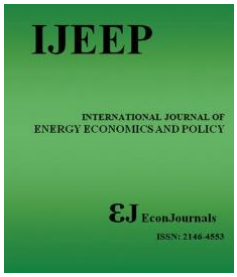


**International Journal of Energy Economics and Policy**

ISSN: 2146-4553

available at http: www.econjournals.com

**International Journal of Energy Economics and Policy, 2026, 16(1), 672-681.**

# Examining the Interconnections Among Tourism, Energy Consumption, Environmental Pollution, and Economic Growth in the Fragile Five Countries: A Panel Quantile Regression Analysis

**Aissulu Nurmambekovna Ramashova[1], Rakhman A. Alshanov[2], Nazym Zhunusbekova[3], Aizhan Urinbasarovna Abishova[1], Nalima Sartanova[4], Karlygash Sovetovna Baisholanova[5]*, Aida Mazhidovna Dauzova[6], Kundyz Myrzabekkyzy[7]**

[1]M.Auezov South Kazakhstan University, Shymkent, Kazakhstan, [2]Turan University, Almaty, Kazakhstan, [3]Satbayev University, Almaty, Kazakhstan,[4]Akhmet Baitursynuly Kostanay Regional University, Kostanay, Kazakhstan, [5]Al-Farabi Kazakh National University, Almaty, Kazakhstan, [6]Almaty Humanitarian-Economic University, Almaty, Kazakhstan, [7]Khoja Akhmet Yassawi International Kazakh-Turkish University, Turkestan, Kazakhstan. *Email: baisholanova@yandex.kz

**Received:** 14 June 2025 **Accepted:** 12 October 2025 **DOI:** https://doi.org/10.32479/ijeep.21385

**ABSTRACT**

This study examines how the relationship between economic growth and tourism revenues, energy intensity, and $CO_2$ emissions in the Fragile Five countries (Brazil, Indonesia, India, South Africa, and Turkey) varies across different growth regimes using Panel Quantile Regression. The analysis utilizes data from 1995 to 2023, which includes metrics such as GDP growth rate, the share of international tourism revenues in exports, energy intensity (measured in kg of oil equivalent/$1,000 of GDP with a constant 2021 PPP), and $CO_2$ emissions, all retrieved from the World Bank. Cross-sectional dependence was assessed using the Breusch-Pagan LM test, while stationarity was evaluated with the second-generation CIPS test, and appropriate level or difference transformations were applied. The findings indicate that tourism revenues have a positive and statistically significant effect on growth in the lower quantile (25%), with a borderline significant positive effect observed in the median quantile (50%). Energy intensity negatively and significantly impacts growth in both the lower (25%) and upper (75%) quantiles, highlighting that productivity constraints are obvious in both low- and high-growth regimes. Additionally, $CO_2$ emissions exhibit a positive and significant relationship with growth in the upper (75%) quantile, suggesting that increases in emissions are associated with economic booms during periods of rapid expansion. Overall, by emphasizing distribution-sensitive heterogeneities that linear approaches based on average effects may overlook, this study underscores the need for quantile-specific policy designs. These policies should aim to support tourism demand and employment in low-growth regimes while focusing on energy efficiency and cleaner production technologies in high-growth contexts. The conclusion is that tourism contributes to growth in certain regimes; energy intensity remains a persistent constraint; and managing the relationship between emissions and growth is crucial for sustainability during high-growth phases.

**Keywords:** Fragile Five, Economic Growth, Tourism Revenues, Energy Consumption, Environmental Pollution, $CO_2$ Emissions, Panel Quantile Regression

**JEL Classifications:** C13, C20, C22

## 1. INTRODUCTION

The increased volatility in the global financial landscape since 2008 has underscored the sensitivity of emerging economies to external financing conditions, bringing the concept of the "Fragile Five" into focus. "Fragility" refers to an economy's vulnerability to both internal and external shocks. Macro-level sources of fragility include deficiencies in trade and financial liberalization, macroeconomic instability, and structural weaknesses within the financial system (Reinhart and Rogoff, 2009; Frankel and

Saravelos, 2012). In this context, the expansionary monetary and fiscal policies enacted following the 2008 Global Financial Crisis created substantial international liquidity. However, signals from the US Federal Reserve (FED) indicating a reduction in asset purchases in 2013 triggered capital outflows from emerging economies (Eichengreen and Gupta, 2016).

As a result of these developments, Morgan Stanley identified the five countries most adversely affected by tightening external funding conditions as the "Fragile Five": Brazil, Indonesia, India, South Africa, and Turkey (Lord, 2013). These countries share several common characteristics, including high current account deficits, elevated inflation rates, volatile growth, and a heavy reliance on external financing. Their currencies are particularly susceptible to rapid depreciation in response to global shocks. Moreover, financial markets in these nations tend to react synchronously to FED policies and periods of uncertainty (Chadwick, 2019). The integration of global capital markets has further heightened the vulnerability of these economies to external shocks (Obstfeld and Taylor, 2004).

The tangible effects of this fragility were clearly observed in exchange rate movements in 2013, where the South African rand depreciated by 14.4% against the US dollar, the Turkish lira by 9.9%, the Indian rupee by 12.1%, and the Brazilian real by 7.6%. This co-movement indicates that expectations regarding FED tightening are quickly reflected in the asset prices and fund flows of developing countries, with fragility indicators exerting simultaneous pressure through financial channels (Badkar, 2014; Chadwick, 2019).

Country profiles reveal that common vulnerabilities manifest in different combinations across various nations. Brazil, the largest economy in Latin America, has shown a structure sensitive to Federal Reserve cycles under a floating exchange rate regime. In 2023, Brazil's growth is projected to be 2.91%, with a per capita income of approximately US$9,200 and a debt-to-GDP ratio around 83% (World Bank, 2025). While liberalization and privatization efforts have curtailed hyperinflation, they have also heightened external fragility, with the financial and industrial sectors serving as primary transmitters of economic shocks (Baer, 2008; Jurkowska et al., 2024). Indonesia is anticipated to grow by 5.05% in 2023, with a per capita income of US$4,240 and a debt-to-GDP ratio of 39%. Significant exchange rate depreciation and monetary policy errors post-2013 have worsened its economic fragility. Furthermore, the recent low interest rate and low monetary growth approach have driven inflation close to 3% (BPS, 2024; IMF, 2024; World Bank, 2025). India is expected to achieve a growth rate of 7.69% in 2023, raising its per capita income to approximately US$2,230. Despite its robust service sector and dynamic private sector, high population density has limited per capita income growth (World Bank, 2025; IMF, 2024). The literature emphasizes the synchronized responses of financial markets to uncertainties from the Federal Reserve (Chadwick, 2019). South Africa's export structure is heavily reliant on precious metals, heightening its economic fragility. In 2023, growth is expected to be around 0.6%, with a per capita income of about US$6,000 and a debt-to-GDP ratio of 74% (World Bank, 2025; IMF, 2024). After the expansionary policies of the pandemic, inflation and exchange rate pressures have persisted, making financial channels more prominent in the transmission of economic shocks across different sectors (Jurkowska et al., 2024). Meanwhile, Turkey is projected to grow by 4.5% in 2023, with a per capita income of approximately US$12,850 and a debt-to-GDP ratio of 35%. Its dependence on energy imports and intermediate goods remains a significant factor contributing to the current account deficit (World Bank, 2025; IMF, 2024). Due to its sensitivity to the Federal Reserve and reliance on external financing, Turkey is included on both the "Old" and "New" Fragile Five lists (Amaro, 2017).

The overall fragility framework is influenced by key macroeconomic indicators such as the current account deficit to GDP ratio, external debt, public borrowing requirements, and inflation rates (Frankel and Saravelos, 2012). Between 2008 and 2021, the current account balances of these nations exhibited a fluctuating yet fragile trend (Eichengreen and Gupta, 2016). Additionally, the distinction between the "New Fragile Five" (Turkey, Argentina, Pakistan, Egypt, and Qatar), defined by S&P in 2017, highlights increased reserve adequacy and rising external financing costs, underscoring the persistence of Turkey's fragility (Amaro, 2017).

Understanding the macrofinancial background of the Fragile Five requires considering the cyclicality of capital flows, sensitivity to policy regimes, and the dynamics of external balance. Real and sustainability indicators, such as tourism, energy consumption, and environmental pollution, are directly influenced by these macroeconomic conditions through the interactions of exchange rates, interest rates, inflation, and current account balances. Thus, examining the relationship between economic growth and environmental as well as energy indicators in this group of countries using panel quantile regression provides an empirically robust approach. This method is effective in revealing the heterogeneous policy sensitivities and vulnerabilities across different segments of the economic distribution, particularly at the extremes.

Addressing the determinants of economic growth in the Fragile Five requires a collaborative analysis of the asymmetries and structural dependencies highlighted in the literature. Findings related to Central Asia suggest that the asymmetric relationship between oil prices and agricultural and industrial production significantly influences stability (Aidarova et al., 2024; Baisholanova et al., 2025). Additionally, the effects on growth through energy consumption, renewable energy use, and foreign trade indicators indicate that vulnerability to shocks increases with high energy dependence (Abdibekov et al., 2024). The volatility between energy companies and gold and oil prices shows that price fluctuations can be transmitted to the real sector through financial channels, thereby impacting growth and the dynamics of energy consumption and environmental emissions (Sultanova et al., 2024; Sabenova et al., 2024). Panel studies reveal that structural elements, such as employment, natural resource revenues, and foreign direct investment, are key drivers of growth (Baimaganbetov et al., 2019; Baimagambetova et al., 2025). Furthermore, the connections established with sustainable

development and environmental indicators underscore the environmental aspect of fragility (Pirmanova et al., 2025). In this context, examining the effects of tourism revenues, energy consumption, and environmental pollution on growth in the Fragile Five using a panel quantile regression approach is appropriate. This approach captures the direction and magnitude of marginal effects across different segments of the growth distribution (low-, medium-, and high-growth regimes), thereby revealing asymmetric and heterogeneous responses. Such a framework is especially useful for distinguishing between sensitivities that arise in extreme situations (e.g., lower quantiles during recession/crisis and upper quantiles during rapid expansion) and for identifying potential threshold and nonlinear relationships, as well as conditional interactions within the tourism-energy-emissions triad. This analysis allows policymakers to identify factors that increase vulnerability in low-growth quantiles (such as energy intensity, emission pressure, and tourism revenues sensitive to exchange rate shocks) and those that support growth in higher quantiles (including renewable energy transition, energy efficiency, and high-value-added tourism). Consequently, this enables the design of quantile-specific and targeted policy initiatives, such as green investment incentives, energy efficiency standards, tourism product diversification, and carbon management.

## 2. LITERATURE REVIEW

Obstfeld and Taylor (2004) systematically examine the long-term integration dynamics of global capital markets, crisis episodes, and their impact on growth and policy constraints within a historical framework. The authors describe the evolution of capital mobility during "two waves of globalization" (the late 19$^{th}$ century to 1914 and the period post-1970s), measuring the depth of financial integration with indicators such as savings-investment correlations, deviations from interest rate parity, and current account dynamics. Their main conclusion is that the international macroeconomy functions under a "trilemma," which indicates that it is only possible to maintain two out of the following three options at the same time: full capital mobility, a fixed exchange rate, and an independent monetary policy. This finding demonstrates that the frequency and severity of crises are closely linked to institutions, exchange rate regimes, and the financial regulatory framework. In the absence of a credible circulation regime and a robust policy framework, growth that relies on external financing generates fragility. Through long-term data analysis, the book illustrates the potential for both "beneficial discipline" and "harmful instability" of capital flows. It serves as a foundational reference for contemporary literature arguing that prudent macroprudential measures, flexible exchange rate policies, reserve buffers, and institutional strengthening are crucial for enhancing resilience to external shocks and reducing crisis susceptibility in emerging economies, such as the Fragile Five.

Frankel and Saravelos (2012) systematically evaluate the predictive power of "early warning" indicators in explaining differences in country-level exposure to the 2008-2009 global crisis. The candidate variables were determined based on a comprehensive meta-review of over 80 early warning literature sources. Crisis severity was operationalized using six dependent variables: contraction in real GDP, industrial production, stock returns, nominal exchange rate depreciation, international reserve depletion, and applications for International Monetary Fund programs. Cross-sectional regressions and extensive robustness analyses against multiple measures of crisis severity demonstrate that pre-crisis reserve adequacy (especially the reserve stock from 2007) is consistently and statistically significantly negatively associated with crisis severity. In contrast, real exchange rate overvaluation shows positive and significant relationships with exchange rate pressure and output losses. Although alternative sample definitions, weighting schemes, and sensitivity analyses support the stability of these findings, the explanatory power of other indicators - such as the current account deficit, credit expansion, and short-term external debt-remains limited and context-sensitive when reserve adequacy and real exchange rate misalignment are considered in the model. The results suggest that external buffers (reserves) and relative price competitiveness (real exchange rate) should be prioritized in policy as the primary determinants of external fragility.

The concept of "Fragile Five" was introduced by Lord (2013) in a Morgan Stanley FX Pulse note, which provides an early warning framework designed to identify the common macro-financial vulnerabilities of Brazil, India, Indonesia, South Africa, and Turkey. The note emphasizes that persistent current account deficits, high and sticky inflation, slowing growth dynamics, and excessive reliance on short-term portfolio inflows (especially in fixed-income securities) create vulnerabilities through exchange rates, particularly in response to shifts in U.S. monetary policy and contractions in global risk appetite. The 2013 "taper tantrum" episode exemplifies a contextual shock that emphasized these vulnerabilities. In this context, exchange rate pressure and tightening financial conditions in these economies have been empirically documented as mechanisms that progress alongside the deterioration of external financing conditions, varying in intensity across countries. This concept later became established in academic and policy literature as an acronym for the risk of "unstable externally financed growth," associated with the thesis that high external financing requirements combined with low reserve buffers significantly increase susceptibility to global interest rate shocks.

Amaro (2017) noted that in 2017, S&P Global Ratings reclassified the most vulnerable economies to global interest rate hikes and monetary tightening, labeling them as the "new Fragile Five" consisting of Turkey, Argentina, Pakistan, Egypt, and Qatar. He pointed out that this revision marked a structural departure from Morgan Stanley's traditional 2013 set of Brazil, India, Indonesia, Turkey, and South Africa (BIITS). Amaro highlights high external financing requirements, dynamics of current account deficits, and susceptibility to global interest rate shocks as the primary determinants of fragility. He emphasizes that rising borrowing costs in emerging markets can exacerbate these vulnerability channels. This list and justification have been echoed in various media reports, confirming the sensitivity of this group to policy transmission mechanisms (exchange rates, interest rates, capital flows), particularly in a rising interest rate environment. In this context, Amaro's study provides evidence supporting the

assumption that interactions among tourism, energy consumption, environmental pressures, and growth, within the context of the Fragile Five, create a fragile environment sensitive to external financing conditions.

Chadwick (2019) analyzes the relationship between U.S. monetary policy (specifically, the Federal Reserve's policy rate) and monetary policy uncertainty (measured by the MOVE index) in connection with exchange rates and equity markets in the "Fragile Five" and "Troubled Ten" countries. This analysis employs time-varying copula models using daily data from 1995 to 2017. The study's findings, which utilize MSCI indices and nominal exchange rate series, indicate that this relationship fluctuates over time, strengthening and weakening periodically. It becomes particularly pronounced during periods of market stress and local crises in the late 1990s. Moreover, the dependence dynamics between foreign exchange and equity markets exhibit differences across countries. While the study highlights varied patterns across nations, it also reveals that sensitivity to U.S. monetary policy and uncertainty in the post-global crisis period is not consistently higher than in previous times. These results underscore the duration and regime-dependent nature of how external shocks transmit through financial channels and the significance of designing macroprudential and flexible policies.

Wu et al. (2022) investigate the causal relationship between global economic policy uncertainty (GEPU) and tourism activities within the Fragile Five countries (Brazil, India, Indonesia, South Africa, and Turkey) using a three-dimensional wavelet approach. This methodology operates in the time-frequency-scale domain, allowing the separation of non-linear and regime-dependent dependencies. It reveals the simultaneity and lead-lag relationships between variables, as well as the duration-sensitive nature of causality (short, medium, and long-run). The findings indicate that shocks in GEPU establish a transmission channel influencing tourism, with variations over time and frequency. Notably, during periods of heightened uncertainty, the effects are stronger in the short and medium term, particularly during crisis or stress phases, and exhibit significant heterogeneity across countries. The study also identifies reciprocal interactions, suggesting that tourism dynamics can impact economic uncertainty through the confidence channel. The authors argue that maintaining policy stability and predictability can mitigate the negative effects of uncertainty on tourism. They emphasize the need for a policy mix, complemented by market and product diversification, resilience-focused destination management, and macroprudential frameworks in tourism to lessen the impact of shocks in fragile economies.

Guo et al. (2023) employ a bootstrapped panel quantile regression approach to examine the effects of natural resource abundance on economic growth at a global scale, particularly in the context of the "resource curse" hypothesis. This method captures the heterogeneity of coefficients across different segments of the conditional growth distribution (lower, middle, and upper quantiles), revealing regime-dependent and scale-selective relationships that may be obscured by linear average effects. The bootstrapped inference enhances the reliability of estimates by minimizing small sample bias and sensitivity to parametric assumptions. The findings indicate that the relationship between natural resource revenues and economic growth varies significantly across quantiles. Specifically, the negative impact of resource intensity on growth is more pronounced in lower growth quantiles, while in higher quantiles, the effects may weaken or even reverse when accompanied by efficient institutions, diversified production structures, and human capital accumulation. By testing the robustness of these findings through sensitivity analyses and alternative variable sets (e.g., the composition of resource rents and variations in macroeconomic control variables), the study demonstrates the inadequacy of uniform policy recommendations. For lower quantiles, it suggests implementing resource management frameworks that enhance institutional capacity, transparency, and fiscal rules. In contrast, for higher quantiles, it recommends channeling resource revenues into human capital, innovation, and competitive diversification. These quantile-focused insights provide a unique perspective on the relationship between resource abundance and economic growth, taking into account country-specific conditions and cyclical regimes.

Hoque et al. (2023) empirically examine how trade policy uncertainty (ITPU) spills over into the stock markets of the Fragile Five economies: Brazil, India, Indonesia, South Africa, and Turkey. The study investigates the interaction between ITPU and stock market returns and volatility within a spillover/connectedness framework. It also reveals the transmission channels of uncertainty shocks to capital markets. The findings indicate that trade policy-induced uncertainty has a significant and lasting impact on stock markets, particularly during periods of heightened global volatility (risk-off periods), with varying effects across countries. The authors emphasize a twofold message for policymakers: (i) Ensuring predictability and clarity in trade policies can reduce financial fragility, and (ii) Utilizing macroprudential tools and regulations to enhance market depth can help limit the contagion effects of uncertainty shocks on the stock market. This study systematically documents how uncertainty-driven shocks propagate through financial channels in the context of the Fragile Five, underscoring the importance of country-specific variations and regime-dependent effects for effective policy design.

Jurkowska et al. (2024) analyze sector-based risk transmission and the role of the global volatility index (VIX) in shock propagation within the Fragile Five using a time-varying parameter VAR (TVP-VAR) framework. By dynamically mapping the "source-transmitter-receiver" relationships of the VIX with indices from the Energy, Financials, Industrials, Basic Commodities, and Real Estate sectors, the study tracks the evolution of connectedness across countries and time. The results show that two-way transmission between the VIX and sector indices remains weak across all countries, resulting in a relatively low average Total Connectedness Index (TCI). This suggests that, despite underlying exposures between the US and the F5 stock markets, the VIX can present a neutral role in inter-sectoral stress transmission. Variations within the sectoral network reveal that shock transmission channels are sensitive to both regime and

time, indicating that sector-specific vulnerability profiles should be taken into account in policy design aimed at enhancing market stability. The study confirms the method's ability to capture crisis spillovers at a high resolution through time-varying dependency measures and documents that external volatility shocks (the VIX) have limited and heterogeneous effects at the sectoral level in F5 economies.

Alqaralleh et al. (2025) examine the direction, magnitude, and regime dependence of the relationship between tourism and economic growth using a Panel Quantile ARDL (PQARDL) framework. This approach allows for simultaneous estimation of both asymmetric (positive/negative tourism shocks) and quantile-specific (low-, medium-, and high-growth quintiles) effects. The method decomposes increases and decreases in tourism indicators using partial sums (NARDL logic) and provides a heterogeneous specification of short- and long-run coefficients across different segments of the conditional growth distribution. The study reveals threshold, scale, and regime effects that have been overlooked by linear single-mean models. Following appropriate diagnostic steps for the panel structure - considering unit roots, cointegration, cross-sectional dependence, and heterogeneity - the authors report quantile-based long and short-run elasticities and causality patterns. They demonstrate significant differences across quantiles, highlighting that the effects of tourism shocks on growth can be asymmetrical in both sign and magnitude. The study provides quantile-specific implications, emphasizing that uniform tourism strategies at the policy level may not be equally effective across all economic cycles. For example, in low growth quantiles, employment and demand incentives that reduce vulnerability are more beneficial, while in higher quantiles, strategies focused on productivity growth, diversification, and resilience are more appropriate.

## 3. METHODS

Panel Quantile Regression (PQR) is a framework that allows for the simultaneous examination of the effects of explanatory variables at different cross-sections (lower, middle, and upper quantiles) of the conditional distribution of the dependent variable. While classical panel approaches typically focus on relationships around the conditional mean, this method reveals heterogeneity across units and periods by capturing marginal effects that vary across the distribution (Koenker and Bassett, 1978). This feature provides analytical advantages, particularly in areas characterized by structural diversity and regime dependence, such as economic growth, income distribution, and financial fragility.

In fixed-effect panel quantile regressions, the multiplicity of individual effects can complicate the establishment of parameter increments and asymptotic properties. To address this issue, Canay (2011) proposed a two-stage estimation procedure that decomposes fixed effects through an appropriate transformation. This approach enables the attainment of consistent and asymptotically normally distributed coefficients. Similarly, Kato et al. (2012) developed asymptotic results that offer reliable inference under certain regularity conditions, addressing the challenges associated with increasing parameter size. More recently, Galvao et al. (2024) tested the validity of resampling (bootstrap) techniques in panel quantile regression, demonstrating that these methods enhance the reliability of inference, particularly regarding standard errors and test statistics. Collectively, these contributions establish panel quantile regression as a methodologically powerful and preferable tool for studies seeking to isolate the effects of variables across different cyclical regimes.

## 4. DATA AND FINDINGS

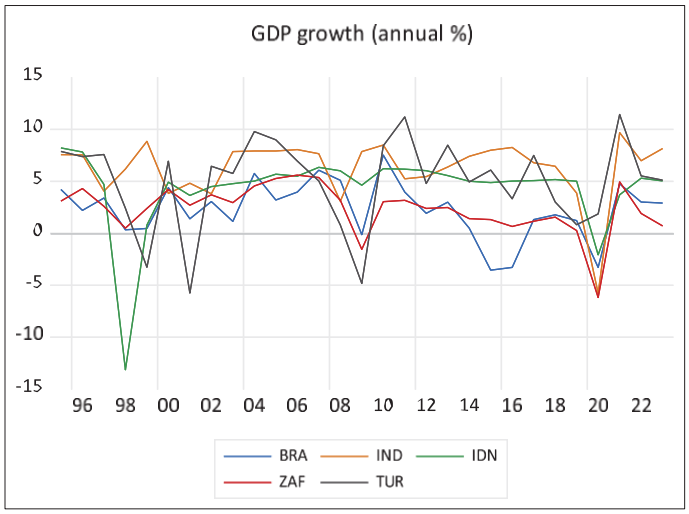
The Fragile Five represents a group with diverse economic and social structures due to their geographical locations. Creating a common set of macroeconomic indicators that influence economic growth within such a heterogeneous group is a challenging process. This study investigates the impact of energy consumption, tourism revenue (revenue from foreign tourists), and environmental pollution on economic growth. The quantile regression approach, favored as an econometric method, is expected to yield significant results, particularly since it reveals the impacts of the independent variables across different percentiles. The study used the ratio of tourism and energy consumption to national income, with economic growth represented as the annual change in national income. The research period spans from 1995 to 2023, and data were obtained from https://data.worldbank.org (Access date: April 1, 2025). Brief definitions and sources of the variables are provided in Table 1.

Table 2 shows a clear hierarchy and asymmetry when comparing the growth distributions of the Fragile Five (BRA, IDN, IND, TUR, ZAF). The ranking in terms of average growth is as follows: IND (6.2919) > TUR (4.9886) ≈ IDN (4.3314) > ZAF (2.3365) ≈ BRA (2.2903). This indicates that India experienced a faster growth trend during the period, while Turkey and Indonesia followed a moderate trend. In contrast, Brazil and South Africa exhibited slower growth rates. The mean for the entire sample is 4.0477, and the median is 4.7626. The fact that the minimum and maximum values range from -13.1267 to 11.4394 suggests considerable volatility in the distribution. Extreme values indicate different risk profiles across the countries: Indonesia experienced the sharpest contraction at -13.1267, while Turkey recorded the largest single increase at 11.4394. The standard deviation for volatility is high for TUR (4.3095) and IDN (3.8432), while IND's value of 2.9072 suggests a relatively narrower spread. The skewness coefficients are negative in all countries (e.g., IDN -3.5123; IND -2.5673; ZAF -1.5478), indicating that the distributions are concentrated in the left tail, meaning that downward shocks are more "pronounced" and likely. Kurtosis values are particularly pronounced in a leptokurtic manner for IDN (16.1362) and IND (11.2616), highlighting that growth performance is sensitive to rare but significant shocks due to the high probability of tail congestion and over-observation. The standard deviation of 3.6116 at the aggregate level (All) emphasizes within-group heterogeneity, while the median being higher than the mean (4.7626 > 4.0477) aligns with the finding of negative skewness. In the aggregate assessment, the distributions are asymmetric; the downward tail risks necessitate distribution-sensitive frameworks in policy design that are more cautious than approaches relying solely on the "average effect."

Graph 1 illustrates the GDP trends over time for each country. A comparison of the curves indicates that India and Turkey experienced a higher and more sustained growth rate throughout the period, while Brazil and South Africa showed a shallower and flatter growth trajectory. Indonesia's data, on the other hand, is marked by significant fluctuations, including sharp declines and rapid recoveries at short intervals. A common feature across these series is the sudden disruptions caused by global shocks, accompanied by attempts to return to equilibrium, leading to a wide range of oscillations around long-term averages. This visual representation supports the conclusion that volatility is high in Turkey and Indonesia, whereas India's growth rhythm is relatively stable. Conversely, Brazil and South Africa exhibit slow growth and limited acceleration.

Table 3 reveals that the proportion of tourism revenue in exports varies by country. Based on average values, Brazil ranks highest (≈10.01%), followed closely by India (≈9.95%). Indonesia sits in the middle (≈9.72%), while Turkey (≈9.56%) and South Africa (≈9.53%) have lower percentages. When examining the relationships between the median, mean, and skewness coefficients, it becomes evident that the distributions for Indonesia and India are negatively skewed, indicating that low shares are occasionally more pronounced. Brazil's slightly positive skewness and flatter (platykurtic) distribution suggest that its data oscillates closer to the center rather than being concentrated at the extremes. In terms of volatility, measured by standard deviation, India has the highest (≈0.35), followed by Brazil (≈0.29) and Indonesia (≈0.27). Turkey (≈0.20) and South Africa (≈0.21) exhibit more limited volatility. Extreme values reinforce each country's profile: Brazil has the overall maximum (≈10.47), while Indonesia has the overall minimum (≈8.67). With a very high kurtosis (≈8.67), Indonesia displays a distribution prone to tail accumulation and extreme observations, whereas India shows a similar but more limited leptokurtic pattern. The overall data (All) is nearly symmetrical (skewness ≈ 0) and has a near-normal kurtosis (≈3.15). This indicates that while average country differences present a more orderly picture, significant heterogeneity exists across nations.

**Graph 1:** The time path graph for the GDP variable




Graph 2 enables side-by-side analysis of the LOGINTRTE variable, which represents the share of international tourism revenues in exports over time by country. Visually, Turkey and Brazil tend to stay in the upper range, displaying distinct peak-trough cycles. India and Indonesia, despite a declining trend, also experience short-term and sharp episodes of volatility. In contrast, South Africa is characterized by a relatively low level and a more subdued pattern. All series show sudden breaks that coincide with periods of heightened global shocks, followed by gradual normalization. This suggests that although fluctuations occur around the mean, tail risks are evident. Rapid directional changes, particularly in Turkey and Indonesia, confirm the high

**Table 1: Research variables and sources**

| Code | Country | Variable | Description | Source |
|---|---|---|---|---|
| BRA | Brazil | GDPGR | GDP growth (annual %) | https://data.worldbank.org |
| IDN | Indonesia | LOGINTRE | International tourism, receipts (% of total exports) | https://data.worldbank.org |
| IND | India | $CO_2$ | (Total) excluding LULUCF (Mt $CO_2e$) | https://data.worldbank.org |
| TUR | Turkey | ENGC | Energy use (kg of oil equivalent)/$1,000 GDP (constant 2021 PPP) | https://data.worldbank.org |
| ZAF | South Africa | | | |

**Table 2: Descriptive statistics for the GDP variables**

| Country | Mean | Median | Maximum | Minimum | Standard deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| BRA | 2.2903 | 2.9085 | 7.5282 | −3.5458 | 2.6884 | −0.5154 | 3.1217 |
| IDN | 4.3314 | 5.0331 | 8.2200 | −13.1267 | 3.8432 | −3.5123 | 16.1362 |
| IND | 6.2919 | 7.4102 | 9.6896 | −5.7777 | 2.9072 | −2.5673 | 11.2616 |
| TUR | 4.9886 | 5.7632 | 11.4394 | −5.7500 | 4.3095 | −0.9502 | 3.4848 |
| ZAF | 2.3365 | 2.6000 | 5.6038 | −6.1689 | 2.3688 | −1.5478 | 6.9121 |
| ALL | 4.0477 | 4.7626 | 11.4394 | −13.1267 | 3.6116 | −1.2671 | 6.3191 |

**Table 3: Descriptive statistics for the LOGINTRTE variables**

| Country | Mean | Median | Maximum | Minimum | Standard deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| BRA | 10.0102 | 9.9613 | 10.4663 | 9.5225 | 0.2906 | 0.0485 | 1.7331 |
| IDN | 9.7231 | 9.7338 | 10.0787 | 8.6738 | 0.2733 | −2.0311 | 8.6681 |
| IND | 9.9533 | 10.0824 | 10.3854 | 9.1979 | 0.3525 | −0.7345 | 2.3473 |
| TUR | 9.5550 | 9.6040 | 9.8099 | 9.0370 | 0.2004 | −0.7534 | 2.8194 |
| ZAF | 9.5288 | 9.5350 | 9.8422 | 8.9875 | 0.2058 | −1.2480 | 4.4563 |
| ALL | 9.7541 | 9.7170 | 10.4663 | 8.6738 | 0.3328 | −0.0146 | 3.1491 |

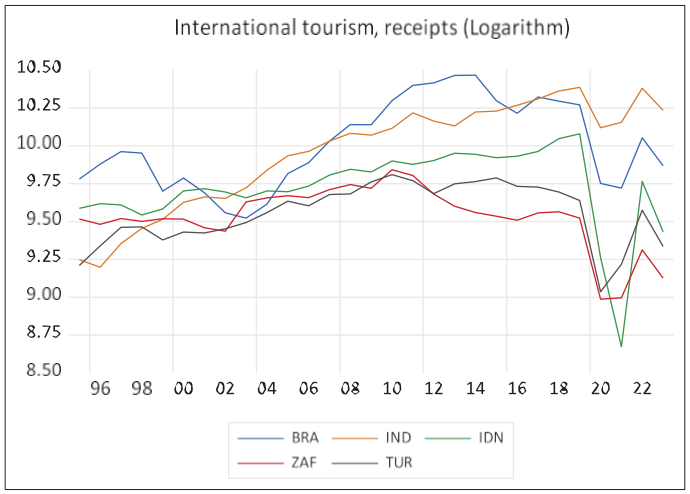
sensitivity of these series to shocks and their significant volatility in terms of standard deviation. Brazil and South Africa display limited acceleration, while India maintains a more regular rhythm. Overall, the findings suggest that the Fragile Five share common vulnerabilities, especially in the tourism-export nexus, but these vulnerabilities vary in severity and duration across countries.

Table 4 presents descriptive statistics (mean, median, minimum-maximum values, standard deviation, skewness, and kurtosis) for $CO_2$ emissions among the Fragile Five, both individually and collectively. Comparisons of means and medians reveal that India has the highest emissions, while Indonesia, South Africa, and Brazil cluster in the middle, with Turkey positioned lower. Volatility indicators show that India exhibits the widest ranges and standard deviations, indicating more significant fluctuations, while Indonesia experiences moderate fluctuations, and Turkey, Brazil, and South Africa have more limited variations. This suggests that India'' emissions data drives the total variation in both level and variance. The skewness coefficients reveal that the distribution of $CO_2$ emissions is right-skewed for India, Indonesia, and Turkey, indicating a right-tailed structure. In contrast, South Africa and Brazil exhibit a left-tailed structure. Additionally, the kurtosis values at the country level show platykurtic characteristics compared to the norm. In the overall analysis, significant right skewness and high kurtosis - resulting from the pooling effect - suggest that cross-country differences amplify tail risks at the aggregated level. These findings indicate that $CO_2$ emissions display a heterogeneous pattern in terms of both level and volatility within the Fragile Five. Therefore, it is advisable to prioritize distribution-sensitive and country-specific assessments rather than average-focused approaches in policymaking and analysis.

Graph 3 presents a country-by-country comparison of $CO_2$ emissions over time in the Fragile Five countries. When examining the levels and slopes of the curves, it is evident that India consistently has the highest emissions, accompanied by a steeper upward trend. Indonesia shows significant fluctuations in the middle range, while Brazil and South Africa maintain a relatively flat trajectory with minimal acceleration. Turkey demonstrates a more stable trend at the lowest level of emissions. Although common cyclical movements and simultaneous inflection points (characterized by sudden declines followed by gradual recoveries) are notable across these countries, the increasing concentration of emissions in the upper tail over time, along with the persistence of level differences among the countries, indicates the influence of country-specific structural dynamics (such as energy mix, industrial composition, and demographic pressures). The observed visual patterns suggest heterogeneous volatility and differences in slopes across the panel. Therefore, it is advisable to employ distribution-sensitive methods (e.g., quantile-based analysis) and inferences that account for heteroskedasticity, rather than relying solely on individual average effects. Additionally, recognizing persistent country-level differences in policy interpretations is crucial to avoid misleading generalizations about the pooled trends.

Table 5 provides descriptive statistics for the ENGC indicator (measured in kilograms of oil-equivalent energy use/$1,000 GDP at constant 2021 PPP), reflecting energy intensity in the Fragile Five countries at both individual and aggregate levels. Comparisons of means and medians indicate that South Africa has the highest energy intensity (mean ≈180.37; median ≈177.58), followed by India (≈107.42; ≈105.30). Indonesia (≈79.49), Brazil (≈77.64), and Turkey (≈69.69) are clustered in a lower range, indicating higher energy use and lower energy efficiency. The

**Graph 2:** The time path graph for the LOGINTRTE variable




**Graph 3:** The time path graph for the $CO_2$ emissions variable

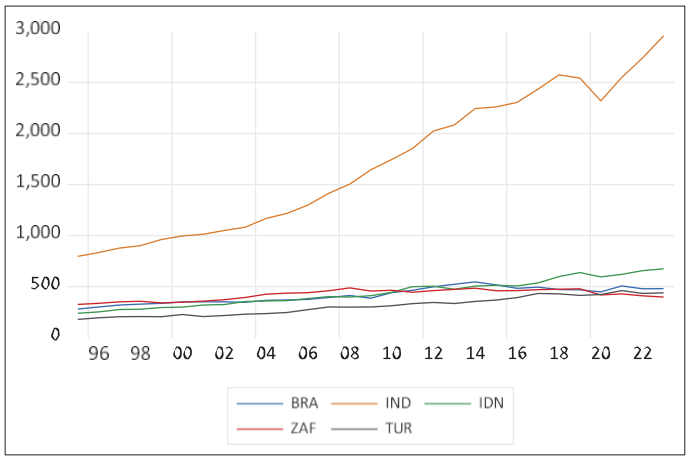



**Table 4: Descriptive statistics for the $CO_2$ emissions variables**

| Country | Mean | Median | Maximum | Minimum | Standard deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| BRA | 416.4724 | 412.7003 | 546.1498 | 279.9611 | 76.1871 | −0.0325 | 1.7010 |
| IDN | 438.5198 | 411.3744 | 674.5359 | 239.1030 | 130.6913 | 0.2296 | 1.8866 |
| IND | 1702.4160 | 1643.0650 | 2955.1820 | 796.4639 | 682.0278 | 0.2017 | 1.6045 |
| TUR | 310.1476 | 301.3618 | 460.6554 | 178.3690 | 90.4313 | 0.1629 | 1.6343 |
| ZAF | 421.0603 | 436.2792 | 487.9087 | 325.1993 | 51.8857 | −0.4930 | 1.8039 |
| ALL | 657.7232 | 438.3156 | 2955.1820 | 178.3690 | 611.4009 | 2.2142 | 6.8880 |

minimum-maximum ranges are widest in South Africa (≈140.69-228.23) and noticeably broader in India and Indonesia. In contrast, Brazil shows a narrower range (≈73.71-80.79), suggesting greater stability, while Turkey has less variability (≈53.95-79.12). Consistent with these findings, the standard deviation is highest in South Africa (≈26.76), followed by India (≈18.16) and Indonesia (≈12.01). Turkey (≈7.10) and Brazil (≈1.78) demonstrate limited volatility. The skewness of the distribution is positive (indicating a right tail) for Indonesia, India, and South Africa, while it is negative (indicating a left tail) for Turkey and Brazil. The kurtosis values generally indicate a near-normal to platykurtic distribution (≈1.55-2.76) on a country-by-country basis, although a higher right skewness (≈1.35) and kurtosis (≈3.71) are notable in the aggregate data due to the pooling effect. In summary, the table illustrates significant heterogeneity in energy intensity, characterized by high and fluctuating energy use in South Africa and India, while Brazil and Turkey reflect lower and more stable energy intensity. Thus, it is recommended to prioritize distribution-sensitive and country-specific assessments over average-focused analyses in policy and comparative studies.

Graph 4 presents a country-by-country comparison of the ENGC indicator (measured in kg of oil equivalent/$1,000 GDP at constant 2021 PPP), which reflects energy intensity in the Fragile Five countries. When examining the levels and slopes of the curves, it is evident that South Africa occupies the highest band, exhibiting wide fluctuations throughout the chart. India follows, maintaining a lower yet still relatively high level of energy intensity with significant volatility. Indonesia and Brazil fall into a middle band; Indonesia shows intermittent sharp oscillations, while Brazil exhibits a shallower and more stable trend. Turkey is positioned in the lowest band with a relatively narrow range of volatility. Notably, during common shock periods across these countries, simultaneous breaks (short-term jumps or declines) occur; however, the distance between the bands remains largely consistent over time, highlighting persistent level differences. This pattern suggests that country-specific structural factors - such as energy mix, industrial composition, and productivity dynamics - play a significant role. Given the visual pattern's heterogeneous volatility and slope differences, it is advisable to utilize methods robust to heteroskedasticity and distribution-sensitive approaches (e.g., quantile-based) that also account for potential structural breaks, rather than relying solely on average effects for conclusions. In policy discussions, it is more appropriate to consider improvements in energy efficiency and sectoral transformation priorities on a country-by-country basis, rather than generalizing from pooled trends.

Table 6 presents the findings of the cross-sectional dependence and unit root tests for the research series. Cross-sectional dependence was assessed using the Breusch-Pagan LM test, confirming dependence across all four variables. Consequently, the CIPS test - a second-generation unit root test - was employed to examine the stationarity of the series. The results indicated that the GDPGR and ENGCC variables are stationary at the level, while the LOGINTRE and $CO_2$ variables are stationary at the first difference. Based on these findings, the first differences of these variables were utilized in further analysis.

Panel quantile regression results for the influence of environmental pollution, energy consumption, and tourism revenues on economic growth are summarized in Table 7.

**Graph 4:** The time path graph for the ENGC variable

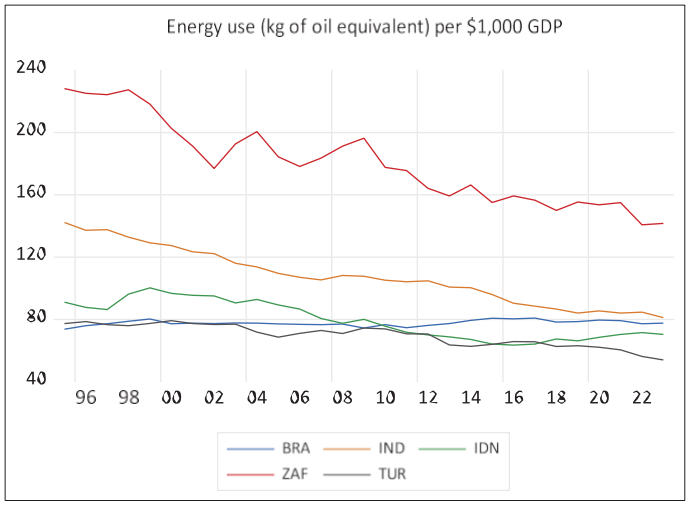



**Table 5: Descriptive statistics for the ENGC variables**

| Country | Mean | Median | Maximum | Minimum | Standard deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| BRA | 77.6398 | 77.3453 | 80.7899 | 73.7081 | 1.7817 | −0.1003 | 2.7584 |
| IDN | 79.4885 | 77.4651 | 100.2539 | 63.4806 | 12.0075 | 0.2236 | 1.5456 |
| IND | 107.4239 | 105.3045 | 142.2426 | 81.0793 | 18.1641 | 0.3020 | 2.0387 |
| TUR | 69.6918 | 70.9751 | 79.1192 | 53.9498 | 7.0989 | −0.4762 | 2.1693 |
| ZAF | 180.3734 | 177.5760 | 228.2322 | 140.6895 | 26.7571 | 0.4053 | 2.0647 |
| ALL | 102.9235 | 80.5644 | 228.2322 | 53.9498 | 43.7684 | 1.3456 | 3.7107 |

**Table 6: The cross-sectional dependence and unit root test results for the research series**

| Variable code | Cross-section dependence (Breusch-Pagan LM) | | Level (CIPS unit root test) | | 1st difference (CIPS unit root test) | |
|---|---|---|---|---|---|---|
| | t-statistics | P | t-statistics | P | t- statistics | P |
| GDPGR | 54.35219 | 0.0000 | −3.63201 | <0.01 | | |
| LOGINTRE | 103.9992 | 0.0000 | −2.04981 | ≥0.10 | −3.34646 | <0.01 |
| $CO_2$ | 205.1501 | 0.0000 | −2.05309 | ≥0.10 | −4.19662 | <0.01 |
| ENGC | 145.8511 | 0.0000 | −2.45635 | <0.05 | | |

**Table 7: Panel quantile regression model results**

| Variables | Quantiles | Coefficients | Std. error | t-value | Pr(>\|t\|) |
|---|---|---|---|---|---|
| $\Delta CO_2$ | 0.25 | 0.01851 | 0.01322 | 1.40027 | 0.16385 |
| | 0.50 | 0.00794 | 0.01557 | 0.50985 | 0.61103 |
| | 0.75 | 0.03131 | 0.01844 | 1.69822 | 0.09010 |
| ΔLOGINTRE | 0.25 | 3.49381 | 1.70175 | 2.05307 | 0.04210 |
| | 0.50 | 1.92636 | 1.17285 | 1.64246 | 0.10295 |
| | 0.75 | 1.44789 | 1.62024 | 0.89363 | 0.37320 |
| ΔENGC | 0.25 | −0.19434 | 0.09252 | −2.10063 | 0.03764 |
| | 0.50 | −0.11153 | 0.07935 | −1.40542 | 0.16232 |
| | 0.75 | −0.13887 | 0.06903 | −2.01184 | 0.04634 |

When assessing the impact of energy consumption on economic growth, it is found that energy consumption has a negative and significant effect on economic growth at the 25% and 75% quantile levels. However, this negative effect is not statistically significant at the 50% level.

In contrast, the effect of tourism revenues on economic growth is positive and significant at the 25% quantile level, with a positive effect also observed at the 50% quantile level at the 10% significance level. This finding highlights the positive impact of low to moderate levels of tourism revenue on economic growth.

Regarding environmental pollution's impact on economic growth, it is observed that it has a positive and significant effect at the 75% quantile level. This suggests that high levels of environmental pollution can also indicate economic vitality for the Fragile Five countries.

## 5. CONCLUSION AND RECOMMENDATIONS

This study analyzed the effects of energy consumption, tourism revenues, and environmental pollution on economic growth in the Fragile Five countries using the panel quantile regression method. Unlike traditional panel regression models, this approach allows for the examination of independent variables across different growth quantiles (low, medium, and high growth periods). As a result, the findings provide a more detailed understanding of the determinants of economic growth in these countries. One of the key findings is the cross-sectional dependence of environmental pollution among the Fragile Five countries. This suggests that these countries may share similar socioeconomic structures despite being in different geographical regions. The empirical results indicate that energy consumption has a negative impact on economic growth across all growth levels. This might indicate a dependence on foreign energy sources or a lack of synchronization between economic growth and energy consumption. Regarding tourism revenues, the results show a positive and significant effect at the 25% quantile level, and a positive effect at the 50% quantile level with a 10% significance level. This suggests that tourism can contribute to the economy at certain growth levels. While the structural contribution of the tourism sector to economic growth in the Fragile Five countries is limited, it can become significant during specific periods. In terms of environmental pollution, the model indicates that its effect is limited (with a significance level of 10%) during periods of high growth (75% quantile). However, this positive effect underscores the need for a thorough investigation of the relationship between environmental pollution and economic growth in the Fragile Five countries. Future research could explore the social and political attitudes of these countries regarding environmental pollution or analyze the impact of environmental pollution on economic growth alongside various macroeconomic indicators.

## REFERENCES


Abdibekov, S.U., Gridneva, Y.E., Kaliakparova, G.S., Amankeldi, N.A., Perneyeva, G.A., Kulbay, B.S., Myrzabekkyzy, K. (2024), The relationship between energy consumption, agricultural and ındustrial production, and economic growth: ARDL border value approach in the case of Kazakhstan. International Journal of Energy Economics and Policy, 14(3), 79-86.

Aidarova, A.B., Ramashova, A.N., Baisholanova, K., Jaxybekova, G., Imanbayev, A., Kenzhebekova, I., Kelesbayev, D. (2024), Relationship between oil price, ınflation, and economic growth in BRICS countries: Panel cointegration analysis. International Journal of Energy Economics and Policy, 14(6), 24-31.

Alqaralleh, H., Alsarayreh, A., Alsaraireh, A. (2025), The asymmetric relationship between tourism and economic growth: A panel quantile ARDL analysis. Economies, 13(4), 97.

Amaro, S. (2017), Turkey is Still in the 'Fragile Five' but it's Got Company. CNBC. Available from: https://www.cnbc.com/2017/11/06/these-are-now-the-5-most-fragile-countries-exposed-to-higher-interest-rates-according-to-sp.html Available from: https://data.worldbank.org [Last accessed on 2025 April 01].

Badkar, M. (2014), The Fragile Five: Here's What's Happening In The Five Emerging Markets Causing Chaos in World Markets. Available from: https://www.businessinsider.com/heres-how-the-fragile-five-are-doing-2014-1 [Last accessed on 2016 Jan 10].

Baer, W. (2008), The Brazilian Economy: Growth and Development. 6th ed. Boulder, CO: Lynne Rienner.

Baimaganbetov, S., Kelesbayev, D., Yermankulova, R., Izzatullaeva, B., Almukhambetova, B. (2019), Effects of oil price changes on regional real income per capita in Kazakhstan: Panel data analysis. International Journal of Energy Economics and Policy, 9(4), 356-362.

Baimagambetova, L., Baibulekova, L., Aliyeva, Z.T., Aidarova, A.B., Mashirova, T., Balapanova, E., Nurpeissova, A., Bolganbayev, A. (2025), Analysis of the effects of energy consumption, employment, mining, natural resource income, and foreign direct ınvestments on economic growth in the central asian turkic republics using panel causality tests. International Journal of Energy Economics and Policy, 15(3), 204-213.

Baisholanova, K.S., Dauzova, A.M., Kazan, H., Myrzabekkyzy, K., Tazhibayeva, R.M., Sarsenova, A.E., Utebayeva, Z.A., Nurgabylov, M. (2025), Asymmetric relationship between oil prices, agricultural production, and ındustrial production in Kazakhstan: Application of the NARDL method. International Journal of Energy Economics and Policy, 15(4), 465-471.

BPS (Badan Pusat Statistik - Statistics Indonesia). (2024), Indonesia's Economy in 2023 Grew by 5.05 Percent (y-on-y) [Press Release]. Available from: https://www.bps.go.id/en/pressrelease/2024/02/05/2379/indonesia-s-economy-in-2023-grew-by-5-05-percent-y-on-y-.html

Canay, I.A. (2011), A simple approach to quantile regression for panel data. The econometrics journal, 14(3), 368-386.

Chadwick, M.G. (2019), Dependence of the "Fragile Five" and "Troubled Ten" emerging market financial systems on US monetary policy and monetary policy uncertainty. Research in International Business and

Finance, 49, 251-268.
Eichengreen, B., Gupta, P. (2016), Managing Sudden Stops (Policy Research Working Paper No. 7639). World Bank. Available from: https://hdl.handle.net/10986/24213 [Last accessed on 2025 April 01].
Frankel, J., Saravelos, G. (2012), Can leading indicators assess country vulnerability? Evidence from the 2008-09 global financial crisis. Journal of International Economics, 87(2), 216-231.
Galvao, A.F., Parker, T., Xiao, Z. (2024), Bootstrap inference for panel data quantile regression. Journal of Business and Economic Statistics, 42(2), 628-639.
Guo, Y., Wong, W.K., Su, N., Ghardallou, W., Gavilan, J.C.O., Uyen, P.T.M., Cong, P.T. (2023), Resource curse hypothesis and economic growth: A global analysis using bootstrapped panel quantile regression analysis. Resources Policy, 85, 103790.
Hoque, M.E., Soo-Wah, L., Uddin, M.A., Rahman, A. (2023), International trade policy uncertainty spillover on stock market: Evidence from fragile five economies. The Journal of International Trade and Economic Development, 32(1), 104-131.
International Monetary Fund (IMF). (2024), World Economic Outlook: Steady but Slow - Resilience Amid Divergences. IMF. Available from https://www.imf.org/en/publications/weo/ıssues/2024/04/16/world-economic-outlook-april-2024 [Last accessed on 2025 Apr 01].
Jurkowska, A., Ozcelebi, O., Fijorek, K. (2024), Stock market TVP-VAR dynamic connectedness and VIX shocks spillovers: Evidence from a sectoral analysis of the fragile five. International Entrepreneurship Review, 10(1), 97-126.
Kato, K., Galvao, A.F. Jr., Montes-Rojas, G.V. (2012), Asymptotics for panel quantile regression models with individual effects. Journal of Econometrics, 170(1), 76-91.
Koenker, R., Bassett, G. Jr. (1978), Regression quantiles. Econometrica: Journal of the Econometric Society, 46, 33-50.
Lord, J. (2013), EM Currencies: The Fragile Five (Global Outlook), Morgan Stanley Research. Available from: https://www.morganstanley.com/institutional/research/pdf/FXPulse_20130801.pdf
Obstfeld, M., Taylor, A.M. (2004), Global Capital Markets: Integration, Crisis, and Growth. Cambridge: Cambridge University Press.
Pirmanova, Z., Niyazbekova, R., Yerekeyeva, S., Sabenova, B., Isatayeva, G., Abuov, K., Bolganbayev, A. (2025), An analysis on the connection between sustainable development and per capita greenhouse gas emissions, PM2.5 exposure, and renewable energy consumption in Kazakhstan using the nonlinear cointegration (NARDL) method. International Journal of Energy Economics and Policy, 15(5), 246-254.
Reinhart, C.M., Rogoff, K.S. (2009), This Time is Different: Eight Centuries of Financial Folly. United States: Princeton University Press.
Sabenova, B., Talimova, L., Kanabekova, M., Zhakipbekova, D.S., Seitova, G., Maulenkulova, G.E., Bolganbayev, A. (2024), The relationship between the return of Energy companies listed on the Kazakhstan stock exchange and the exchange rate, KASE index, and gold return: ARDL bounds value approach. International Journal of Energy Economics and Policy, 14(5), 131-140.
Sultanova, Z., Pazilov, G.A., Baibulekova, L., Kassymbekova, G., Lukhmanova, G., Issayeva, G., Myrzabekkyzy, K. (2024), Comparative analysis of the volatility structures of the stock prices of energy companies traded on the Kazakhstan stock exchange and international gold and oil prices. International Journal of Energy Economics and Policy, 14(1), 21-30.
World Bank. (2025), GDP Growth (Annual %), GDP Per Capita (Current US$) and Central Government Debt, Total (% of GDP). World Development Indicators. Available from https://data.worldbank.org/indicator/ny.gdp.mktp.kd.zg?locations=TR [Last accessed on 2025 April 01].
Wu, T.P., Wu, H.C., Liu, S.B., Wu, C.F., Wu, Y.Y. (2022), Causality between global economic policy uncertainty and tourism in fragile five countries: A three-dimensional wavelet approach. Tourism Recreation Research, 47(5-6), 608-622.