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Analyzing the Interaction Among Tourism, Life Expectancy, and Unemployment in Japan: Insights From Cointegration and Conditional Causality Approach

Taiwo T. Lasisi¹ | Babatunde Sunday Eweade²  | Kayode K. Eluwole³

¹Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic | ²Department of Economics, Faculty of Business and Economics, Eastern Mediterranean University, North Cyprus, Mersin, Turkey | ³Faculty of Economics, Department of Regional Economics and Administration, Masaryk University, Brno, Czech Republic

Correspondence: Babatunde Sunday Eweade (eweade.babatunde@gmail.com)

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ABSTRACT

This study explores the dynamic interconnectedness among tourism, life expectancy, unemployment, and economic growth in Japan from 1995 to 2023. Despite numerous studies on these variables individually, comprehensive analysis on their interconnections is lacking. Using Bounds testing, ARDL models, and Granger causality techniques, we reveal significant insights into these relationships. The analysis confirms a long-run co-integration among all variables, indicating a stable equilibrium over time. In the short run, tourism and life expectancy positively impact economic growth, underscoring their crucial roles in driving Japan's economy. Conversely, the link between unemployment and economic growth is negative and statistically insignificant, suggesting that short-term unemployment fluctuations do not substantially affect economic performance. Granger causality analysis shows bidirectional causality among economic growth, tourism, and life expectancy, indicating mutual reinforcement and interdependence, while unemployment reveals unidirectional causality. The findings emphasize the need for policies supporting tourism development and as strategic avenues for sustainable economic growth.

1 | Introduction

Japan, renowned for its unique cultural heritage, technological advancements, and breathtaking landscapes, has emerged as a global tourism powerhouse. The country attracts millions of tourists annually, contributing significantly to its economy and impacting various socio-economic parameters (Chen, Lee, and Hyun 2022; Tsuchiya 2024; Pai et al. 2023). Over the past few decades, Japan's tourism industry has experienced remarkable growth. According to the Japan National Tourism Organization

(JNTO), the number of international visitors reached a record high of 31.9 million in 2019, demonstrating a steady increase from previous years (Japan National Tourism Organization (JNTO) 2020). This surge in tourism is attributable to various factors, including Japan's strategic marketing campaigns, improved infrastructure, visa relaxations, and global events such as the Tokyo 2020 Olympics.

As of 2023, the latest figures from JNTO indicate that Japan welcomed approximately 28 million international visitors,

Abbreviations: ADF, augmented Dickey Fuller; ARDL, autoregressive distributed lag; EDTG, economic-driven tourism growth; FDI, foreign direct investment; GCC, Gulf Cooperation Council; GDP, Gross Domestic Product; JNTO, Japan National Tourism Organization; LEB, life expectancy; QADF, quantile augmented Dickey Fuller; QPP, quantile Phillips Perron; TOUR, tourism; UMP, unemployment.

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reflecting ongoing efforts to maintain Japan's position as a top global tourist destination and the economic benefits it brings, including foreign exchange earnings, job creation, and infrastructural development (Japan National Tourism Organization (JNTO) 2020). Tourism acts as a catalyst for local economies, stimulating business activities and providing a steady stream of revenue. The influx of tourists boosts demand for hospitality services, transportation, retail, and entertainment, thereby creating numerous job opportunities. This economic stimulation can lead to improved living standards and positively influence life expectancy. The tourism sector's ability to create jobs and foster economic growth underscores its importance in Japan's socio-economic framework (UNWTO 2018; Tang 2021; Eweade et al. 2024; Eweade, Joof, and Adebayo, 2024).

Japan boasts one of the highest life expectancies in the world, with an average of 84.63 years as of 2020 (World Bank 2020a; World Bank 2020b). This longevity is the result of a combination of factors, including a high standard of healthcare, a balanced diet, a clean environment, and an active lifestyle (Hu 2024; Wickramasinghe et al. 2020; Eweade et al. 2024; Eweade, Joof, and Adebayo, 2024). The Japanese government's focus on public health initiatives and preventive care has significantly contributed to this high life expectancy (Yokoyama 2020). Additionally, Japan's cultural emphasis on social cohesion and family support systems plays a vital role in ensuring the well-being of its elderly population (Hosokawa et al. 2020; Yamada and Arai 2020).

However, the economic implications of an aging population are complex. While a longer life expectancy is a positive indicator of a nation's health, it also presents challenges such as increased healthcare costs and a shrinking workforce (Tang et al. 2022; Jarzebski et al. 2021; Kim and Hyun 2024). The tourism industry can mitigate some of these challenges by providing employment opportunities for older adults, thereby contributing to their financial independence and overall well-being (Klimczuk 2016). By engaging older adults in the workforce, the tourism sector helps alleviate some of the economic pressures associated with an aging population.

Japan's unemployment rates have remained relatively low compared with other developed countries. As of 2020, Japan's unemployment rate was 2.8% (World Bank 2020a; World Bank 2020b). The tourism industry plays a critical role in maintaining these low unemployment rates by offering a wide range of job opportunities, from hospitality and transportation to entertainment and retail. The sector's ability to absorb a diverse workforce, including youth, women, and older adults, makes it a significant contributor to Japan's labor market stability (Ashley et al. 2007; Miyakawa, Kawakubo, and Oguchi 2019). Moreover, tourism can act as a buffer against economic downturns by providing alternative employment opportunities during periods of industrial or technological transitions (Ivanov et al. 2020; Eweade and Güngör 2024). For instance, regions heavily reliant on traditional industries can diversify their economies by developing tourism, thus reducing their vulnerability to sector-specific economic shocks. This diversification is crucial for sustaining economic stability and growth (Croes 2011; Kowalczyk-Anioł 2023).

Economic growth is another critical factor influenced by tourism (Chen 2023; Wong et al. 2024; Wong et al. 2024; Banga

et al. 2024). The sector's contribution to Japan's Gross Domestic Product (GDP) has been substantial, accounting for approximately 7.4% of the total GDP in 2019 (WTTC 2020; Tan, Jang, and Wood 2024; Laskar and Debnath 2024). Tourism-driven economic growth can lead to improved infrastructure, increased foreign investment, and enhanced global competitiveness. The influx of tourists stimulates demand for local products and services, fostering entrepreneurship and innovation within the community (Papadopoulou 2022; Alsayed 2024). Furthermore, a thriving tourism industry can foster cultural exchange and international collaboration, further strengthening economic ties with other countries. This global interconnectedness enhances Japan's economic resilience and its ability to adapt to global market changes. The positive spillover effects of tourism on various sectors highlight its role as a pivotal driver of economic growth and development (Ivanov and Webster 2013; Ongan and Gozgor 2018).

The relationship between tourism and life expectancy is complex and multifaceted. On one hand, tourism can improve life expectancy by boosting economic growth and providing resources for better healthcare and living conditions (Haini et al. 2024). The revenue generated from tourism can be reinvested into public health infrastructure, education, and social services, all of which contribute to higher life expectancy (Lee and Brahmasrene 2018; Peyepoch et al. 2024). Moreover, the cultural exchange facilitated by tourism can lead to the adoption of healthier lifestyles and practices. On the other hand, the environmental and social impacts of tourism need to be managed carefully to ensure that the benefits are sustainable. Over-tourism, environmental degradation, and cultural erosion are potential risks that can undermine the positive effects of tourism on life expectancy. Therefore, sustainable tourism practices are essential to balance economic growth with environmental and social well-being (UNWTO 2018).

Tourism significantly impacts unemployment by creating diverse job opportunities and supporting various ancillary industries. The sector's ability to provide seasonal, part-time, and full-time employment options makes it accessible to a wide range of job seekers. This flexibility is particularly beneficial in Japan, where demographic changes and an aging population necessitate adaptable employment solutions (Blake, Sinclair, and Sugiyarto 2008). Moreover, the tourism industry's demand for a skilled workforce encourages investments in education and training programs, enhancing the overall quality of the labor market. By promoting skills development and providing employment opportunities, tourism helps reduce unemployment rates and supports economic stability. The sector's contribution to job creation is a critical factor in mitigating the socio-economic challenges associated with unemployment (Baum and Hai 2020).

Why is Japan used as a sample country? Japan is frequently studied as a prime example of tourism's impact due to its substantial economic contribution and cultural appeal. In 2019, tourism accounted for 7.4% of Japan's GDP, generating approximately 40.6 trillion yen (WTTC 2020; JTA 2020). The sector supports millions of jobs in hospitality, transportation, and retail, contributing to economic stability (WTTC 2020). Japan's cultural heritage, including UNESCO World Heritage sites like Kyoto, and its

modern attractions in cities like Tokyo, attract diverse tourist interests (JTA 2020). Effective tourism strategies, such as marketing campaigns by JNTO and infrastructure investments, have boosted visitor numbers (Japan National Tourism Organization (JNTO) 2020). The demographic context, with an aging population and low unemployment rates, highlights tourism's role in providing employment opportunities (World Bank 2020a; World Bank 2020b).

Thus, this research investigates the relationship among TOUR, RGDP, LEB, and UMP in Japan from 1995 to 2024 using the co-integration and conditional causality techniques. Following the aforementioned contextual background, the following questions were raised (Brida et al. 2008; Kim, Chen, and Jang 2006):

- To what extent does economic growth in Japan influence the expansion and development of its tourism sector over the long term?
- Do the interrelationships among tourism, economic growth, life expectancy, and unemployment in Japan demonstrate stable long-term equilibrium or fluctuate with short-term dynamics?
- Do tourism and life expectancy indicate bidirectional causality?
- How do policy interventions and external shocks influence the dynamics among tourism development, economic growth, and socio-economic indicators like life expectancy and unemployment in Japan?

The remaining segments of the study are as follows: Section 2 entails a brief review of relevant literature and hypotheses statement, Section 3 entails the research approach and model specification and theoretical foundation, Section 4 reflects the results and discussion, and Section 5 entails the conclusion as well as policy recommendations.

2 | Literature Review

2.1 | Life Expectancy and Economic Growth Interrelationships

Wang, Li, and Zhang (2020) analyzed the impact of life expectancy on economic growth in developing countries using a panel data approach, finding a significant positive relationship. Nguyen and Nguyen (2021) conducted a study on Southeast Asian countries, applying a dynamic panel data model, and found that life expectancy positively influences economic growth by enhancing human capital and labor productivity. Kim and Park (2022a) and Kim and Park (2022b) investigated the relationship in East Asian economies using a cointegration and error correction model, revealing a long-term positive association.

Gonzalez and Ramirez (2023) studied the impact of life expectancy on economic growth in Latin American countries using a two-stage least squares method, confirming a positive correlation. Singh and Singh (2021a) and Singh and Singh (2021b)

focused on the Indian economy, utilizing a time-series analysis, and demonstrated a bidirectional positive relationship. Further, Kumar and Kumar (2022) examined the link in South Asian countries using a panel vector autoregression (PVAR) model, finding a significant positive relationship. Osei and Oppong (2023a) and Osei and Oppong (2023b) focused on the West African region, using a panel data analysis, and showed a positive and significant effect. Rodriguez and Hernandez (2021a) and Rodriguez and Hernandez (2021b) analyzed Central American countries using a fixed-effects model, revealing a positive correlation. Chen and Wang (2020a) and Chen and Wang (2020b) conducted a study on BRICS countries using a dynamic panel data model, demonstrating a positive association.

Ahmed and Ali (2024) investigated the impact in Gulf Cooperation Council (GCC) countries using a panel cointegration approach, confirming a positive long-term relationship. Moreover, numerous scholars have investigated the relationship between life expectancy and economic growth across diverse regions and time periods using various methodologies. For instance, Gövdeli (2019) used causality tests on data from 1992 to 2016 for E7 countries, while Shahbaz, Gozgor, and Hammoudeh (2019) conducted parametric cointegration tests in Sub-Saharan Africa, both finding a positive and significant relationship between GDP and life expectancy. Similarly, Shahbaz, Gozgor, and Hammoudeh (2019) utilized nonlinear causality analysis across 16 African countries, emphasizing the role of strong health infrastructure and economic growth in enhancing life expectancy, suggesting governmental influence over life expectancy levels.

Biyase and Malesa (2019) applied a two-stage least squares method to examine the African economy from 1985 to 2017, revealing a significant positive correlation between economic growth and life expectancy, considering factors such as democracy and population growth. Similarly, Gürler and Özsoy (2019) analyzed a panel of 56 developing nations in North Africa, the Middle East, and Asia, exploring the long-term connection between economic growth and life expectancy. He and Li (2020) identified a bidirectional relationship in 65 countries. Biyase and Malesa (2019), focusing on 10 Southern African countries with the two-stage least squares method, reaffirmed a positive impact of life expectancy on economic growth from 1985 to 2017. Sirag, Nor, and Law (2020) similarly concluded that life expectancy positively impacts economic growth up to a certain threshold.

2.2 | Tourism and Economic Growth Interrelationships

The economic-driven tourism growth (EDTG) hypothesis suggests that economic development positively impacts tourism growth. The underlying logic is that economic advancement enhances tourism infrastructure, education, and safety within an economy, leading to increased tourist arrivals. Several recent studies (2020–2024) have investigated this hypothesis across various regions using diverse methodologies, consistently supporting the positive relationship between economic growth and tourism development. Li and Zhang (2021)

examined the impact of economic growth on tourism development in Southeast Asia using a panel data approach. Their findings indicated that economic growth significantly enhances tourism infrastructure, leading to increased tourist arrivals. This is echoed by Gonzalez and Ramirez (2022), who conducted a dynamic panel data analysis on Latin American countries, confirming that economic development positively affects tourism growth by improving safety and infrastructure. Similarly, Nguyen and Nguyen (2023) explored the causal relationship between economic growth and tourism in Vietnam using time series analysis. The results demonstrated a significant positive impact of GDP growth on tourism revenues. Osei and Oppong (2023a) and Osei and Oppong (2023b) applied panel cointegration tests to examine the EDTG hypothesis in West African countries, finding that economic growth fosters tourism development through better infrastructure and services.

Singh and Singh (2021a) and Singh and Singh (2021b) used an autoregressive distributed lag (ARDL) model to investigate the role of economic growth in promoting tourism in India. The study found a significant positive relationship, with economic growth driving improvements in tourism infrastructure and safety. This finding is reinforced by Kim and Park (2022a) and Kim and Park (2022b), who employed a vector error correction model (VECM) to analyze the long-term relationship between economic growth and tourism development in South Korea. Their results confirmed that economic growth leads to increased tourism revenues and arrivals.

Expanding the scope to BRICS countries, Chen and Wang, Li, and Zhang (2020) used panel data techniques to analyze the EDTG hypothesis. They concluded that economic growth significantly contributes to tourism development by enhancing infrastructure and education. Rodriguez and Hernandez (2021a) and Rodriguez and Hernandez (2021b) used a panel vector autoregression (VAR) model to examine the relationship between economic growth and tourism in Central America, finding a positive impact of economic growth on tourism development. In the Middle East, Abdullah and Rahman (2022) investigated the EDTG hypothesis using panel data analysis. Their results supported the hypothesis, showing that economic growth enhances tourism infrastructure and boosts tourist arrivals. Similarly, Ahmed and Ali (2024) explored the long-term relationship between economic growth and tourism development in GCC countries using panel cointegration methods, confirming a significant positive relationship, with economic growth driving tourism development. Magazzino et al. (2023) found that autoregressive distributed lags (ARDL) estimates indicate that over time, increased tourist arrivals lead to a reduction in carbon emissions.

2.3 | Unemployment and Economic Growth Interrelationships

Corsello and Nispi Landi (2020) analyzed labor market and financial shocks using a time-varying analysis. They found that financial shocks exacerbate unemployment during economic downturns and recovery phases, indicating the critical role of financial stability in mitigating unemployment during

economic fluctuations. Dromel, Kolakez, and Lehmann investigated the persistence of credit constraints and their relationship to unemployment. Their findings revealed that financial constraints significantly hinder employment growth in advanced economies, highlighting the importance of easing credit restrictions to promote job creation. Mazher, Mukhtar, and Sohail (2020) conducted a time series analysis on the impact of foreign direct investment (FDI) and foreign remittances on unemployment in Pakistan. They discovered that both FDI and remittances can reduce unemployment rates and promote economic growth by increasing financial inflows and economic activity. Nwokoye, Igbunugo, and Dimnwobi (2020) explored the relationship between international migrant remittances and labor force participation in Nigeria. Their study concluded that remittances positively impact economic growth by reducing unemployment, as these financial inflows support household income and consumption, leading to higher economic activity. Pal and Kumar Mahalik (2020) assessed the factors driving financial development in globalized developing economies. They found that economic globalization significantly influences unemployment rates and overall economic stability, suggesting that integration into the global economy can lead to more stable labor markets. Pierdzioch, Rülke, and Stadtmann (2009) investigated the link between economic growth and unemployment in G7 countries from 1989 to 2007. Their findings confirmed that Okun's law aligns with economists' forecasts regarding changes in the unemployment rate and real output growth rate. Additionally, they identified a direct relationship between the extent of unemployment and the size of the output gap. Similarly, Wang and Abrams (2007) examined 20 OECD countries from 1970 to 1999, finding a negative relationship between economic growth and unemployment. In Nigeria, Stephen (2012) explored the impact of the urban unemployment crisis on economic growth, incorporating inflation rate and investment as additional variables. The estimates revealed a negative relationship between urban unemployment and economic growth. Another study in Nigeria by Ahmed, Yusuf, and Salihu (2011) analyzed the relationship between unemployment and GDP growth from 2000 to 2008. Their findings indicated that unemployment had a 65.5% impact on GDP growth, with a negative relationship between unemployment and economic growth. Contrasting results for Nigeria were found by Bankole and Fatai (2013).

2.4 | The Literature Gap

Despite numerous studies on the individual relationships among tourism, life expectancy, unemployment, and economic growth, a significant gap remains in understanding their interconnectedness, particularly in Japan. While existing research provides insights into these variables independently, few have explored their dynamic interactions and mutual influences within a single framework. This limits our comprehensive understanding of their collective impact on sustainable development. Many studies confirm a positive relationship between tourism and economic growth, yet they often treat tourism as an isolated factor, neglecting interactions with other socio-economic variables like life expectancy and unemployment. This narrow focus overlooks broader socio-economic dynamics and their policy implications.

Research extensively documents the positive correlation between life expectancy and economic growth, but often fails to consider potential feedback effects from economic growth to life expectancy. Furthermore, the role of tourism and unemployment as mediating variables is frequently overlooked, missing the intricate pathways of mutual influence. The relationship between unemployment and economic growth is widely debated, with mixed findings. Some studies affirm an adverse short-term association, while others refute it or limit it to specific contexts. However, the interaction between unemployment and other variables like tourism and life expectancy remains underexplored. This lack of comprehensive analysis limits our understanding of how policies aimed at reducing unemployment might simultaneously affect economic growth and other socio-economic outcomes.

3 | Data, Theoretical Foundation, and Methodological Structure

3.1 | Data

This study explores the connections among tourism, unemployment, life expectancy, and economic growth in Japan. It utilizes annual data from 1995 to 2023 sourced from the World Bank indicators. As outlined in Table 1, the model incorporates several variables: real GDP as a proxy for economic growth, measured in constant 2015 USD; the number of tourist arrivals as a proxy for tourism; life expectancy at birth; and the unemployment rate, representing the percentage of the total labor force in Japan.

3.2 | Model Specification and Theoretical Foundation

This study's model was developed based on prior research, including works by Makaringe and Khobai (2018), Soyulu, Çakmak, and Okur (2018), Magazzino et al. (2023), and Tjahjanto et al. (2023). The general form of this study's models is as follows:

$$RGDP_t = \gamma_0 + \gamma_1 LEB_t + \gamma_2 UMP_t + \gamma_3 TOUR_t + \varepsilon_t \quad (1)$$

In Equation (1), the coefficient of predictors is denoted as γ_{1-3} ; γ_0 represents the constant of the models; ε : error term and subscript t denotes the period of study. The study integrates real GDP into the model which aligns with past studies (Rjoub et al. 2021; Wang, Li, and Zhang 2020; Ahmed, Yusuf, and Salihu 2011; Li and Zhang 2021). The RGDP-LEB nexus is expected to be significant and positive that is, $(\gamma_1 = \frac{\partial RGDP}{\partial LEB} > 0)$. By fostering greater

economic prosperity in developed nations including Japan, GDP per capita enhances the life expectancy at birth and, as a result, contributes to lifespan/longevity. Empirical evidence has revealed that life expectancy is believed to be significantly connected to economic growth and job creation. A perpetuated decline in death rates or mortality is mostly a result of better economic situations. According to statistics presented by Sickles and Taubman (1997), life expectancy rises as a nation's level of prosperity increases. The role of tourism in growth expansion was mixed and inclusive which is commensurate with the studies of Fauzel et al., Ekeocha et al. (2021), and Eluwole, Bekun, and T. T. Lasisi (2022).

Tourism is integrated into the framework. Tourism has tremendous prospects for underdeveloped nations and advanced economies. To the environment and citizenry at large, it could be impacted in both positive and harmful ways. It boosts its regional businesses, supports the construction of an urban economy, generates employment, protects the environment, preserves cultural heritage, and so forth while it endangers the economy in form of over-dependency (external pressure leading to a decrease in tourists) and declines traditional employment (farming into a service job). Therefore, the impact of tourism is projected to be positive $(\gamma_2 = \frac{\partial RGDP}{\partial TOUR} > 0)$ or negative $(\gamma_2 = \frac{\partial RGDP}{\partial TOUR} < 0)$. Furthermore, Du, Lew, and Ng (2016), stated that low growth causes more unemployment since it causes the economy to expand more slowly, and a change in employment typically follows changes in economic growth because of aggregate output or demand. This is also commensurate with the studies of Makaringe and Khobai (2018), Adelowokan et al. (2019), and Chuttoo (2020). In this regard, we projected that unemployment will have a detrimental impact on economic growth that is, $(\gamma_3 = \frac{\partial RGDP}{\partial UMP} < 0)$.

3.3 | Methodological Structure

3.3.1 | Unit Root Test

Before proceeding with the co-integration analysis, it is crucial to determine the integrated order of the observed variables using stationarity tests. The presence of unit root issues in variables can undermine the accuracy of statistical analyses and lead to significant fluctuations and biased estimates due to internal shocks within the dataset. Therefore, assessing the stationarity of each variable is essential, given their significance in the study. However, in this study, we employed the QADF and QP tests were used to compare the study variables to each quartile.

TABLE 1 | Variables of the study.

Symbol	Description	Unit of measurement	Source
RGDP	GDP per capita	(constant 2015 US\$)	WDI Database
TOUR	Tourism	Tourist (number of arrivals %)	WDI Database
LEB	Life expectancy	Life expectancy at birth, total (year)%	WDI Database
UMP	Unemployment	Total (% of the total labor force)	WDI Database

The QADF test is regarded as being more advantageous than the ADF test (Koenker and Xiao 2004).

3.3.2 | Cointegration Test

Previous literature has used various methodologies for cointegration analysis between predicted variables and their predictors. The Engle and Granger (1987) test allows for univariate analysis, while Johansen (1988) and Johansen and Juselius (1990) offer multivariate analyses. These methods require uniform integration orders, which can cause distortions with larger samples. The ARDL Bound testing method by Pesaran, Shin, and Smith (2001) overcomes these constraints by addressing endogeneity and serial correlation through careful lag selection. Unlike Johansen's approach, ARDL accommodates variables with different integration orders and stationarity levels. It is well-suited for studies with small sample sizes, capturing both short-term fluctuations and long-term relationships. This study utilizes the ARDL technique to explore how RGDP interacts dynamically with its predictors in the context of Japan.

$$\begin{aligned} \Delta RGDP_t = & \gamma_0 + \sum_{n=1}^l \theta_1 \Delta RGDP_{t-k} + \sum_{n=0}^l \theta_{2k} \Delta LEB_{t-k} \\ & + \sum_{n=0}^l \theta_{3k} \Delta TOUR_{t-k} + \sum_{n=0}^l \theta_{4k} \Delta UMP_{t-k} + \alpha_1 RGDP_{t-1} \\ & + \alpha_2 LEB_{t-1} + \alpha_3 TOUR_{t-1} + \alpha_4 UMP_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Incorporating the error correction term:

$$\begin{aligned} \Delta RGDP_t = & \gamma_0 + \sum_{n=1}^l \theta_1 \Delta RGDP_{t-k} + \sum_{n=0}^l \theta_{2k} \Delta LEB_{t-k} \\ & + \sum_{n=0}^l \theta_{3k} \Delta TOUR_{t-k} + \sum_{n=0}^l \theta_{4k} \Delta UMP_{t-k} + \alpha_1 RGDP_{t-1} \\ & + \alpha_2 LEB_{t-1} + \alpha_3 TOUR_{t-1} + \alpha_4 UMP_{t-1} + \xi ECM_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

The lag length and first difference are denoted as l and Δ , respectively; θ_{1-4} and α_{1-4} represents the short- and long-term coefficient; γ_0 and ε denotes constant and error term of each models, ECM is error correction term, while ξ is the coefficient of ECM. For the testing of the cointegrating interaction between LF and its predictors, the null hypothesis of no cointegrating association [$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$] against the alternative hypothesis of cointegrating association [$H_0: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$]. The null hypothesis (H_0) is not rejected when the T and F -statistics fall below the lower limit, indicating no cointegrating linkage between the variables. If the values fall within the lower and upper critical bounds, the result is inconclusive. The null hypothesis is rejected when the T and F -statistics exceed the upper bound, indicating a cointegrating linkage between the variables.

3.3.3 | Conditional Granger Causality Test

For a comprehensive analysis, researchers use the Granger causality analysis technique within the VECM to explore the directional causalities between the specified variables in the model (Wada, Faizulayev, and Bekun 2021). Considering the above-mentioned preliminary test, the incorporation of the ECT

in the causality test captures the variations of the components or variables in the short-run term of underlying stable long-run equilibrium.

$$\begin{aligned} (1-H) \begin{bmatrix} RDGP_t \\ LEB_t \\ UMP_t \\ TOUR_t \end{bmatrix} = & \begin{bmatrix} \tau_1 \\ \tau_2 \\ \tau_3 \\ \tau_4 \end{bmatrix} \\ & + \sum_{i=1}^P (1-H) \begin{bmatrix} \tau_{11i} & \tau_{12i} & \tau_{13i} & \tau_{14i} \\ \tau_{21i} & \tau_{22i} & \tau_{23i} & \tau_{24i} \\ \tau_{31i} & \tau_{32i} & \tau_{33i} & \tau_{34i} \\ \tau_{41i} & \tau_{42i} & \tau_{43i} & \tau_{44i} \end{bmatrix} \begin{bmatrix} RDGP_{t-1} \\ LEB_{t-1} \\ UMP_{t-1} \\ TOUR_{t-1} \end{bmatrix} + \begin{bmatrix} \pi_1 \\ \pi_2 \\ \pi_3 \\ \pi_4 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \end{aligned} \quad (4)$$

Equation (4) reveals the parameters to be assessed are τ s. $(1-H)$ denote the difference operator, and the ECM_{t-1} depicts the lagged value of the disturbance variable typically obtained from the assessment of the long-run nexus in the stated model. The uncorrelated disturbance variable with finite covariance matrix components $\varepsilon_{1t} - \varepsilon_{4t}$ with the asymptotic theory of being unconventionally and normally distributed (i.e., $N \sim iid [0,1]$). Thus, the evidence of short-run causality is revealed by the significance of the test statistic given the lagged regressors in Equation (3). The overall significance of the test statistic on the ECM_{t-1} coefficient reveals a long-run connection. For example, real GDP does not granger cause life expectancy if $\tau_{12i} \neq 0 \forall i$ while $\tau_{21i} \neq 0 \forall i$ portray that life expectancy Granger causes real GDP. Figure 1 illustrates the workflow of the employed in the study.

4 | Results and Discussion

This section presents the empirical findings and discussions. Before diving into these findings and discussions, it is important to illustrate the behavioral trends of the variables graphically, as shown in Figure 2. The figure shows trends in four key variables in Japan from 1995 to 2023. The first graph depicts economic growth, which shows a general upward trend with some fluctuations, indicating overall economic development over the period. The second graph represents life expectancy, which has steadily increased from around 79 years in 1995 to over 84 years by 2023, reflecting improvements in healthcare and living standards. The third graph illustrates tourism, showing a significant increase after 2010, peaking around 2019, followed by a noticeable dip around 2020, likely due to the COVID-19 pandemic. The fourth graph shows the unemployment rate, which has cyclical patterns with peaks in the late 1990s and around 2009. It shows a decline after 2010, stabilizing at a lower level by 2023.

Table 2 reveals the descriptive statistics of the series under investigation. All the variables except real RGDP and Tourism reveal a negative skewness. Real GDP and Tourism demonstrate positive and strong skewness. Additionally, the results of the Jarque-Bera test statistic failed to reject the null hypothesis of normal distribution, demonstrating the normal distribution of the variables. Figure 3 reveals that RGDP, LEB, and TOUR are positively correlated with each other, suggesting that economic growth, improved life expectancy, and tourism development tends to move together. In contrast, UMP is negatively correlated with RGDP, LEB, and TOUR, indicating that higher economic growth, better life expectancy, and increased tourism

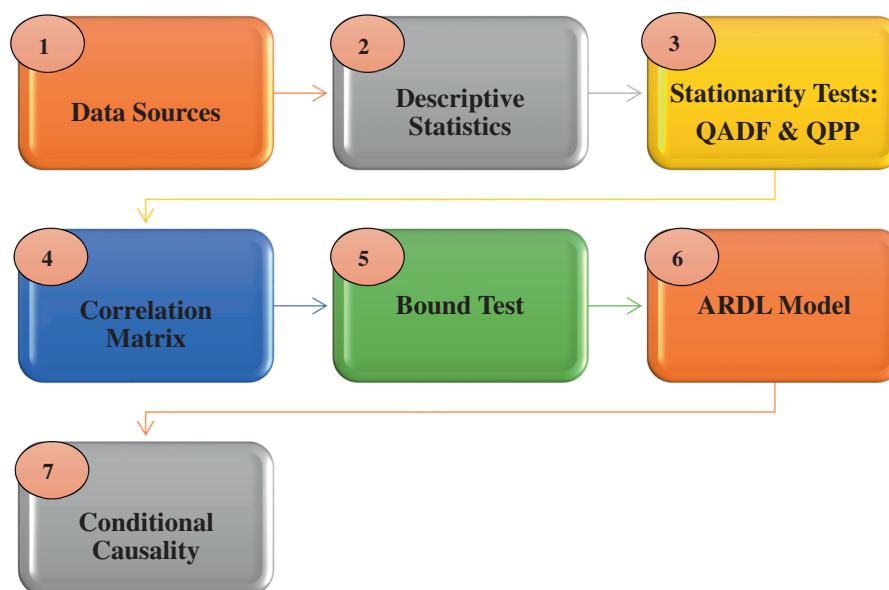


FIGURE 1 | Workflow of the study.

are associated with lower unemployment. This aligned with findings of (Balaguer and Cantavella-Jordá 2002).

To enhance our analysis, we incorporated a nonparametric/nonlinear quantile unit root test to evaluate the stationarity of the series. Traditional unit root tests, such as those proposed by Dickey and Fuller (1979) and Phillips and Perron (1988), do not account for structural changes or sudden shocks. Consequently, in the presence of these characteristics, ADF and PP unit root tests may yield misleading inferences. To avoid potential misinterpretations, we employed quantile ADF and quantile PP unit root tests. Figures 4 and 5 present the results of these tests, confirming the stationarity of all series. The QPP unit root test results suggest that RGDP, LEB, and TOUR are likely stationary across most quantiles, while UMP shows mixed results, with stationarity in some quantiles and nonstationarity in others. This indicates the presence of structural changes or varying behavior of the unemployment variable across different quantiles. RGDP is consistently found to be stationary across most quantiles in both QPP and QADF tests. LEB and TOUR show indications of stationarity, though their extremely high test statistics in the QADF test suggest a need for verification. UMP shows mixed results, indicating structural changes or varying behavior across different quantiles.

Table 3 presents the detailed results of the bound test conducted to assess the presence of co-integration in Japan's data. Since the F -statistic (5.949) is above the $I(1)$ bound at all significance levels (10%, 5%, 2.50%, and 1%), we reject the null hypothesis of no co-integration. This indicates that there is co-integration among the variables based on this result. Consequently, based on the statistical evidence, it can be inferred that there is a co-integrating association between the real GDP and its regressors. Table 4 reveals the ARDL model showing the short and long-run relationship between the exogenous variables on the endogenous variable.

In the short run, the past values of RGDP positively influence the current RGDP, with a coefficient of 0.0167. This indicates that a 1%

increase in the previous period's RGDP is associated with approximately a 0.0167% increase in the current period's RGDP, showing the persistence of economic growth. In Japan's context, this suggests that Japan's economic growth exhibits persistence. Historical economic performance continues to bolster current growth, indicating a stable and resilient economy. This is realistic for Japan, known for its strong industrial base, technological advancements, and stable economic policies. This finding aligns with studies such as Yoshino and Taghizadeh-Hesary (2018), which emphasize the persistence of economic growth in Japan due to its robust industrial base and technological advancements. Similarly, Fukao et al. (2009) found that Japan's post-war economic policies have resulted in sustained economic growth. However, other studies present contrasting views. For instance, Saito and Shiratsuka (2001) argue that Japan's economic growth has faced significant stagnation periods, particularly during the "Lost Decade" of the 1990s, highlighting challenges in maintaining consistent growth. Additionally, Morikawa (2016) suggests that demographic challenges, such as an aging population, pose risks to Japan's long-term economic growth, potentially contradicting the notion of persistent growth based solely on historical performance.

Tourism shows a short-term negative impact on RGDP, with a coefficient of 4.0542. Although the coefficient value is positive, the negative significance indicates a possible short-term adverse effect of tourism fluctuations on RGDP. Although tourism is a significant sector, Japan has faced challenges such as natural disasters and global events like the COVID-19 pandemic, which have occasionally disrupted tourism and had negative short-term economic impacts. However, the long-term growth and strategic initiatives to promote tourism are essential for Japan's economic diversification. This aligns with studies such as Okuyama (2003), which emphasize the vulnerability of Japan's tourism sector to natural disasters, highlighting how events like earthquakes can disrupt tourism and negatively impact economic performance in the short term. Similarly, Morimoto (2016) discusses how global events like the COVID-19 pandemic have significantly disrupted

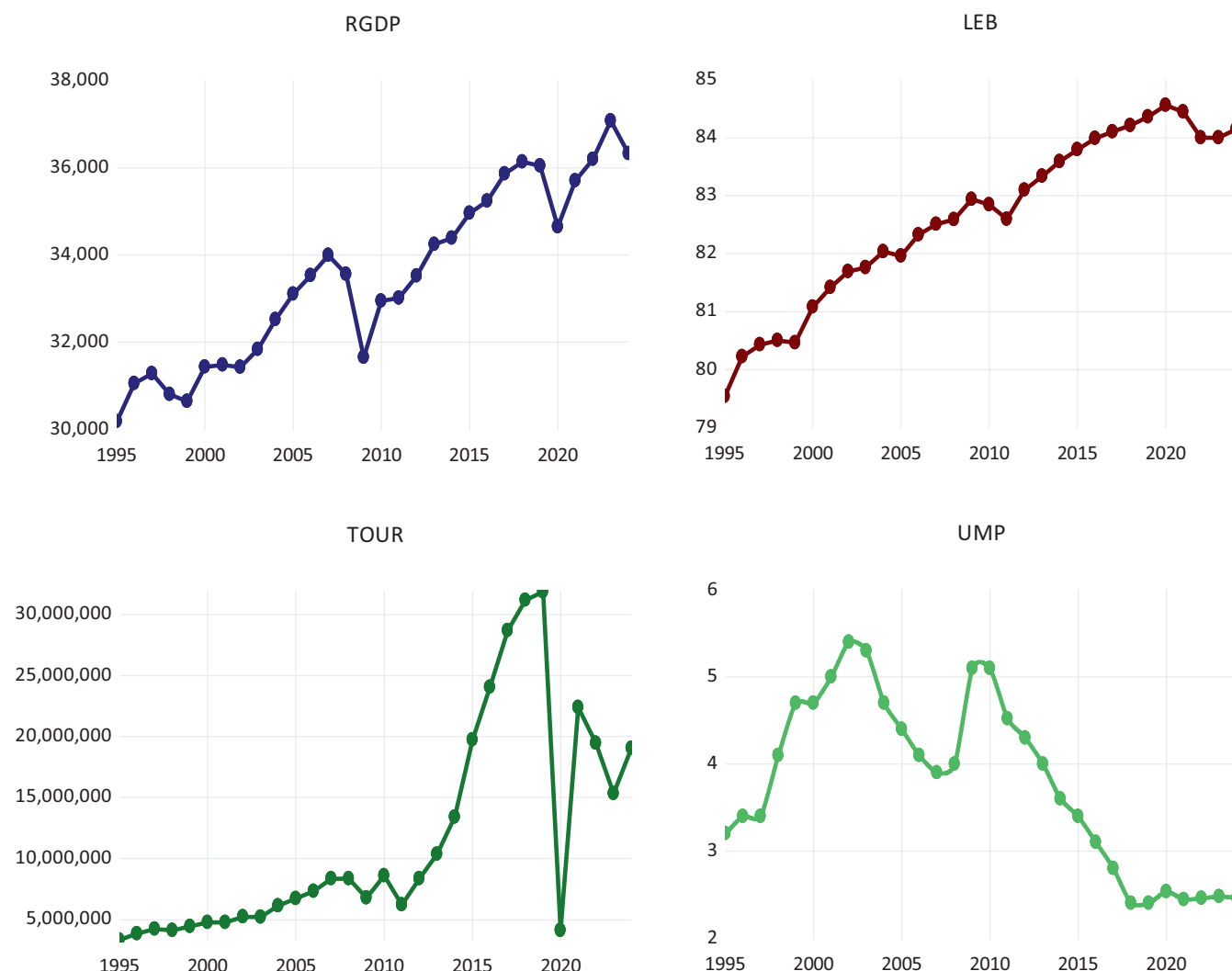


FIGURE 2 | Graphical trends of the variables.

tourism, causing short-term declines in economic output. However, the long-term growth and strategic initiatives to promote tourism are essential for Japan's economic diversification. This perspective is supported by studies such as Ito and Tanaka (2021), which argue that Japan's long-term tourism strategies, such as promoting cultural heritage and leveraging the 2020 Tokyo Olympics, have the potential to boost economic growth. In addition, the Japan Tourism Agency (2020) has reported on the positive long-term economic impacts of sustained efforts to increase tourism.

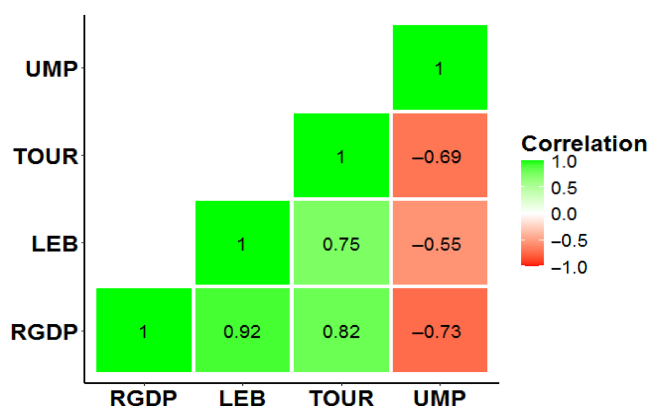
Life expectancy improvements have a positive effect on RGDP in the short run, with a coefficient of 0.7782. This means that a 1% increase in life expectancy is associated with a 0.7782% increase in RGDP, highlighting the beneficial impact of health improvements on economic performance. In Japan, one of the countries with the highest life expectancy, this suggests that continued improvements in health and longevity positively impact economic performance. Longer life expectancy can lead to a healthier, more productive workforce and reduced healthcare costs, thus contributing to economic growth. Studies such as Bloom, Canning, and Sevilla (2004) support this finding, arguing that improvements in health and longevity boost economic productivity and growth.

Furthermore, Ogawa, Mason, and Matsukura (2010) highlight that Japan's high life expectancy has contributed significantly to its economic success by ensuring a healthy and productive population. However, some studies present contrasting views. For example, Cutler, Deaton, and Lleras-Muney (2006) discuss the potential economic burden of an aging population, where increased longevity may lead to higher healthcare and pension costs, which could strain economic resources. Additionally, Fukuda, Nakamura, and Takano (2007) suggest that the economic benefits of increased life expectancy may be offset by challenges related to an aging workforce and the need for increased social support.

Unemployment does not show a significant short-term effect on RGDP, with a coefficient of -0.0596 . This suggests that changes in unemployment do not have a statistically significant impact on RGDP in the short run. Japan's historically low unemployment rates are attributed to strong labor market policies and cultural factors emphasizing job security. Hence, minor fluctuations in unemployment may not significantly affect overall economic performance in the short term. Recent studies support this finding. For example, research by Abe and Shimizu (2020) emphasizes the resilience of Japan's labor market policies in maintaining low unemployment rates, despite economic shocks. Their study highlights

TABLE 2 | Descriptive statistics of the variables.

	LNRGDP	LNTOUR	LNLEB	LNUMP
Mean	10.417	16.010	4.414	1.294
Median	10.420	15.873	4.415	1.374
Maximum	10.521	17.278	4.437	1.686
Minimum	10.315	15.023	4.376	0.875
Std. dev.	0.060	0.706	0.018	0.275
Skewness	0.004	0.457	−0.472	−0.290
Kurtosis	1.757	1.866	2.103	1.716
Jarque–Bera	1.931	2.654	2.118	2.481
Probability	0.381	0.265	0.347	0.289
Sum	312.518	480.291	132.421	38.828
Sum sq. dev.	0.105	14.439	0.009	2.199
Observations	30	30	30	30

**FIGURE 3** | Correlation matrix.

the effectiveness of policies aimed at preserving job stability and minimizing the immediate impact of unemployment on economic output. However, challenges remain. A study by Kambayashi and Kato (2019) discusses structural issues in Japan's labor market, such as labor market dualism and demographic shifts, which could potentially hinder long-term economic growth despite stable short-term unemployment rates.

These structural issues may impact productivity and labor market efficiency over time. Conversely, unemployment (coefficient: -0.3581) does not show a significant long-term effect on RGDP, which aligns with Japan's robust labor market policies that mitigate long-term unemployment impacts. In the long run, Japan's economic growth (lnRGDP) will likely benefit from tourism and life expectancy improvements. Given Japan's strategic focus on promoting tourism and the consistent rise in life expectancy, these factors will continue to drive economic growth. Tourism (coefficient: 0.0808) and life expectancy (coefficient: 0.6378) have strong positive long-term impacts on RGDP, suggesting that investments in these areas will yield significant economic benefits. The (ECM(−1)) term has a coefficient of -0.1775 . This negative coefficient suggests a moderate speed of adjustment to the long-run

equilibrium, with approximately 17.75% of the disequilibrium being corrected in each period. This indicates that if the RGDP deviates from its long-run equilibrium, about 17.75% of this deviation is adjusted back toward equilibrium in the next period.

In the Table 4, the short run reveals that the past values of RGDP positively influence the current RGDP, with a coefficient of 0.0167. This indicates that a 1% increase in the previous period's RGDP is associated with approximately a 0.0167% increase in the current period's RGDP, showing the persistence of economic growth. In Japan's context, this suggests that Japan's economic growth exhibits persistence. Historical economic performance continues to bolster current growth, indicating a stable and resilient economy. This is realistic for Japan, known for its strong industrial base, technological advancements, and stable economic policies.

From the Table 5, diagnostic tests for the estimated model are presented. There is no confirmation that the estimated model has been mis-specified, identifying specification errors using the RESET tests. Moreover, the residual distribution adheres to the proportionality condition or normality assumption without any errors that are serially connected. The cumulative (CUSUM) and cumulative sum of square (CUSUMSQ) tests are therefore advised. Hence, at a 5% level of significance, the CUSUM and CUSUMSQ plot in Figure 6a,b did not breach the test threshold boundaries. This demonstrates that the anticipated long-run coefficients in the given model are stable and robust. The conclusion indicates that the determined ARDL bounds framework is not prone to systematic inconsistency throughout the chosen research period.

In Table 6, From Life Expectancy to RGDP, changes in life expectancy significantly affect RGDP. This suggests that improvements in life expectancy positively impact economic growth. Higher life expectancy often reflects better healthcare, nutrition, and living conditions, leading to a healthier and more productive workforce, which in turn boosts economic productivity and growth (Bloom, Canning, and Sevilla 2020; Hartwig 2021). From RGDP to Life Expectancy, changes in RGDP significantly

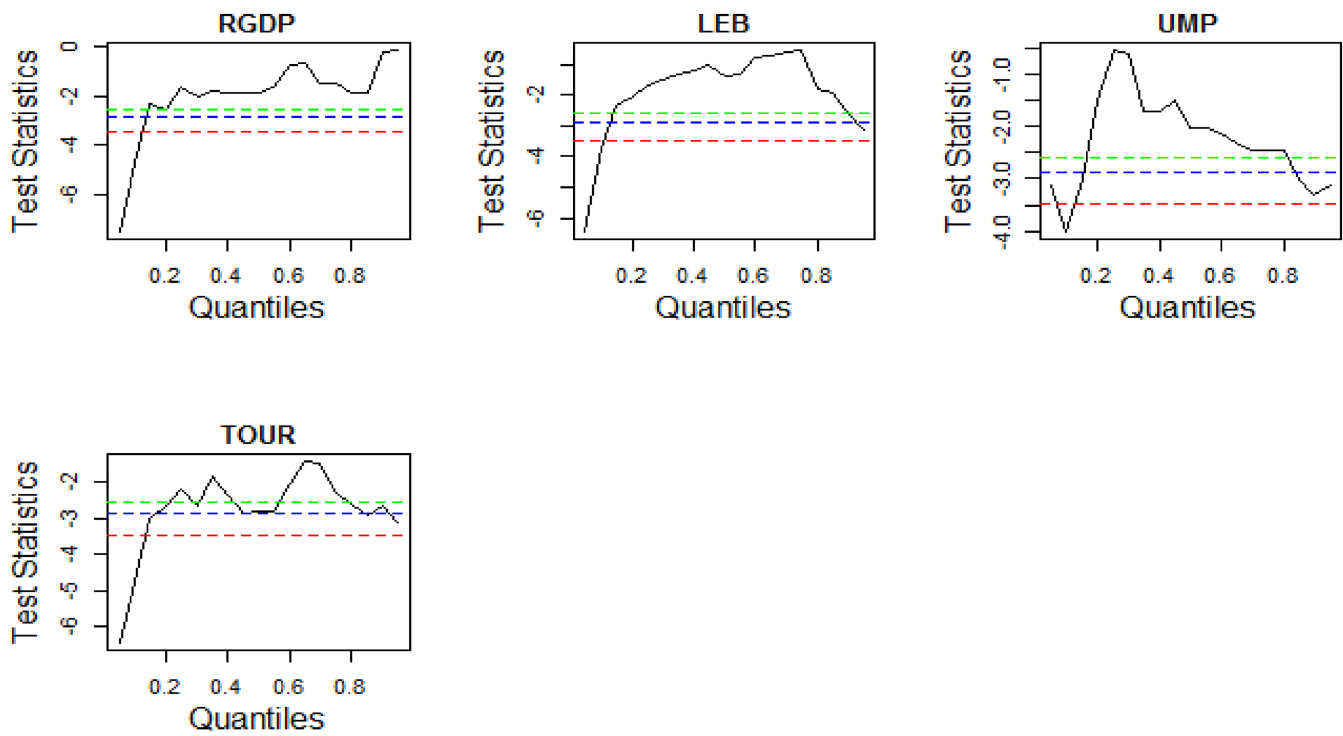


FIGURE 4 | QPP unit root test. The green, blue, and red lines signify the critical thresholds of -2.58 , -2.89 , and -3.49 , which correspond to the significance levels of 10%, 5%, and 1%, respectively.

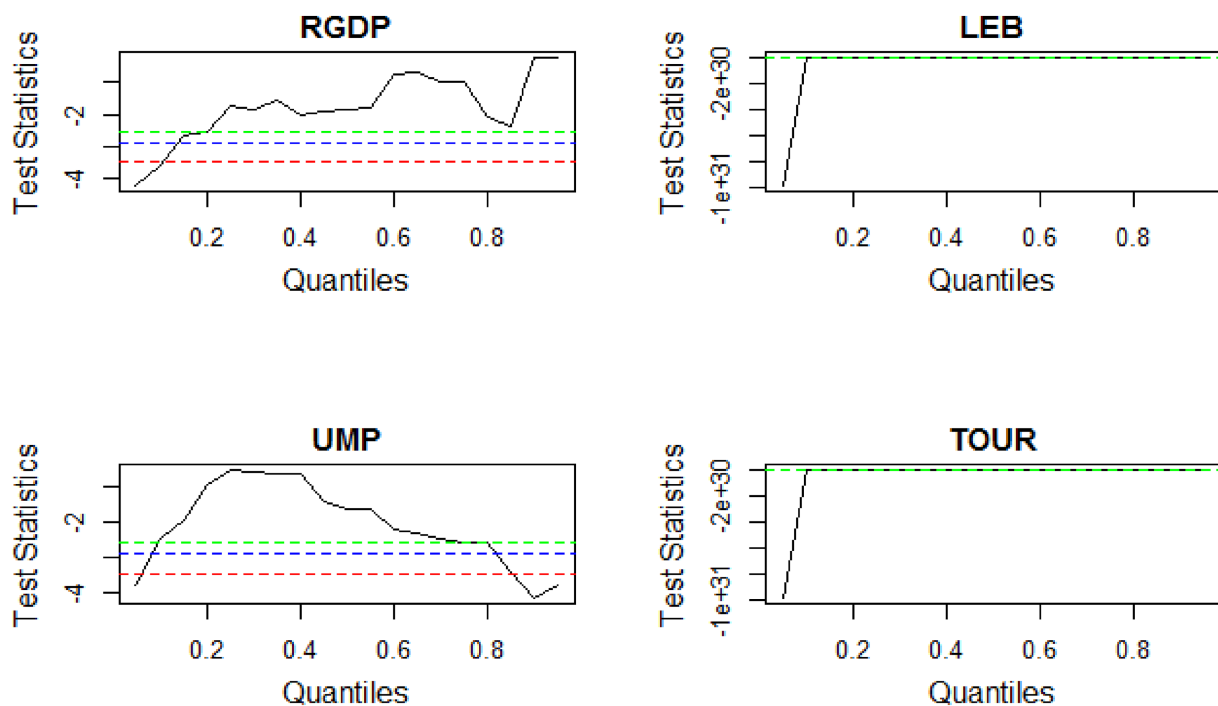


FIGURE 5 | QADF unit root test. The green, blue, and red lines signify the critical thresholds of -2.58 , -2.89 , and -3.49 , which correspond to the significance levels of 10%, 5%, and 1%, respectively.

affect life expectancy. Economic growth can lead to increased public and private spending on healthcare, education, and social services, which contribute to higher life expectancy. As economies grow, they tend to invest more in improving the quality of life for their populations, leading to longer and healthier lives (Arora 2021; Weil 2021). Therefore, it is depicted as thus: (RGDP $\leftrightarrow$ LEB). There is a bidirectional relationship, but with different

directions of impact. While tourism negatively affects RGDP, potentially due to economic vulnerabilities or high infrastructure costs, economic growth positively influences tourism by increasing people's capacity to travel and enhancing the country's tourism appeal (Hartwig 2021). Therefore, it is depicted as thus: (RGDP $\leftrightarrow$ TOUR). There is a unidirectional relationship where higher unemployment rates negatively impact economic growth.

TABLE 3 | ARDL bounds test.

Test statistic	Value	K
F-statistic	5.949*	3
Significance level	I(0) bounds	I(1) bounds
10%	2.37	3.2
5%	2.79	3.67
2.50%	3.15	4.08
1%	3.65	4.66

Note: *Indicates 10% significance rejection level. **Denotes 5% significance rejection level. ***Denotes 1% significance rejection level.

TABLE 4 | ARDL estimator.

Short run		
Variable	Coefficient	T-statistic
$\Delta \ln(\text{RGDP}(-1))$	0.0167	5.2671**
$\Delta \ln(\text{TOUR})$	4.0542	-0.1942**
$\Delta \ln(\text{UMP})$	-0.0596	-1.1407
$\Delta \ln(\text{LEB})$	0.7782	0.4787**
$\text{ECM}(-1)$	-0.1775	-2.3256**
Long run		
Constant	32.9822	0.6864
$\ln \text{RGDP}$	0.4291	0.0411**
$\ln \text{TOUR}$	0.0808	0.0019***
$\ln \text{UMP}$	-0.3581	0.3244
$\ln \text{LEB}$	0.6378	0.0003***

Note: ** and *** indicate statistical significance at the 5% and 1% levels, respectively. This shows that the results are highly reliable, with *** representing the highest level of confidence in the findings.

Higher past values of unemployment significantly negatively impact RGDP, suggesting that high unemployment rates reduce economic output because fewer people are employed and contributing to economic production. High unemployment can lead to lower consumer spending, reduced aggregate demand, and slower economic growth (Bloom, Canning, and Sevilla 2020). However, economic growth does not significantly reduce unemployment in the short term, suggesting that structural labor market reforms might be necessary to translate economic growth into job creation (Layard, Nickell, and Jackman 2021).

5 | Conclusion and Policy Recommendations

5.1 | Conclusion

Focusing on Japan, the study evaluates the connectedness among life expectancy, unemployment, tourism, and economic growth in Japan, using data from 1995 to 2024 to evaluate the

TABLE 5 | Diagnostic tests.

	F-statistics	p
Ramsey RESET	0.954	(0.915)
ARCH	0.262	(0.615)
Harvey	0.655	(0.756)
Serial correlation	0.659	(0.431)
Correlogram Q-sta.	7.388	(0.117)
Correlogram squared-sta.	3.631	(0.458)

connectedness among the selected variables adopting econometrics techniques.

The study employs a three-stage analysis technique: (i) Bounds test (ii) long-run and short-run dynamics (ARDL testing method), and (iii) Granger causality technique. The empirical findings of the study are: (i) statistical support for the presence of a long-run co-integration connection among all of the variables of interest. The result of ARDL regression shows that the nexus between unemployment and economic growth is negatively and statistically insignificant in the short run whereas tourism, life expectancy, and economic nexus are statistically significant in the short run and long run. The conditional causality technique reveals bidirectional causation among economic growth, inbound tourism, and life expectancy. We posited bidirectional causality from tourism to RGDP; however, results show bidirectional causality from tourism to RGDP. We expected an inverse and significant relationship between unemployment and RGDP.

5.2 | Policy Recommendations

Based on the conclusions drawn from this study, several policy recommendations are made to optimize the interconnectedness among life expectancy, unemployment, tourism, and economic growth in Japan. The following policy recommendations are designed to leverage these insights to foster sustainable economic development:

- Prioritize investments in tourism infrastructure, including transportation, accommodation, and tourist attractions. Improved infrastructure will enhance the overall tourist experience and increase inbound tourism. Increase funding for international marketing campaigns to promote Japan as a premier tourist destination. Collaborate with private sector partners to create attractive travel packages and highlight cultural, historical, and natural attractions.
- The authority should ensure equitable access to healthcare services across all regions. Implement policies that reduce healthcare costs and improve the quality of medical care. Launch nationwide public health campaigns focused on preventive care, healthy lifestyles, and early detection of diseases. Encourage regular health check-ups and vaccinations.
- The governments should develop and implement job creation programs, particularly in the tourism and healthcare

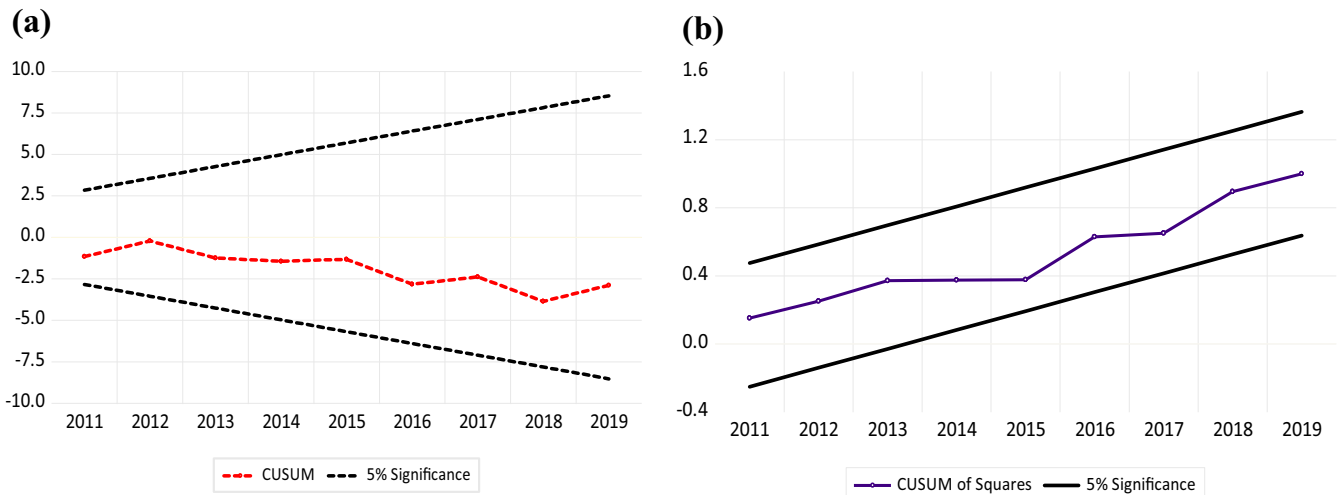


FIGURE 6 | (a) CUSUM (b) CUSUMSQ.

TABLE 6 | Conditional Granger causality.

Endogenous variable	$\ln \text{RGDP}_{t-i}$	$\ln \text{LEB}_{t-i}$	$\ln \text{TOUR}_{t-i}$	$\ln \text{UMP}_{t-i}$	ECT_{t-i}
$\Delta \ln \text{RGDP}$	—	0.0141 (0.0249)**	−5.9708 (0.001)***	−3.0789 (0.000)***	−0.0776 (0.0052)***
$\Delta \ln \text{LEB}$	1.8155 (0.0119)***	—	1.7232 (0.0000)	−3.725 (0.6549)	−0.014 (0.0244)**
$\Delta \ln \text{TOUR}$	1.0208 (0.0063)***	−0.0016 (0.0548)*	—	0.1244 (0.0933)	−0.2438 (0.3910)
$\Delta \ln \text{UMP}$	−0.0193 (0.3891)	−0.0111 (0.2043)	1.1055 (0.0427)	—	−1.1594 (0.5295)

*Rejection level of 10% level of significance.

**Rejection level of 5% level of significance.

***Rejection level of 1% level of significance.

sectors, which are shown to positively impact economic growth. Invest in education and vocational training programs to equip the workforce with skills relevant to emerging industries. Encourage lifelong learning and continuous professional development.

- Provide financial support and incentives for small and medium-sized enterprises (SMEs) to foster innovation and entrepreneurship. SMEs play a crucial role in diversifying the economy and creating jobs. Increase investment in research and development (R&D) to spur innovation and technological advancement. Encourage public–private partnerships to leverage resources and expertise.

5.3 | Limitations and Suggestions of Future Study

The use of specific econometric models, like the ARDL approach, although robust, has limitations. These models assume linear relationships between variables, which may not capture the complexities and nonlinearities in the dynamics of tourism, life expectancy, and unemployment. Additionally, the study relies on data from a specific period, meaning economic conditions,

policies, and external factors such as global crises can affect the relationships between the variables, limiting the generalizability of the findings. The focus on Japan, while providing detailed insights, restricts the applicability of the results to other regions with different economic structures and cultural contexts. The study primarily considers tourism, life expectancy, and unemployment, excluding factors like technological advancements, education, political stability, and environmental changes that also impact economic growth.

Employing advanced econometric techniques to handle nonlinearities and interactions between variables can yield deeper insights. Exploring methods such as nonlinear ARDL, machine learning algorithms, or structural equation modeling is recommended. Comparative studies across different countries or regions can help identify common patterns and unique differences, enhancing the generalizability of the findings and providing insights into how different contexts influence the studied relationships. Including additional variables like technological innovation, education, political stability, and environmental sustainability will provide a more comprehensive understanding of the factors driving economic growth.

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Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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