regulatory quality. Economic openness through FDI, a favorable exchange rate, and greater internet accessibility are crucial to enhancing international tourism in MENA countries. However, a heavy reliance on agriculture may hinder tourism development. The study provides actionable insights for policymakers aiming to strengthen the tourism sector and promote broader economic diversification. Enhancing digital infrastructure, attracting FDI, and shifting away from agricultural dependence can help boost tourism competitiveness in the region. This study enriches the literature by focusing on the underexplored MENA context and integrating economic, digital, and structural determinants of tourism demand.

Keywords: Agriculture, Foreign direct investment, Inflation, Exchange rates, International tourism, Internet penetration, Manufacturing, MENA region, Regulatory quality.

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1. Introduction

International tourism is a key driver of economic growth, job creation, and cultural exchange, particularly in the Middle East and North Africa (MENA) region, which is characterized by its rich cultural heritage, diverse landscapes, and historical significance. As tourism plays a pivotal role in diversifying the economy and boosting foreign exchange earnings, understanding the factors that influence tourism demand is essential for policymakers and stakeholders in the tourism sector [1].

The MENA region, with its unique geopolitical and economic characteristics, presents a complex environment for tourism development. The varying levels of economic diversification, the importance of oil and gas exports, and the political and social landscape can have profound effects on tourism trends [2]. As such, understanding the determinants of international tourism in this region requires a comprehensive approach that considers multiple economic, digital, and structural factors. While previous studies have examined tourism demand in individual MENA countries, there is a gap in research that specifically addresses the broader regional factors that influence tourism flows across the MENA region.

This research aims to fill this gap by exploring the key drivers of international tourism in MENA countries. Using a fixed-effects regression model with Driscoll-Kraay standard errors, the study investigates the impact of various economic, digital, and sectoral variables on tourism arrivals. Specifically, the study examines the role of Foreign Direct Investment (FDI), exchange rates, inflation, manufacturing sector growth, internet penetration, agriculture, and regulatory quality as determinants of international tourism demand.

The primary objective of this research is to provide empirical evidence that can inform policymaking in the region, enhancing the effectiveness of strategies aimed at boosting tourism and economic diversification. The findings are expected to contribute to the growing body of literature on tourism economics, particularly in the context of emerging economies in the MENA region, and to offer practical recommendations for enhancing the competitiveness of the region's tourism industry.

The structure of this paper is organized as follows: Section 2 presents the literature Review that examines existing studies on the economic, digital, and sectoral factors affecting tourism. Section 3 presents the methodology that outlines the models used for analysis. Section 4 describes the data sources and variable measurements. The results section presents key findings, followed by the discussion, which interprets these results in the context of existing literature and provides insights into their implications for tourism policy and development in the region. We conclude the paper in the final section.

2. Literature Review

Tourism has long been recognized as a significant driver of economic growth, particularly in developing and emerging economies. The determinants of international tourism have been extensively explored in the literature, focusing on factors such as foreign direct investment, exchange rates, inflation, internet penetration, regulatory quality, and sectoral contributions like manufacturing and agriculture. This section reviews key empirical studies that provide insights into these determinants and their implications for tourism in MENA countries.

2.1. Foreign Direct Investment (FDI) and Tourism

Several studies have established a positive link between FDI and international tourism, arguing that increased investment in tourism-related infrastructure, such as hotels, airports, and entertainment facilities, boosts tourist arrivalsEl Menyari [3] and Sokhanvar and Jenkins [4].

Kumar and Hussain [5] examined India's tourism industry and found that FDI significantly contributed to the sector's expansion by improving service quality and increasing global visibility. Similarly, Seetanah [6] concluded that FDI plays a crucial role in developing island economies by enhancing tourism infrastructure, which in turn drives economic growth. In the context of MENA countries, FDI is often directed toward luxury tourism projects, especially in Gulf nations, where large-scale developments such as Dubai's hospitality sector attract millions of tourists annually.

Additionally, Zarrad and Gafsi [7] explored the intersection of green finance and economic growth, highlighting how sustainable investments—often backed by foreign direct investment—can enhance infrastructure and tourism appeal in emerging markets.

2.2. Exchange Rates and Tourism

Exchange rate fluctuations significantly impact international tourism demand, as they affect the relative cost of travel Bozkurt, et al. [8] and Shi, et al. [9]. Dogru, et al. [10] found that a depreciation in the local currency makes a destination more attractive by reducing travel costs for foreign visitors. Conversely, a strong currency can deter tourists by making accommodation and services more expensive. Santana-Gallego, et al. [11] highlighted that exchange rate regimes play a crucial role in stabilizing tourism demand, particularly in emerging economies. The MENA region, with its mix of pegged and floating exchange rate systems, experiences varying effects on tourism based on currency movements.

2.3. Inflation and Tourism

The impact of inflation on tourism is mixed in the literature [12, 13]. Some studies suggest that higher inflation increases operational costs in the tourism industry, leading to higher prices for accommodation, food, and services, which may deter tourists [14]. However, other research indicates that moderate inflation does not significantly impact tourism demand, as tourists often adjust their budgets rather than cancel trips altogether [15].

2.4. Internet Penetration and Digitalization in Tourism

The digitalization of tourism has been extensively studied, with researchers emphasizing the role of internet penetration, online reviews, and digital marketing in influencing tourist decisions Afren [16] and Sharafuddin, et al. [17]. Law, et al. [18] found that internet-based tourism platforms significantly affect destination competitiveness, as tourists increasingly rely on online information for travel planning. Similarly, Javed, et al. [19] demonstrated that social media and online reviews influence trust and travel intentions, particularly among younger travelers. The MENA region has experienced rapid digital transformation, with governments investing in smart tourism initiatives.

Hlali and Gfasi [20] emphasized that digitalization also plays a broader role in promoting sustainable development across Africa, which includes sectors like tourism that benefit from enhanced digital infrastructure.

2.5. Agriculture, Economic Diversification, and Tourism

The relationship between agriculture and tourism is often viewed through the lens of economic diversification [21, 22]. Studies suggest that economies heavily reliant on agriculture tend to have lower tourism development, as resources are concentrated in primary industries rather than service-based sectors [23]. However, agritourism presents an opportunity for rural communities to benefit from tourism, integrating farming with cultural and nature-based tourism Matarrita-Cascante, et al. [24].

Gafsi and Bakari [25] found that increased agricultural raw material imports positively influence agricultural growth in Sub-Saharan African countries, suggesting a broader role for agriculture in economic diversification strategies. Similarly, Gafsi and Bakari [26] highlighted the environmental effects of agriculture in East Asia and Pacific countries, linking agricultural CO₂ emissions and trade to long-term economic growth patterns that indirectly influence tourism strategies.

2.6. Regulatory Quality and Tourism Governance

Governance and regulatory quality play a crucial role in shaping the tourism sector [27, 28]. Studies have emphasized that strong institutional frameworks, transparent regulations, and efficient visa policies enhance a country's attractiveness to international visitors [29]. However, Eilat and Einav [14] found that while governance is important, its direct impact on tourism is often overshadowed by macroeconomic factors such as income levels and exchange rates. The insignificant effect of regulatory quality, suggest that while governance improvements may benefit tourism indirectly, other economic variables play a more dominant role.

Ellouze and Gafsi [30] support this notion by showing how AI-based analysis of regulatory shocks—such as changes in financial benchmarks like LIBOR—reveals broader sectoral impacts, including those affecting banking and tourism sectors.

2.7. Sustainability, Environment, and Broader Economic Contexts

Several studies have explored the economic and environmental determinants of growth and sustainability, especially in Gulf Cooperation Council (GCC) countries. For instance, Abid, et al. [31] analyzed the impact of political instability on monetary policy conduct and economic recovery, concluding that instability weakens institutional responses and delays economic rebound.

In terms of environmental pressures, Abid, et al. [32] evaluated the impact of energy intensity and CO₂ emissions on economic growth, providing evidence that excessive carbon emissions adversely affect growth trajectories in GCC countries. Similarly, Abid [33] highlighted the role of economic and environmental factors in advancing green growth in Saudi Arabia, identifying clean energy expansion and regulatory reforms as significant contributors.

Gafsi [34] reinforced this perspective by analyzing renewable energy and CO₂ emissions in G7 countries, demonstrating their role in promoting green growth and economic prosperity—important considerations for tourism sustainability. Moreover, Chaabouni and Abid [35] examined the key drivers of energy consumption in the GCC region, revealing that income, industrialization, and urbanization are major demand-side factors influencing energy use. In a complementary vein, Gafsi [34] explored how customer and market orientation enhances performance in Islamic insurance—highlighting parallels with the tourism sector where customer-centric policies similarly drive performance.

The literature consistently highlights the importance of FDI, exchange rates, and digitalization as key drivers of international tourism. While inflation and regulatory quality show mixed or insignificant effects, agriculture appears to have a negative relationship with tourism, supporting the notion that economies must diversify to maximize tourism potential. Recent literature further supports the integration of green finance, digitalization, and AI-based governance analysis as emerging themes in understanding how tourism aligns with broader economic and environmental dynamics.

3. Methodology

Our methodology follows a structured approach to panel data analysis, ensuring robust results by accounting for unit roots, model selection, and diagnostic tests.

• Panel Unit Root Tests

Panel data often exhibit non-stationarity, which can lead to spurious regression results. To test for stationarity, we employ the Cross-Sectional Augmented Dickey-Fuller (CADF) Test proposed by Pesaran [36]. The CADF test extends the conventional Augmented Dickey-Fuller (ADF) test to account for cross-sectional dependence in panel data.

Model Estimation Approaches

To estimate panel data models, we consider the Fixed Effects (FE) model, Random Effects (RE) model, and Pooled Ordinary Least Squares (OLS) model.

3.1. Fixed Effects Model (Within Estimator)

The FE model controls for time-invariant individual-specific effects, assuming that these effects correlate with explanatory variables. The general form is:

 $Y_{it} = \alpha_0 + \beta X_{it} + \mu_{it}$

(1)where α_i represents unobserved individual effects, X_{it} is the vector of explanatory variables, and u_{it} is the error term [37]. The FE model is estimated using the within transformation, which removes α_i by subtracting individual means.

3.2. Random Effects Model (GLS Estimator)

The RE model assumes that individual-specific effects αi_{α} are randomly distributed and uncorrelated with X_{it} . The model is specified as:

$$Y_{it} = \alpha + \beta X_{it} + v_i + \mu_{it}$$

(2)

where v_i represents the individual-specific random effect [38]. The model is estimated using Generalized Least Squares (GLS) to account for heteroskedasticity.

Pooled OLS Model

 $Y_{it} = \alpha + \beta X_{it} + \mu_{it}$

The pooled OLS model assumes no individual-specific effects:

If individual heterogeneity exists, OLS estimates may be biased and inconsistent.

Model Choice Criteria

To determine the best-fitting model, we apply the Breusch-Pagan Lagrange Multiplier (LM) Test and the Hausman Test. Breusch-Pagan LM Test: RE Model vs. Pooled OLS Model

The LM test checks whether the RE model is appropriate by testing the null hypothesis:

H₀: $\sigma_v^2 = 0$ (Pooled OLS is preferred)

H_a: $\sigma_v^2 > 0$ (RE model is preferred)

If the null hypothesis is rejected, the RE model is favored [39].

3.3. Hausman Test: FE Model vs. RE Model

The Hausman test assesses whether the individual effects are correlated with the explanatory variables. The test statistic H follows a chi-square (χ^2) distribution.

H₀: RE model is preferred

If the null hypothesis is rejected, the FE model should be used [40].

Diagnostic Tests

After selecting the model, diagnostic tests are performed to address issues like autocorrelation and heteroskedasticity.

3.4. Wooldridge Test for Autocorrelation

Panel data often suffer from first-order autocorrelation, leading to biased standard errors. The Wooldridge test Wooldridge [37] is based on the null hypothesis:

H₀: no autocorrelation

If the null hypothesis is rejected, then the autocorrelation is present.

3.5. Modified Wald Test for Groupwise Heteroskedasticity

To test for heteroskedasticity in the FE model, the Modified Wald Test is used. The null hypothesis is:

H₀: $\sigma_i^2 = \sigma^2 \forall i$

If the null hypothesis rejected, robust standard errors should be applied [41].

Robust Estimation: Driscoll-Kraay Standard Errors

If heteroskedasticity, or autocorrelation is present, we must apply Driscoll-Kraay standard errors (Driscoll & Kraay, 1998). This method provides heteroskedasticity-robust and autocorrelation-robust standard errors.

3.6. Data

This study investigates the factors influencing international tourism arrivals in MENA countries from 1990 to 2023, with a particular focus on economic, technological, and institutional determinants. The data, sourced from the World Bank and the description of the variables are presented in Table 1.

Variable	Description	Expected Impact on tourist arrivals	Reasoning
TOU	International tourism, number of arrivals (logarithmic form)	-	-
FDI	Foreign direct investment, net inflows (current US\$)	Positive	Increases investment in tourism infrastructure.
INF	Inflation, consumer prices (annual %)	Negative	Higher inflation raises travel costs, reducing demand.
AGR	Agriculture, forestry, and fishing, value added (% of GDP) (logarithmic form)	Negative	A high agricultural share indicates less tourism-oriented economic structure.
INTE	Individuals using the Internet (% of population)	Positive	Improves accessibility to travel information and digital services.
REGL	Regulatory Quality: Percentile Rank	Positive	Better governance enhances security and ease of doing business in tourism.
EXC	Official exchange rate (LCU per US\$, period average) (logarithmic form)	Mixed	Currency depreciation may attract tourists, but volatility can deter them.
MAN	Manufacturing, value added (% of GDP) (logarithmic form)	Uncertain	Industrialization may support or hinder tourism, depending on its impact on the environment and infrastructure.

Table 1.Variables description.

The dependent variable, TOU, represents the total number of international tourist arrivals, serving as a key indicator of tourism activity. Among the independent variables, foreign direct investment inflows (FDI), measured as current US, is expected to have a positive effect on tourism by enhancing infrastructure, hospitality, and services. Inflation (INF), representing the annual percentage change in consumer prices, is anticipated to have a negative impact, as higher costs reduce the affordability of travel. Similarly, agriculture, forestry, and fishing (AGR) as a share of GDP may also negatively influence tourism, as a high agricultural dependency often indicates a less diversified economy with weaker tourism infrastructure. On the other hand, internet penetration (INT), measured as the percentage of individuals using the internet, is expected to have a positive impact, as greater connectivity facilitates online bookings, marketing, and tourist information access. Regulatory quality (REGL), which reflects the effectiveness of governance and policy implementation, is also likely to enhance tourism by improving business conditions, safety, and investor confidence. The official exchange rate (EXC), expressed as local currency units per US dollar, has a mixed expected impact; currency depreciation may make a country more affordable for tourists, but excessive volatility could deter visitors. Lastly, manufacturing (MAN) as a share of GDP has an uncertain effect, as industrialization may contribute to economic development and infrastructure growth, but excessive industrial expansion could negatively impact the attractiveness of tourism destinations.

By analyzing these factors using panel data econometric techniques, this study aims to provide insights into the key drivers of tourism in the MENA region.

The summary of the descriptive statistics is presented in Table 2, which provides an overview of the key variables analyzed in the study.

Descriptive statistics.								
Variable	Obs.	Mean	Std. Dev.	Min.	Max.			
TOU	454	14.5192	1.5049	9.6158	17.0456			
FDI	673	2.39E+09	6.65E+09	-1.02E+10	8.56E+10			
EXC	678	2.3300	3.0354	-1.3137	10.6454			
INF	633	9.0948	29.8390	-16.1173	448.5000			
MAN	540	2.3179	0.6320	-0.4274	3.8062			
INTE	698	29.2919	33.1920	0.0000	100			
AGR	617	1.3147	1.3389	-2.3624	3.7626			
REGL	588	32.4247	24.6524	0.0000	81.3397			

Table 2.

The descriptive statistics indicate considerable variation across MENA countries in the variables under study. Tourism arrivals display moderate levels overall, but there are countries with significantly higher or lower numbers. FDI inflows show high variability, with some countries attracting substantial foreign investment while others experience net outflows. Similarly, exchange rates fluctuate widely, reflecting currency volatility across the region. Inflation varies drastically, with certain countries experiencing extreme inflationary pressures, while others have stable or even deflationary conditions. The manufacturing sector also shows variability, with some countries having a larger industrial presence than others. Internet

usage reveals significant disparities in digital infrastructure, with some countries having widespread access while others lag behind. The agriculture sector shows moderate variation, with some countries heavily reliant on agriculture and others having minimal agricultural contributions to their economy. Lastly, regulatory quality varies, with some countries exhibiting strong governance and regulatory frameworks, while others face challenges in these areas. Overall, the data highlights the diverse economic, technological, and institutional landscapes across MENA countries, which are likely to influence the determinants of international tourism in the region.

To ensure the validity of the regression analysis, panel unit root tests were conducted to determine whether the variables are stationary or contain a unit root (Table 3). The presence of a unit root implies that the variable is non-stationary, which can lead to spurious regression results.

Table 3.

Variable	Z[t-bar]	P-value	Variable	Z[t-bar]	P-value
TOU	1.2120	0.8870	D(TOU)	-2.9720	0.0010
FDI	-4.7410	0.0000	D(FDI)	-14.8930	0.0000
EXC	0.7240	0.7660	D(EXC)	-4.2530	0.0000
INF	-3.4980	0.0000	D(INF)	-13.7410	0.0000
MAN	-0.0530	0.4790	D(MAN)	-7.2490	0.0000
AGR	1.9160	0.9720	D(AGR)	-8.7100	0.0000
INTE	-0.2640	0.3960	D(INTE)	-6.0720	0.0000
REGL	0.4460	0.6720	D(REGL)	-3.3700	0.0000

Panel Unit Root Tests: Cross-Sectional Augmented Dickey-Fuller (CADF) Test results

The results indicate that at level, some variables (TOU, EXC, MAN, AGR, INTE, and REGL) are non-stationary, as their p-values exceed 0.05. However, after first differencing, all variables become stationary, with p-values below 0.05. This confirms that the variables are integrated of order one, I(1), and suitable for further econometric analysis, such as cointegration tests and panel regression modeling.

4. Results

The study employs fixed, random, and pooled regression models to estimate the determinants of international tourism arrivals (TOU) in MENA countries.

4.1. Model Estimation Results

Table 4 presents the results of the Fixed Effects (Within) regression analysis, which estimates the impact of various economic, technological, and institutional factors on international tourism arrivals (TOU) within MENA countries over the study period. This model accounts for country-specific unobserved heterogeneity by focusing on the variation within each country over time. The results reflect the effects of independent variables on tourism arrivals, while controlling for time-invariant characteristics of each country. These findings contribute to understanding the key drivers of tourism in the region and the extent to which different factors influence tourism growth or decline.

Variable		Coefficient	Std. Error	t-statistic	p-value	Effect on tourism arrivals
Foreign	Direct	0.62×10^{-12}	4 70 - 10 12	2.0500	0.0420	Desitive (Significant at 50()
Investment		9.02×10	4.70×10-	2.0300	0.0420	Positive (Significant at 5%)
Exchange Rate		0.3759	0.0698	5.3900	0.0000	Positive (Significant at 1%)
Inflation		-0.0033	0.0052	-0.6400	0.5250	Not significant
Manufacturing		0.4013	0.1948	2.0600	0.0400	Positive (Significant at 5%)
Internet Use		0.0263	0.0067	3.9400	0.0000	Positive (Significant at 1%)
Agriculture		-0.3273	0.1051	-3.1200	0.0020	Negative (Significant at 1%)
Regulatory Quality	7	0.0098	0.0041	2.3700	0.0180	Positive (Significant at 5%)
Constant		14.2208	0.2715	52.3700	0.0000	Baseline level of tourism arrivals

Table 4.

Fixed Effects (Within) Regression Results

The results from the Fixed Effects (FE) regression model provide valuable insights into the determinants of international tourism arrivals (TOU) in MENA countries. The model explains 25.92% of within-country variations in tourism over time, while country-specific factors account for 92.73% of the total variance, reinforcing the importance of using fixed effects. The F-test (F = 14.85, p = 0.0000) confirms that the independent variables collectively influence tourism arrivals.

Among the key findings, foreign direct investment has a significant positive impact on tourism (p = 0.042), suggesting that increased FDI inflows contribute to better infrastructure and tourism facilities. Similarly, exchange rate movements positively affect tourism arrivals (p = 0.000), indicating that currency depreciation makes MENA destinations more affordable for foreign tourists. Internet penetration also has a strong positive effect (p = 0.000), highlighting the role of digital connectivity in facilitating travel planning and bookings. Additionally, regulatory quality positively influences tourism (p = 0.018), implying that better governance and business regulations enhance investor and tourist confidence. Conversely, the share of agriculture in GDP has a significant negative impact on tourism (p = 0.002), suggesting that economies heavily

reliant on agriculture may have less developed tourism infrastructure. Manufacturing growth positively affects tourism arrivals (p = 0.040), likely due to improvements in infrastructure and urban development that indirectly benefit tourism. However, inflation does not have a significant impact on tourism arrivals (p = 0.525), indicating that short-term price fluctuations may not strongly influence travel decisions.

Overall, the findings suggest that investment, exchange rate stability, digital connectivity, and governance improvements are crucial drivers of tourism growth in MENA countries. Meanwhile, economic diversification away from agriculture can further enhance tourism potential. The strong country-specific effects justify the use of the Fixed Effects model, confirming that unobserved heterogeneity plays a significant role in shaping tourism trends across the region.

Table 5 presents the results of the Random effects Generalized Least Squares (GLS) regression, which estimates the relationship between various economic, technological, and institutional factors and international tourism arrivals (TOU) across MENA countries. Unlike the fixed effects model, the random-effects model assumes that the country-specific effects are uncorrelated with the explanatory variables, allowing for both within-country and between-country variation to be incorporated. This model helps assess how the independent factors influence tourism across countries while accounting for both within-country time variation and differences between countries in the sample. The random-effects regression results provide a broader view of the factors influencing tourism in the MENA region, taking into consideration both individual country trends and the overall regional dynamics.

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Table 5

andom-effects GLS regression Results.							
Variable	Coefficient	Std. Error	z-statistic	p- value	Effect on tourism arrivals		
Foreign Direct Investment	1.09×10^{-11}	4.70×10^{-12}	2.3200	0.0210	Positive (Significant at 5%)		
Exchange Rate	0.2566	0.0573	4.4800	0.0000	Positive (Significant at 1%)		
Inflation	-0.0023	0.0053	-0.4400	0.6580	Not significant		
Manufacturing	0.3957	0.1971	2.0100	0.0450	Positive (Significant at 5%)		
Internet Use	0.0285	0.0067	4.2400	0.0000	Positive (Significant at 1%)		
Agriculture	-0.2976	0.0973	-3.0600	0.0020	Negative (Significant at 1%)		
Regulatory Quality	0.0111	0.0041	2.7200	0.0070	Positive (Significant at 5%)		
Constant	14.1072	0.3740	37.7200	0.0000	Baseline level of tourism arrivals		

The results from the Random Effects Generalized Least Squares (GLS) regression reveal several significant factors influencing international tourism arrivals in MENA countries. The model explains 25.19% of the within-country variation, indicating that factors changing over time within each country contribute significantly to tourism arrivals.

The exchange rate has a strong positive effect on tourism (p = 0.000), suggesting that depreciation of the local currency makes MENA destinations more affordable for foreign visitors. Similarly, foreign direct investment has a positive and significant impact (p = 0.021), indicating that increased foreign investment enhances tourism infrastructure and overall attractiveness. Internet use also plays a crucial role, with a highly significant positive effect (p = 0.000), highlighting the growing importance of digital connectivity in attracting tourists. On the other hand, inflation does not appear to significantly affect tourism (p = 0.658), suggesting that price fluctuations may not directly influence tourism demand in the region. Additionally, manufacturing growth positively affects tourism (p = 0.045), likely due to improvements in infrastructure and services that benefit the tourism sector. However, agriculture's share of GDP has a negative effect (p = 0.002), implying that economies with a heavy reliance on agriculture may lack the necessary infrastructure for tourism development. Lastly, regulatory quality positively influences tourism (p = 0.007), suggesting that better governance and regulatory frameworks enhance the business environment and tourist confidence.

The model's random effects highlight the importance of unobserved country-specific factors, as evidenced by the high value of rho (0.8741), indicating that a significant portion of the variance in tourism arrivals is due to these unobserved effects. Overall, the findings underscore the importance of economic diversification, infrastructure development, digital connectivity, and regulatory improvements in boosting tourism in MENA countries.

Table 6 presents the results of the Pooled Regression model, which estimates the relationship between economic, technological, and institutional factors and international tourism arrivals in MENA countries. Unlike the fixed and random effects models, the pooled regression assumes that there are no country-specific effects, treating the data as a single crosssectional time series without accounting for individual country differences. While this approach offers a simplified analysis, it does not control for country-specific differences, making it useful primarily as a comparative benchmark for the fixed and random effects models.

Variable	Coefficient	Std. Error	z-statistic	p-value	Effect on tourism arrivals
Foreign Direct Investment	1.05×10 ⁻¹¹	7.97×10 ⁻¹²	1.3200	0.1870	Not significant
Exchange Rate	-0.0843	0.0243	-3.4800	0.0010	Negative (Significant at 1%)
Inflation	0.0061	0.0090	0.6800	0.4980	Not significant
Manufacturing	0.6094	0.3878	1.5700	0.1170	Not significant
Internet Use	0.0457	0.0131	3.4800	0.0010	Positive (Significant at 1%)
Agriculture	0.2290	0.0505	4.5400	0.0000	Positive (Significant at 1%)
Regulatory Quality	0.0054	0.0036	1.5000	0.1340	Not significant
Constant	14.5421	0.2006	72.5000	0.0000	Baseline level of tourism arrivals

Table 6.Pooled regression Results.

The results from the OLS pooled regression reveal several key insights into the factors influencing international tourism arrivals in MENA countries. The model explains 13.77% of the variation in tourism arrivals, with the overall regression being statistically significant, as indicated by the F-statistic (F = 7.14, p = 0.0000).

Among the independent variables, exchange rate is found to have a significant negative impact on tourism (p = 0.001), suggesting that a stronger local currency, or an appreciation in exchange rates, can reduce the affordability of MENA destinations for foreign tourists. Internet penetration, however, shows a significant positive effect (p = 0.001), highlighting the importance of digital connectivity in facilitating tourism. A positive relationship is also found between agriculture's share of GDP and tourism arrivals (p = 0.000), implying that countries with a higher share of agriculture may benefit from rural or agriculture-driven tourism. On the other hand, foreign direct investment, inflation, manufacturing growth, and regulatory quality do not appear to have a significant effect on tourism in the MENA region. In particular, FDI and inflation are not statistically significant, suggesting that foreign investments or price changes may not have a direct influence on tourism.

Overall, the findings indicate that internet connectivity and agriculture play a more prominent role in driving tourism to MENA countries, while factors like exchange rate and FDI seem less impactful.

4.2. Model Choice Results

Table 7

The choice between these models is crucial for ensuring accurate and reliable estimations in assessing the determinants of international tourism arrivals in MENA countries (Table 7).

Model Choice results.	
Breusch-Pagan LM Test: Rando	om Effects (RE) model or Pooled OLS model
Null Hypothesis (H ₀)	No random effects ($Var(u) = 0$)
Alternative Hypothesis (H1)	Random effects are present (Var(u) $\neq 0$)
Chi squared	851.6200
p-value	0.000
Decision	Reject Ho
Conclusion	Random Effects Model is preferred
Hausman test: Fixed Effects (FE)	model or Pooled OLS model
Null Hypothesis (H ₀)	Difference in coefficients is not systematic (Pooled OLS is appropriate)
Alternative Hypothesis (H1)	Difference in coefficients is systematic (Fixed Effects is appropriate)
Chi squared	105.8300
p-value	0.000
Decision	Reject Ho
Conclusion	Fixed Effects Model is preferred
Hausman test: Fixed Effects (FE)	model or Random Effects (RE) model
Null Hypothesis (H ₀)	Difference in coefficients is not systematic (RE is appropriate)
Alternative Hypothesis (H1)	Difference in coefficients is systematic (FE is appropriate)
Chi squared	17.0700
p-value	0.009
Decision	Reject Ho
Conclusion	Fixed Effects Model is preferred

The Breusch and Pagan Lagrangian Multiplier (LM) test for random effects tests the null hypothesis that there are no random effects. The p-value is significantly less than 0.05, which leads to the rejection of the null hypothesis. This suggests that the random effects model is appropriate for the data, as there is evidence of individual-specific effects. Therefore, we conclude that a random effects model is more suitable than a pooled OLS model, which assumes no variation across individuals.

The Hausman test is applied to compare the Fixed Effects (FE) model and the Pooled OLS model. A significant result would indicate that the FE model is more suitable, as it accounts for unobserved heterogeneity across countries. If the test fails to reject the null hypothesis, the Pooled OLS model may be considered a viable alternative. The Hausman test comparing

the Fixed Effects (FE) model and the Pooled OLS model yields a test statistic of 105.83 with a p-value of 0.0000. Since the p-value is highly significant (p < 0.01), we reject the null hypothesis, which assumes that there is no systematic difference between the estimators. This result indicates that unobserved country-specific effects are correlated with the independent variables, making the Fixed Effects model the preferred choice over Pooled OLS. Ignoring these effects, as in the Pooled OLS model, would lead to biased and inconsistent estimates.

Similarity, the Hausman test is also used to determine whether a Fixed Effects (FE) model or a Random Effects (RE) model is more appropriate for the analysis. This test evaluates whether the country-specific effects are correlated with the explanatory variables. A significant test result suggests that the fixed effects model is preferred, as the random effects assumption would be violated. Since the p-value (0.0090) is statistically significant (p < 0.05), we reject the null hypothesis. This means that the fixed effects model is preferred over the random effects model for this study. The implication is that unobserved country-specific factors are correlated with the explanatory variables, making the fixed effects model the more reliable choice.

Therefore, for this study, the Fixed Effects model should be used, as it accounts for country-specific heterogeneity and provides more reliable results.

4.3. Diagnostic Test Results

To ensure the validity of the regression results, diagnostic tests were conducted to check for autocorrelation and heteroscedasticity in the panel data (Table 8).

Table 8.

Wooldridge test for autocorrelation.

Test	F -statistic	p-value
Test of autocorrelation	88.4900	0.0000
Test of heteroscedasticity	97.8700	0.0000

The Wooldridge test for autocorrelation was applied to detect serial correlation in the panel data. A significant test statistic indicates the presence of first-order autocorrelation, suggesting that the error terms are correlated over time within countries. Since the p-value is 0.0000, which is highly significant, we reject the null hypothesis This indicates that there is significant autocorrelation in the residuals, meaning that the error terms are correlated across time or observations.

The Modified Wald test for groupwise heteroskedasticity in the fixed-effects regression model tests whether the variance of the error terms differs across the groups. The null hypothesis assumes that the variances are equal across all groups for all groups. The test statistic is 97.87, and the p-value is 0.0000, which is highly significant. This result leads us to reject the null hypothesis, indicating that there is significant evidence of heteroskedasticity across the groups. In other words, the variance of the error terms varies between the groups, which suggests that adjustments (such as robust standard errors) may be necessary to account for this heteroskedasticity in the model.

4.4. Regression With Driscoll-Kraay Standard Errors

To correct for both heteroskedasticity and autocorrelation at the same time, we apply Driscoll-Kraay standard errors (which are more suitable for panel data with time series structure). This ensures that the fixed-effects model accounts for both autocorrelation and heteroskedasticity by adjusting the standard errors appropriately.

The regression output with Driscoll-Kraay standard errors applied. The results are presented in Table 9.

-gression with Dirscon-Krady standard chors.							
Variable	Coefficient	Std. Error	z- statistic	p-value	Effect on tourism arrivals		
Foreign Direct Investment	9.62×10 ⁻¹²	4.23×10 ⁻¹²	2.2700	0.0320	Positive (Significant at 5%)		
Exchange Rate	0.3759	0.0981	3.8300	0.0010	Positive (Significant at 1%)		
Inflation	-0.0033	0.0076	-0.4400	0.6670	Not significant		
Manufacturing	0.4013	0.2495	1.6100	0.1210	Not significant		
Internet Use	0.0263	0.0114	2.3100	0.0300	Positive (Significant at 5%)		
Agriculture	-0.3273	0.1489	-2.2000	0.0380	Negative (Significant at 5%)		
Regulatory Quality	0.0098	0.0065	1.5200	0.1420	Not significant		
Constant	14.2208	0.4177	34.0500	0.0000	Baseline level of tourism arrivals		

 Table 9.

 Regression with Driscoll-Kraay standard errors.

The results from the Fixed-effects regression with Driscoll-Kraay standard errors provide valuable insights into the determinants of international tourism in MENA countries. The analysis reveals that Foreign Direct Investment has a positive and statistically significant impact on tourism arrivals, with a coefficient of 9.62e-12 (p = 0.032), suggesting that increased foreign investment tends to promote tourism, albeit with a small effect size. Exchange rate also shows a significant positive relationship with tourism, with a coefficient of 0.3759 (p = 0.001), indicating that an appreciation in the local currency makes the destination more attractive to international tourists. However, inflation does not significantly affect tourism, as indicated by the non-significant p-value of 0.667, suggesting that inflationary pressures do not influence tourists' decisions to visit the region. Manufacturing, with a coefficient of 0.4013, is not statistically significant (p = 0.121), indicating that the growth of

the manufacturing sector does not have a notable impact on tourism. In contrast, internet penetration is positively associated with tourism arrivals, with a statistically significant coefficient of 0.0263 (p = 0.030), highlighting the role of digital connectivity in boosting tourism. Agriculture exhibits a negative and statistically significant relationship with tourism, with a coefficient of -0.3273 (p = 0.038), suggesting that a higher reliance on agriculture may detract from tourism, potentially due to limited economic diversification. Finally, regulatory quality shows a positive but insignificant relationship with tourism (p = 0.142), suggesting that regulatory quality does not have a strong impact on tourism in MENA countries.

Overall, the results emphasize that factors such as FDI, exchange rate, and internet penetration are significant drivers of tourism, while agriculture has a negative influence, and inflation, manufacturing, and regulatory quality appear less impactful.Top of Form

5. Discussion

The results from the Fixed-effects regression with Driscoll-Kraay standard errors provide crucial insights into the factors influencing international tourism in the Middle East and North Africa (MENA) region.

5.1. Foreign Direct Investment (FDI) and Tourism Growth

The analysis finds that FDI has a positive and statistically significant impact on international tourism arrivals in MENA countries. This suggests that foreign investment plays a crucial role in enhancing tourism infrastructure, hospitality services, and transportation networks, ultimately attracting more visitors.

This result aligns with findings by Tang and Tan [42] who showed that FDI positively influences tourism by improving the quality and availability of tourism-related facilities. Kumar and Hussain [5] analyzed FDI inflows in tourism-related sectors and found a strong positive correlation between FDI and tourism demand in developing countries. Seetanah [6] used a dynamic panel data model and showed that FDI boosts tourism development by financing hotel chains, airlines, and tourism-related infrastructure.

Similarly, United Nations Conference on Trade and Development [43] emphasizes that FDI in tourism-related sectors, such as hotels, airlines, and tour operators, enhances the global appeal of a destination. However, the small effect size in the current analysis suggests that while FDI contributes to tourism growth, other factors may have a more direct influence.

5.2. Exchange Rate and Tourism Demand

A significant positive relationship is observed between exchange rate appreciation and international tourism. This implies that when the local currency strengthens, MENA countries attract more tourists. While this might seem counterintuitive, since a stronger currency makes travel more expensive, this effect could be explained by the perceived economic stability and improved infrastructure that often accompany currency appreciation.

Prior studies, such as those by Sak and Karymshakov [15] found that exchange rate fluctuations influence tourism demand, but the direction of this effect varies by region. In the case of MENA, a stronger currency may signal greater economic stability and improved services, outweighing the cost factor. Sak and Karymshakov [15] found that exchange rate stability is a key determinant of tourism demand, especially in emerging economies. Santana-Gallego, et al. [11] examined bilateral tourism flows and concluded that exchange rate appreciation increases tourist arrivals in politically stable regions. Chang, et al. [44] used panel data on Asian economies and found that tourists prefer destinations with a stable exchange rate, as it signals economic strength and reliability.

5.3. Inflation and Tourism Demand

The regression results indicate that inflation is not a significant determinant of tourism in MENA countries. This suggests that tourists may not be highly sensitive to short-term price fluctuations in the region.

This finding is consistent with the work of Dogru, et al. [10] analyzed inflation and tourism demand across 20 countries and found that tourists prioritize destination attractiveness over inflation levels. They found that while inflation can influence tourism costs, tourists often prioritize factors such as safety, accessibility, and cultural attractions over price variations. Additionally, in resource-rich economies like the GCC (Gulf Cooperation Council) countries, where subsidies and government interventions keep costs relatively stable, inflation may not significantly impact tourism.

Martin and Witt [45] found that inflation's impact on tourism is only significant in highly price-sensitive destinations, which is not the case for MENA. Eugenio-Martin, et al. [23] showed that while hyperinflation deters tourism, moderate inflation does not significantly alter tourist preferences.

5.4. Internet Penetration and Tourism Growth

The analysis finds that internet penetration is positively and significantly associated with tourism arrivals, highlighting the growing importance of digital connectivity in tourism.

Several studies support this finding. Law, et al. [18] argue that digital platforms, online booking systems, and social media significantly influence tourists' decisions. They found that internet accessibility significantly improves tourism marketing, online bookings, and customer engagement. Likewise, Javed, et al. [19] found that improved internet access enhances destination marketing, facilitates online travel planning, and increases visitor confidence. Matarrita-Cascante, et al. [24] emphasized that social media exposure and digital marketing play a key role in increasing tourism arrivals, particularly among younger travelers.

5.5. Agriculture and Tourism: A Negative Relationship

A negative and statistically significant relationship is found between agriculture and international tourism. This suggests that a higher reliance on agriculture may hinder tourism growth, possibly due to limited economic diversification, lower investment in the service sector, and inadequate infrastructure in agriculturally dependent regions.

This aligns with the resource allocation hypothesis, which argues that economies heavily focused on agriculture may divert resources away from tourism-related industries [46]. Additionally, Narayan [47] found that in developing economies, an overreliance on agriculture can slow the transition to service-based industries, which are essential for tourism. Zaei and Zaei [48] found that excessive focus on agriculture reduces the appeal of urban tourism, as infrastructure investment remains limited in rural economies.

5.6. Manufacturing and Tourism: No Significant Relationship

The regression results indicate that manufacturing does not significantly influence tourism. This aligns with previous literature, which suggests that while manufacturing is crucial for economic growth, it does not directly impact tourism, unless linked to business travel and industrial tourism. Brida, et al. [49] found that manufacturing impacts tourism only when linked to business travel, such as expos, trade fairs, and corporate tourism. Chou [50] found that in non-industrialized economies, manufacturing's effect on tourism is negligible compared to services.

5.7. Regulatory Quality and Tourism

Although regulatory quality is positively correlated with tourism, the relationship is not statistically significant. This suggests that while effective governance, legal frameworks, and transparency are beneficial, they may not be primary drivers of tourism in MENA.

However, studies such as Eilat and Einav [14] found that countries with strong governance and regulatory frameworks tend to experience higher tourism inflows due to increased investor confidence and improved infrastructure. The non-significance in this study may suggest that other factors, such as security concerns, geopolitical stability, and cultural appeal, play a more dominant role in MENA's tourism sector. Blanke and Chiesa [29] argue that while regulatory quality matters, tourism inflows are driven more by marketing, infrastructure, and security considerations.

5.8. Recommendations

The analysis highlights FDI, exchange rate stability, and internet penetration as significant drivers of international tourism in MENA, while agriculture appears to negatively impact tourism development. Inflation, manufacturing, and regulatory quality have limited direct effects on tourism inflows.

Based on the findings, policymakers in MENA countries should implement targeted strategies to enhance international tourism. First, the significant impact of Foreign Direct Investment (FDI) on tourism suggests that governments should create more investment-friendly environments by improving infrastructure, reducing bureaucratic hurdles, and providing incentives for foreign investors in the tourism sector. Special economic zones and public-private partnerships could further attract investment in hospitality, entertainment, and cultural tourism. Second, the positive effect of exchange rates highlights the need for stable monetary policies that prevent excessive currency appreciation, which could make travel more expensive for international tourists. Policymakers should consider promoting exchange rate stability through sound fiscal management and strategic currency interventions when necessary. Third, the role of internet penetration in increasing tourism arrivals underscores the importance of digital infrastructure development. Expanding high-speed internet access, improving online tourism marketing, and supporting digital payment systems would enhance a destination's appeal to tech-savvy global travelers. Additionally, investment in smart tourism initiatives, such as digital guides, virtual reality tourism experiences, and AI-driven customer service, could significantly improve tourist satisfaction and increase arrivals.

Conversely, the negative impact of agriculture on tourism indicates the need for better economic diversification. Countries with high dependence on agriculture should consider policies that promote a balanced economic structure, ensuring that tourism and service industries complement rather than compete with the agricultural sector. Strategies such as agritourism, where tourists engage in farm experiences and rural tourism, could integrate the two sectors and create synergies. While inflation and manufacturing were found to have insignificant effects on tourism, stable macroeconomic conditions and diversified industrial growth remain essential for long-term economic stability and investor confidence. Finally, although regulatory quality was not statistically significant in the study, improving governance, reducing corruption, and ensuring efficient regulatory frameworks could indirectly contribute to a more attractive tourism environment. Streamlining visa processes, enhancing security, and developing policies that facilitate tourism entrepreneurship would further strengthen the industry's growth.

In conclusion, boosting international tourism in MENA requires a multi-dimensional approach that includes investment promotion, exchange rate stability, digitalization, and sectoral integration. Governments should embrace data-driven decision-making by continuously monitoring tourism trends, leveraging AI and big data analytics, and conducting impact assessments of tourism policies. Collaborative efforts among public and private stakeholders, coupled with regional cooperation, could further position MENA as a globally competitive tourism hub.

6. Conclusion

This study investigates the key determinants of international tourism in MENA countries, utilizing a fixed-effects regression model with Driscoll-Kraay standard errors to account for heteroscedasticity and autocorrelation. The results highlight the complex interplay between economic, digital, and sectoral factors that influence tourism arrivals in the region.

The findings underscore the positive and significant role of Foreign Direct Investment in boosting tourism, emphasizing that increased foreign investment in tourism infrastructure can effectively promote international arrivals. This aligns with the broader literature, which highlights FDI as a crucial driver of tourism sector development. Similarly, exchange rates were found to have a significant positive impact, suggesting that currency appreciation makes MENA destinations more attractive to foreign tourists.

In contrast, inflation was found to have no significant impact on tourism in the region, suggesting that despite inflationary pressures, tourists' decisions to visit MENA countries may be less sensitive to price fluctuations than often presumed. The role of manufacturing in tourism was also not significant, indicating that growth in this sector does not directly translate to increased tourism arrivals in MENA countries.

The study further reveals that internet penetration plays a vital role in attracting international tourists. As digital connectivity becomes increasingly integral to travel decision-making, the positive association between internet penetration and tourism underscores the importance of digital infrastructure in fostering tourism growth. Additionally, agriculture, though vital to some MENA economies, exhibited a negative impact on tourism. This suggests that countries heavily dependent on agriculture may face challenges in diversifying their economies to promote tourism effectively.

Finally, regulatory quality was found to have an insignificant effect on tourism in the region, pointing to the need for deeper exploration into governance structures and their indirect effects on tourism. While regulatory frameworks are important for tourism management, other macroeconomic variables seem to play a more dominant role.

The results of this study suggest several policy recommendations for MENA countries to foster tourism growth. Increasing FDI in the tourism sector, enhancing digital infrastructure, and stabilizing exchange rates should be prioritized. Additionally, efforts to reduce agriculture's dominance in the economy and diversify into service-based sectors could significantly contribute to the region's tourism development.

In conclusion, this research provides valuable insights into the determinants of international tourism in MENA countries, offering a solid foundation for future research and policy development aimed at enhancing the region's tourism competitiveness.

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