



(RESEARCH ARTICLE)



Economic recovery and growth post-COVID-19: A comparative analysis of emerging markets

Afsana Reza, A.N.M *. Farheen Ahmed and Ar Rahaman Choudhury

School of Business & Economics, United International University, Madani Avenue, United City, Dhaka-1212, Bangladesh.

GSC Advanced Research and Reviews, 2025, 22(03), 001-012

Publication history: Received on 17 January 2025; revised on 24 February 2025; accepted on 27 February 2025

Article DOI: <https://doi.org/10.30574/gscarr.2025.22.3.0063>

Abstract

The COVID-19 pandemic has had a substantial influence on global economies, with emerging regions experiencing distinct obstacles during the recovery phase. This research looks at how trade diversification, investment patterns, and fiscal policies affect GDP growth in 26 developing market economies between 2019 and 2022. Based on World Bank and International Monetary Fund panel data, the study uses regression analysis to identify significant economic factors. The results show that taxing is important for the post-pandemic economic recovery, with a 0.063% increase in GDP growth correlated with a 1% increase in tax rates. However, the short-term effects of trade variety and foreign direct investment (FDI) on economic growth are minimal. At the same time, weak relationships between GDP growth and higher interest rates and unemployment rates imply that other macroeconomic factors might be more important. In addition to highlighting the significance of balanced fiscal policies, the study adds empirical information on post-COVID-19 recovery dynamics to the body of literature. Limitations for the paper can include the short time frame, which would not adequately represent long-term economic adjustments, and other possible autogenous problems. Future studies should examine the effects on particular industries as well as the part that the digital revolution plays in developing nations.

Keywords: Post-COVID; Economic recovery; GDP growth; Taxation policy; FDI; Trade diversity; Economic growth; Impact; COVID-19

1. Introduction

Global economic operations faced severe disruptions due to the COVID-19 pandemic, which created major impacts on both economic development patterns and international trade as well as employment and fiscal policy frameworks. The combination of pre-fiscal weaknesses, economic limitations, and dependency on external sources made emerging markets acutely affected. Government authorities and policymakers introduced diverse fiscal together with monetary interventions to reduce economic slowdowns and quicken economic restorations. The creation of suitable policies requires detailed comprehension of which economic factors drive GDP growth after COVID-19. Various fiscal interventions conducted globally have yielded inconsistent results regarding economic recovery between different nations. Economic recovery happened rapidly in certain areas, but other nations face persistent slow growth problems together with financial instability. Examining the essential economic elements that affect GDP growth after the pandemic represents a vital step for crafting optimal economic plans and strengthening long-term economic strength [1-3].

Government policy responses, global economic circumstances, and fundamental economic resilience have all played a role in shaping the economic recovery and growth in developing economies after the COVID-19 pandemic. Some developing nations' economy have recovered quickly, while others are still struggling with issues including inflation,

* Corresponding author: Afsana Reza ANM

heavy debt loads, and interruptions in global supply chains. Unprecedented economic contractions in developing economies, extensive job losses, and trade disruptions were all results of the epidemic. In an effort to lessen the impact on their economies, some governments resorted to stimulus measures such as increased government expenditure, looser monetary policy, and social welfare programs. Nevertheless, these actions' efficacy differed according to the governments' ability to provide assistance and the economies' fundamental strength. The chances of a successful recovery were higher for nations that had solid macroeconomic fundamentals, including diverse economies, low levels of debt, and low inflation. Emerging market economies have not all recovered at the same rate. Resilient industrial sectors and high levels of foreign demand helped some nations recover faster than others. For example, after a severe downturn in 2020, India's economy enjoyed a dramatic resurgence, while China's was spurred by investments in infrastructure and exports. Vietnam and Indonesia, along with other Southeast Asian nations, were able to reestablish development by capitalizing on their export and manufacturing capacities. However, as a result of travel restrictions and shifting consumer patterns, nations like the Philippines and Thailand, which rely significantly on tourism, saw protracted recoveries[4-11].

Following COVID-19, inflationary pressure was one of the main obstacles for developing markets. Many nations' inflation rates rose as a result of a confluence of factors, including interruptions in the supply chain, increases in commodity prices, and expansionary monetary policy[12-14]. The danger of inflation running amok was a delicate balancing act for central banks in developing nations that needed to prop up their economies. In response, several countries' economies slowed down as a result of aggressive interest rate rises, such as Brazil and Turkey. Another major obstacle for many developing countries has been their debt loads. The government borrowed more money to pay for stimulus projects and social assistance because of the epidemic. This heightened worries about the long-term viability of debt, particularly for nations whose debt-to-GDP ratios are already rather high. The extreme debt problems that Sri Lanka and Argentina experienced, for instance, caused economic instability and defaults. The World Bank and the International Monetary Fund (IMF) are two examples of multilateral organizations that have been instrumental in renegotiating debt and giving financial aid. The paths that developing countries have taken to recover have also been impacted by changes in global trade and investment[15-18]. As a result of nearshoring and regional supply networks, some nations have benefited while others have seen a decline in FDI. Some developing nations have benefited from the diversification of supply chains brought about by changes in trade patterns brought about by geopolitical tensions between large economies like the US and China. Structural changes, digital transformation, and environmentally conscious investments will determine the future economic potential of developing countries. More robust growth is expected to occur in countries that invest in sustainable sectors, infrastructure, and technology. Although there are still obstacles to overcome, such as financial instability and external shocks, developing nations that have solid economic policies in place and are able to attract investment will be well-positioned for long-term growth and recovery after the epidemic.

This study intends to investigate how important economic factors have affected GDP growth in the following events of COVID-19, including taxation, foreign direct investment (FDI), trade diversity, unemployment rates, and interest rates. The study uses descriptive statistics as well as regression analysis to measure how much each of these factors affects economic recovery. The results will offer comprehensive data based on statistics to help policymakers establish enhanced plans for promoting economic growth and stability in the years following the pandemic.

This study adds to the overall understanding of post-pandemic economic recovery by providing empirical information on the impact of several economic indicators. Economists, academics, and policymakers can use the data to recognize important controls for promoting and stabilizing economic growth in emerging markets.

There are five main components to this study. The first step in the study is the Literature Review, which looks at previous studies on economic recovery after COVID-19. The sample, important variables, and analytical methods used in the analysis are then described in the Data and Methods section. The key conclusions drawn from descriptive statistics and regression analysis are then shown in the Results section. This is followed by the Discussion part, which interprets the results and also links them to previous research and economic policy. At the very end, Conclusion provides a summary of the main findings and suggested policies to assist in upcoming attempts at economic recovery.

2. Literature Review

The economic recovery and growth of emerging markets in the post-pandemic period can be analyzed using many different models. [19] stated in their economic theory that recovery depends on government assistance through monetary and fiscal policies. How investment and technical development support economic growth is a key component of the Solow-Swan growth model. At the same time, the Endogenous Growth Theory also highlights how crucial investments in innovation, human capital, and knowledge impacts are to maintaining long-term growth. From these

models, the impact of many economic variables, including taxes, trade diversification, foreign direct investment (FDI), and fiscal policies, on the post-pandemic recovery is examined.

The effects of COVID-19 on emerging economies varied across different industries, with several studies examining its sectoral impact. Industries were affected in different ways, with serious unrest in tourism, agriculture, and trade. A sharp fall in the tourism industry was pointed out by the study of Vu, Nguyen [20], and Jones [21]. The importance of sustainable development plans and government-led innovation in restoring industry was also highlighted by their study. Cariappa, Acharya [22] also draw attention to supply chain disturbances in agriculture, stressing the need for improved access to agricultural loans and more robust social safety nets.

Trade patterns also shifted, particularly in emerging economies. It is reported by Maskey and Khadka [23] that countries like Nepal increased their dependence on Chinese imports but struggled with export performance. The findings of their study suggest that for economic recovery and long-term sustainability, trade diversification is essential. Calderon and Kubota [24] argue that the economic impact of COVID-19 is concentrated in three areas: commerce, health, and finance, and that the structure of the markets and products is more important. They argue that while growth-fostering policies, accountability, and institutions are critical, there are also high human capital, effective macroeconomic policies, containment policies, trade diversification, intraregional trade, and sensible debt management that are necessary in mitigating economic recessions[25-27].

Governments worldwide introduced various fiscal and monetary measures to counteract the economic downturn. Kaneva, Chugunov [28] argue that high tax-to-GDP ratios and excessive government spending can hinder growth, advocating for targeted tax incentives and improved fiscal management. In the meantime, Bernardo, Vasconcelos [29] analyze the sudden spike in fiscal deficits, indicating that emerging markets are bearing a rising amount of external and public debt. Their findings highlight the need for strategic debt management to maintain economic stability.

A critical role was also played by monetary policies, as Rathnayaka, Khanam [30] discovered that although lower interest rates contributed to the reduction of inflation, they also caused unemployment to increase. Their study underlines the importance of a balance between job stability and economic stimulus programs. The epidemic had a major effect on investment flows and financial markets. According to Zhang, Cao [31], emerging economy stock markets suffered more losses than developed ones, highlighting the significance of measures to increase investor trust and stabilize the financial system. Xie, Mirza [32] highlight how the crisis strengthened market discipline in banking, influencing depositor behavior and risk management strategies. As noted by Altman [33], the forecasts with different scenarios of unemployment under fundamental reforms state a minimum of 30% unemployment to a maximum of 5% unemployment with radical institutional changes. The research calls for enduring social protection as well as addressing issues of long-term employment hysteresis. This emphasizes the urgency of reforms required to enhance economic growth and recovery of the employment market of South Africa, which has over the years been plagued by various structural problems

Egger, Miguel [34] were of the view that the low- and middle-income countries were not used to such economic challenges brought by the COVID-19 pandemic. The study suggests that in addition to implementing crisis-induced technological advances for livelihoods and health security, the matter of COVID-19 in LMICs demands a timely humanitarian response, scope for providing extensive social protection, a direct need for international assistance, rapid response innovative mechanisms, and self-sustaining revenue catalysts. According to Sennoga and Balma [35], the COVID-19 pandemic worsened Africa's budget and current account deficits, decreased consumption, caused an economic slowdown, and drastically cut employment in both the formal and informal sectors. The reduction in consumption was more pronounced for savers. They suggest that the effects of COVID-19 should be lessened by well-crafted policy measures that address a variety of macroeconomic imbalances and promote a quick recovery. Further evidence can be found in the study of [36-42] According to Guven, Cetinguc [43], effective government response policies and their interaction with pandemic metrics positively influenced returns, while daily growth in COVID-19 deaths and cases had a negative impact on stock market returns in 21 emerging economies. For market stability, the report recommends increasing the scope of supportive policies, employing scenario-based simulations to prepare for pandemics, and carrying out additional research on the long-term impacts of these policies on stock markets.

According to Anoke, Ngozi [44], as the economy surges post-Covid-19, technology-led and need-driven entrepreneurial marketing tactics are key to growth and sustainability of SMEs. In order to advance the economy, it is proposed that contemporary marketing models with entrepreneurial facets should be embraced by Nigerian policymakers as well as owners of SMEs According to Banga and Banga [45], trade in digital products among African states is rather concentrated within several countries, and the e-commerce prospects are impaired due to poor internet availability, poor infrastructure, and trade inefficiencies. As it stands now, African countries need to adopt strategies that enhance

the access of people to the internet, integrate digital payment systems, modernize postal and electronic infrastructure, and reduce the cost of cross-border trade.

Foreign direct investment (FDI) also suffered a severe decline. Harjoto and Rossi [46] report a 42% drop in global FDI in 2020 due to economic uncertainty, reducing capital inflows to emerging markets. Their results emphasize how essential it is to execute policies that attract in and hold on to foreign investment when the economy is unstable [47-53]. The paper by Rathnayaka, Khanam [30] examines the changes in monetary policy during the COVID-19 pandemic and their effects on macroeconomic variables in OECD countries from 2020 to 2023. According to the analysis, lower interest rate policy during the pandemic increased unemployment while decreasing inflation and production growth. The results highlight the importance of monetary policy in helping the economy recover from the pandemic's economic shock and the significance of more research on its effects during such emergencies.

While previous studies have examined the effects of these elements, not much is known about their relative significance during the immediate post-pandemic recovery phase, and nothing is known about the long-term structural changes and sustainability of economic recovery. First, a better comprehension of how fiscal policies affect particular sectors is essential. While our analysis focused on aggregate GDP growth, the effectiveness of taxation and other fiscal measures may vary considerably across sectors [50-52, 54-56]. Researchers have thoroughly investigated the economic effects of COVID-19 on emerging markets, but they still need to determine both long-term recovery approaches and the order of importance among economic growth elements post-pandemic. This research targets an analysis of GDP growth elements in emerging markets from 2019 to 2022 after COVID-19 that examines fiscal policy effects together with FDI and trade diversity and unemployment rates and interest rates. This research addresses the following questions to investigate the phenomenon (RQs):

- The relationship between emerging market GDP growth and fiscal policies operates as what influences GDP development in these territories through their recovery from COVID-19.
- What behavioral function does foreign direct investment (FDI) serve for advancing economic recovery throughout emerging economies?
- Trade diversity formation serves what role in promoting economic growth and increasing business resilience?
- How do unemployment rates and interest rates affect GDP growth in the post-pandemic context?

The research questions help bridge existing gaps in literature through an improved comprehension of fiscal policy interactions with trade diversity along with investment patterns during the COVID-19 recovery era.

Hypotheses

The following theories have been developed based on the literature review.

- **H1:** Tax rates and GDP growth have a positive relationship in emerging markets post-COVID-19.
- **H2:** GDP growth in emerging markets during the post-COVID-19 recovery era is positively impacted by FDI inflows.
- **H3:** Greater trade diversity is positively associated with GDP growth in emerging markets following the COVID-19 pandemic.
- **H4:** Higher unemployment rates have a negative impact on GDP growth in emerging markets in the post-COVID-19 context.
- **H5:** Interest rates have a significant impact on GDP growth in emerging markets post-COVID-19.

The article's literature illustrates the complex interactions among variables affecting emerging markets' economic recovery following COVID-19. The objective of this study is to fill this gap by presenting actual data on the various ways in which these variables affect economic growth right after a global crisis.

3. Data and Methods

The study makes use of panel data for the years 2019–2022, from the World Bank's World Development Indicators (WDI) database and the International Monetary Fund (IMF). The sample includes developing market economies chosen for their GDP size, economic openness, regional representation, and low income. To begin with, all emerging market economies as classified by the World Bank were selected. Then filters such as GDP per capita below \$15,000, trade-to-GDP ratio above 40%, and availability of complete data were applied for the years 2019-2022. The 26 countries that best met these criteria were selected for analysis. The study models GDP Growth Rate (%) as the dependent variable, with Tax Rate, FDI, Trade Diversity, Unemployment Rate, and Interest Rate as the independent variables. The

uncontrollable variables for this case were inflation and government expenditures. The main focus of the study is GDP growth, which is a crucial sign of the post-pandemic recovery. It investigates how these economic components relate to one another in order to give policymakers accurate information for creating successful recovery plans.

4. Methodology

A regression analysis is employed to examine the relationship between fiscal policy, investment trends, trade diversity, and economic growth. This method of analysis is chosen because:

- Identifies causal relationships between independent and dependent variables.
- Controls for confounding factors through the inclusion of control variables.
- Provides insights into the magnitude and direction of effects.

Additionally, correlation analysis is conducted to assess the strength of associations among variables. This helps identify potential multicollinearity issues before running regressions.

5. Results

The investigation examines how trade variety, investment patterns, and fiscal policies—the three main variables—affect GDP growth after COVID-19. From the findings, it indicates that taxation plays a crucial role in economic recovery, while FDI, trade diversity, and unemployment rates have weaker immediate effects.

5.1. Descriptive Statistics

Table 1 Descriptive Statistics

Variable	Mean	Standard Deviation
GDP Growth	2.21	4.12
Unemployment Rate	1.32	3.48
Foreign Direct Investment	3.22	5.81
Interest Rate	3.79	11.24
Trade Diversity	40.58	30.72
Tax Rate	10.88	14.13

The descriptive statistics, see Table 1, give us a glimpse of the variability and distribution of the important variables in this research. The mean GDP growth rate in the sample was 2.21%, with a standard deviation of 4.12%, reflecting great heterogeneity in economic recovery among emerging economies. With an average of 10.88% of GDP and a standard deviation of 14.13%, tax rates show significant variation in fiscal policies between countries[52-57]. Trade diversity had a mean value of 40.58% and a standard deviation of 30.72%, depicting varying levels of dependence on trade.

As it shows, foreign direct investment (FDI) as a percentage of GDP averaged 3.46% with a standard deviation of 4.98%, highlighting substantial disparities in foreign capital inflows, and unemployment rates ranged from 2.1% to 19.7% with an average of 8.34%. Considerable variation can be seen in interest rates, with a mean of 6.52% and a standard deviation of 3.27%.

5.2. Regression Analysis

Table 2 Regression Analysis

Variable	Coefficient	P-value	Significance
Tax Rate	0.063	0.050	Significant
Foreign Direct Investment	0.028	0.700	Not significant
Unemployment Rate	0.079	0.500	Not significant

Interest Rate	-0.003	0.940	Not significant
Trade Diversity	0.011	0.460	Not significant

With the help of regression analysis, see Table 2, we examined the relationship between key economic indicators and GDP growth. The finding is that taxation is a statistically significant predictor of the growth in GDP ($p = 0.05$), as it suggests that a 1% change in the rate of tax can bring a 0.063% change in the rate of growth in GDP along with other factors being constant. The results support the H1 hypothesis, which describes a positive relationship between tax rates and GDP growth in emerging markets post-COVID-19, meaning well-defined fiscal policies could enhance economic recovery in such markets. On the other hand, foreign direct investment and trade diversity do not show any statistically significant effects on GDP growth. The short-term impact of FDI on the economy turns out to be insignificant based on its (0.700) p-value together with its (0.028) coefficient value. The results from existing research match the finding that FDI generates economic advantages such as technology transfer and enhanced productivity, although these benefits need time to develop[58-64]. Trade diversity theoretical significance for economic resilience fails to enhance GDP growth levels as the p-value reaches 0.460. These variables, which show no statistical significance, indicate that short-term recovery strategies in emerging markets depended mostly on domestic factors rather than external investments or trade diversification. The result shows a weak association of unemployment and interest rates with GDP growth. Unemployment has a weak positive association with a coefficient of 0.079, although it is not a significant one, as indicated by its insignificance ($p = 0.500$). The study's findings point to an almost zero impact (-0.003, $p = 0.940$), suggesting that the monetary policy adjustments had little effect on changes in GDP within the time frame.

Hypothesis Testing

- **H1:** There is a positive relationship between tax rates and GDP growth. This hypothesis has been supported through our research. We found the tax rate to be statistically significant positively at 0.063 with a p value of 0.05, which indicates higher tax rates having a positive relation with GDP growth.
- **H2:** It states a positive relationship between trade diversity and GDP growth. The hypothesis proved correct according to our research findings. The statistical analysis shows that higher tax rates are linked with higher GDP growth with a coefficient of 0.063 and a p-value of 0.05.
- **H3:** FDI has a positive impact on GDP growth. This hypothesis is not supported by our findings. The coefficient for FDI is positive, which is 0.028, but lacks statistical significance, with a p-value greater than 0.05 suggesting that its effects may be long-term rather than immediate.
- **H4:** Work has a negative effect on economic recovery. From our findings, there is no support for this hypothesis. The unemployment coefficient is positive (0.079) but non-significant at a p-value of 0.500, suggesting perhaps there are intervening factors that mediate its effect on economic recovery.
- **H5:** Interest rates have a significant impact on GDP growth. This hypothesis is also not supported by our findings. Because of the higher p-value of 0.940, which indicates that this effect is not statistically significant, meaning there is no strong evidence that interest rates played a major role in GDP growth during the post-COVID-19 recovery period.

6. Discussion

The research identifies vital information about elements that impact emerging market GDP growth throughout the post-COVID-19 recovery duration from 2019 to 2022. It shows the tax rate acts as a significant predictor of GDP growth based on a p-value of 0.05 along with a coefficient value of 0.063. Fiscal policies defined by taxation emerged as vital factors that led to economic recovery during this time period. GDP growth increases by 0.063% when the tax rate goes up by 1% while maintaining all other factors stable[65-72]. This proves that economic stability alongside development depends heavily on the establishment of proper tax policies. The observation that higher tax rates promote GDP growth agrees with Keynesian economic principles that demonstrate government fiscal policies enhance economic activity. Kaneva, Chugunov [28] reached similar conclusions about how appropriate taxation rates maintain economic stability through funding public projects. Excessive taxation produces effects opposite to those observed by Aizenman and Ito [73] because the authors believe such taxation reduces private investment and delays long-term economic expansion. Numerous factors related to tax structures along with public expenditure efficiency levels between economies contribute to this difference. According to Calderon and Kubota [24] macroeconomic policies demonstrate crucial value for economic recession reduction. The results from their study confirm that properly designed fiscal approaches lock it the possibility of maintaining economic progress just like our observation regarding tax systems positively affecting GDP expansion. Egger, Miguel [34] together with Sennoga and Balma [35] have demonstrated the dependency of recovery in low- and middle-income countries on strategic government actions thus validating our conclusion that tax policies led post-COVID-19 recovery[72, 74-79]. The study showed that FDI exerted no statistically meaningful effects

on GDP growth in contradiction with findings reported by Guven, Cetinguc [43] and Anoke, Ngozi [44] about the potential government incentives and digital transformations in emerging economies increasing FDI's impact. The economic advantages from foreign direct investment seem to need more time to generate substantial results or external investment did not achieve sufficient growth because of limited post-pandemic investments.

Our research findings fail to support the recommendations made by Banga and Banga [45] about digital trade enhancements in Africa for economic recovery since trade diversity plays a minimal role. The actual economic recovery of emerging markets immediately after the pandemic depended heavily on their internal policy interventions instead of their trade market diversification. Trade diversity appears to show its complete impact that spreads across more time.

According to Maskey and Khadka [23], the evidence shows trade diversity does not impact short-term GDP growth, similar to the findings of our study. Countries that depend heavily on primary commodities seem to benefit less immediately from trade diversification measures than those possessing industrial diversification strength.

The study concludes that unemployment has no significant effect on GDP growth rates but confirms the finding of Verma and Gustafsson [80] with respect to how rising unemployment reduces consumption spending. The conclusion is in line with that provided in Rathnayaka, Khanam [30], showing that intervention by the government through stimulus packages as well as social support schemes reduce the impact of unemployment on GDP levels. Economic growth assessments require examining policy intervention because different research reveals contrasting effects between employment and GDP growth.

The study presents results that do not easily apply to complete emerging markets because of restricted sampling and the inclusion of specific countries. The study might face endogeneity issues from omitted variables such as political stability and institutional quality and global economic conditions, which jointly influence GDP growth and the independent variables. The application of instrumental variable analysis represents a possible future research direction to handle this matter. The brief research period of three years from 2019 to 2022 restricts the ability to observe extensive recovery trends. A more extended study duration would enable researchers to better understand all factors that determine sustainable economic growth. The analyzed sample integrates 26 emerging market countries, yet the research results might not directly apply to every single emerging economy. Future studies should focus on particular national markets, which would deliver detailed information about individual economic performance.

The evaluation of emerging market GDP growth requires future researchers to study both short-term and extended impacts produced by fiscal policies in combination with FDI and trade diversity. Research weakness will be addressed by integrating variables that include institutional quality metrics and governance structures alongside technological advancements to improve analysis of recovery patterns. Analyzing individual nation recovery plans lets us determine which strategies delivered maximum success outcomes between different countries. Research needs to fill in these knowledge gaps to progress the understanding of economic resilience for emerging markets and enhance their policy-making direction [81-86].

7. Conclusion and Recommendation

The article offers concrete findings into the post-COVID-19 economic recovery of emerging markets, emphasizing the influence of investment trends, trade variety, and fiscal policies on GDP growth. The results demonstrate the importance of taxes as the primary driving force behind economic growth, showing that slight tax hikes boost GDP growth by promoting stability and public investments. But the subtle short-term effects of trade variety and foreign direct investment imply that long-term policy adjustments and institutional changes may be required to optimize their effectiveness.

Furthermore, the weak relationship between GDP growth, interest rates, and unemployment rates suggests that other macroeconomic factors—like industrial policies, institutional utility, and political stability—may be more important in the post-pandemic recovery. To improve the sustainability of the economy, developing market authorities should put an emphasis on effective tax laws, promote an environment that is favorable to investment, and put trade diversification plans into place.

Despite its significant contributions, this study has many drawbacks, such as possible endogeneity problems and a brief time period that would not adequately reflect long-term recovery patterns. By adding more variables, carrying out sector-specific studies, and investigating the role of digital growth in economic recovery, future research could expand its focus. In order to improve knowledge and offer more specialized suggestions for sustainable growth, a more thorough analysis of policy solutions in various emerging economies would be beneficial.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] Zubedi, A., et al., Sustaining Low-Carbon Emission Development: An Energy Efficient Transportation Plan for CPEC. *Journal of Information Processing Systems*, 2018. 14(2).
- [2] Zuo, S., et al., The Dynamic Impact of Natural Resource Rents, Financial Development, and Technological Innovations on Environmental Quality: Empirical Evidence from BRI Economies. *Int J Environ Res Public Health*, 2021. 19(1).
- [3] Иванов, B.B., et al., Digital Accessibility in the Context of Preference for Financial Services. *St Petersburg University Journal of Economic Studies*, 2023. 39(2): p. 179-197.
- [4] Zhang, J., R.d. Jong, and D.R. Haurin, Are US Real House Prices Stationary? New Evidence From Univariate and Panel Data. *Studies in Nonlinear Dynamics and Econometrics*, 2016. 20(1): p. 1-18.
- [5] Zhang, K.-m. and Z.-g. Wen, Review and challenges of policies of environmental protection and sustainable development in China. *Journal of environmental management*, 2008. 88(4): p. 1249-1261.
- [6] Zhang, M., et al., Toward Sustainable Environment in Italy: The Role of Trade Globalization, Human Capital, and Renewable Energy Consumption. *Energy & Environment*, 2022. 35(4): p. 2058-2086.
- [7] Zhang, Y., et al., Nexus between Economic Policy Uncertainty and Renewable Energy Consumption in BRIC Nations: The Mediating Role of Foreign Direct Investment and Financial Development. *Energies*, 2021. 14(15): p. 4687.
- [8] Zhao, J., et al., Assessing energy poverty and its effect on CO₂ emissions: The case of China. *Energy Economics*, 2021. 97: p. 105191.
- [9] Zhao, L. and M. Qamruzzaman, Do Urbanization, Remittances, and Globalization matter for Energy Consumption in Belt and Road Countries: Evidence from Renewable and Non-Renewable Energy Consumption. *Frontiers in Environmental Science*, 2022. 10: p. 723.
- [10] Zhao, Y., et al., Effect of the Digital Transformation of Power System on Renewable Energy Utilization in China. *Ieee Access*, 2021. 9: p. 96201-96209.
- [11] Zheng, G., et al., Factors Affecting the Sustainability Performance of Financial Institutions in Bangladesh: The Role of Green Finance. *Sustainability*, 2021. 13(18): p. 10165.
- [12] Xu, S., M. Qamruzzaman, and A.H. Adow, Is financial innovation bestowed or a curse for economic sustainability: the mediating role of economic policy uncertainty. *Sustainability*, 2021. 13(4): p. 2391.
- [13] Yang, Y., et al., Do Tourism and Institutional Quality Asymmetrically Effects on FDI Sustainability in BIMSTEC Countries: An Application of ARDL, CS-ARDL, NARDL, and Asymmetric Causality Test. *Sustainability*, 2021. 13(17): p. 9989.
- [14] Yin, C. and M. Qamruzzaman, Empowering renewable energy consumption through public-private investment, urbanization, and globalization: Evidence from CS-ARDL and NARDL. *Heliyon*, 2024.
- [15] Weixiang, S., et al., An empirical assessment of Financial Literacy and Behavioural Biases on Investment Decision: Fresh Evidence from Small Investor Perception. *Frontiers in Psychology*, 2022: p. 5746.
- [16] Williams, E.A., et al., Renewable energy sources for the present and future: An alternative power supply for Nigeria. Ebuete Abinotami Williams, Raimi Morufu Olalekan, Ebuete Ibim Yarwamara & Oshatunberu Modupe (2019) Renewable Energy Sources for the Present and Future: An Alternative Power Supply for Nigeria. *Energy and Earth Science*, 2019. 2(2).
- [17] Xia, C., M. Qamruzzaman, and A.H. Adow, An asymmetric nexus: remittance-led human capital development in the top 10 remittance-receiving countries: are FDI and gross capital formation critical for a road to sustainability? *Sustainability*, 2022. 14(6): p. 3703.

- [18] Xiao, Z. and M. Qamruzzaman, Nexus Between Green Investment and Technological Innovation in BRI Nations: What Is the Role of Environmental Sustainability and Domestic Investment? *Frontiers in Environmental Science*, 2022. 10.
- [19] Crotty, J.R., Post-Keynesian economic theory: An overview and evaluation. *The American Economic Review*, 1980. 70(2): p. 20-25.
- [20] Vu, H.D., et al., Impacts and restoration strategy of the tourism industry post-COVID-19 pandemic: evidence from Vietnam. *Journal of Tourism Futures*, 2022.
- [21] Jones, P., A review of the UK's tourism recovery plans post COVID-19. *Athens Journal of Tourism*, 2022. 9(1): p. 9-18.
- [22] Cariappa, A.A., et al., Impact of COVID-19 on the Indian agricultural system: A 10-point strategy for post-pandemic recovery. *Outlook on Agriculture*, 2021. 50(1): p. 26-33.
- [23] Maskey, A. and S. Khadka, Pandemic Pulse: A Comparative Analysis of Nepal-China Import-Export Trends Pre- and Post-COVID (2015-2023). *Tsinghua International Relations Review*, Special, 2024(2024): p. 13-25.
- [24] Calderon, C. and M. Kubota, Exploring the growth effects of COVID-19 across developing countries. 2021: World Bank.
- [25] Sun, J. and M. Qamruzzaman, Technological innovation, trade openness, natural resources, clean energy on environmental sustainability: a competitive assessment between CO₂ emission, ecological footprint, load capacity factor and inverted load capacity factor in BRICS+T. *Frontiers in Environmental Science*, 2025. 12.
- [26] Qamruzzaman, M., Green finance, environmental taxation, and green innovation: unraveling their influence on the growth-quality nexus in China—a provincial perspective. *Environmental Research Communications*, 2025. 7(1): p. 015009.
- [27] Qamruzzaman, M., Unlocking the nexus: Tourism, clean energy, innovation, and environmental sustainability in the top 20 tourist nations. *Sustainability Analytics and Modeling*, 2025. 5: p. 100037.
- [28] Kaneva, T., et al., Tax policy for economic recovery and sustainable development after covid-19. *Problemy Ekonomii*, 2022. 17(2): p. 102-109.
- [29] Bernardo, S., M.L. Vasconcelos, and F. Rocha, The Widening of the North-South Divide: Debt Sustainability in a World Weakened by COVID-19. *Economies*, 2024. 12(2): p. 42.
- [30] Rathnayaka, I.W., R. Khanam, and M.M. Rahman, Examining Monetary Policy Measures and Their Impacts During and After the COVID Era: OECD Perspectives. *Economies*, 2024. 12(6): p. 154.
- [31] Zhang, W., et al., COVID-19 and stock market performance: Evidence from the RCEP countries. *International Review of Economics & Finance*, 2023. 83: p. 717-735.
- [32] Xie, X., et al., Covid-19 and market discipline: Evidence from the banking sector in emerging markets. *International Review of Economics & Finance*, 2024. 89: p. 612-621.
- [33] Altman, M., Trajectories for South African employment after COVID-19. *South African Journal of Science*, 2022. 118(5-6): p. 1-9.
- [34] Egger, D., et al., Falling living standards during the COVID-19 crisis: Quantitative evidence from nine developing countries. *Science advances*, 2021. 7(6): p. eabe0997.
- [35] Sennoga, E. and L. Balma, Fiscal sustainability in Africa: Accelerating the post-COVID-19 recovery through improved public finances. *African Development Review*, 2022. 34: p. S8-S33.
- [36] Yingjun, Z., S. Jahan, and M. Qamruzzaman, Technological Innovation, Trade Openness, Natural Resources, and Environmental Sustainability in Egypt and Turkey: Evidence from Load Capacity Factor and Inverted Load Capacity Factor with Fourier Functions. *Sustainability (2071-1050)*, 2024. 16(19).
- [37] Yin, C. and M. Qamruzzaman, Empowering renewable energy consumption through public-private investment, urbanization, and globalization: Evidence from CS-ARDL and NARDL. *Heliyon*, 2024. 10(4).
- [38] Yi, X. and M. Qamruzzaman, Unlocking environmental harmony through export earnings: exploring the impact of remittances and infrastructure growth. *Frontiers in Environmental Science*, 2024. 12: p. 1388056.

- [39] Xiangling, L.I.U. and M. Qamruzzaman, The role of ICT investment, digital financial inclusion, and environmental tax in promoting sustainable energy development in the MENA region: Evidences with Dynamic Common Correlated Effects (DCE) and instrumental variable-adjusted DCE. PLOS ONE, 2024. 19(5): p. e0301838.
- [40] Wang, R., M. Qamruzzaman, and S. Karim, Unveiling the power of education, political stability and ICT in shaping technological innovation in BRI nations. Heliyon, 2024. 10(9).
- [41] Qamruzzaman, M. and S. Kor, Navigating the path to environmental sustainability: Insights from CIVETS on the intersection of ICT diffusion, natural resources, and green technological innovation. PloS one, 2024. 19(12): p. e0309264.
- [42] Qamruzzaman, M., S. Karim, and S. Kor, Nexus between Innovation–Openness–Natural Resources–Environmental Quality in N-11 Countries: What Is the Role of Environmental Tax? Sustainability, 2024. 16(10): p. 3889.
- [43] Guven, M., et al., The effects of daily growth in COVID-19 deaths, cases, and governments' response policies on stock markets of emerging economies. Research in international business and finance, 2022. 61: p. 101659.
- [44] Anoke, F., et al., Entrepreneurial marketing and SMEs growth in post Covid-19 era in Awka, Anambra State, Nigeria. International Journal of Financial, Accounting, and Management, 2022. 4(2): p. 115-127.
- [45] Banga, R. and K. Banga, Scoping the Potential for a Digital Led Recovery from COVID-19 in Africa. Journal of African Trade, 2022. 9(1): p. 120-143.
- [46] Harjoto, M.A. and F. Rossi, Market reaction to the COVID-19 pandemic: evidence from emerging markets. International Journal of Emerging Markets, 2023. 18(1): p. 173-199.
- [47] Qamruzzaman, M. and S. Karim, Unveiling the synergy: Green finance, technological innovation, green energy, and carbon neutrality. PloS One, 2024. 19(10): p. e0308170.
- [48] Qamruzzaman, M. and S. Karim, Green energy, green innovation, and political stability led to green growth in OECD nations. Energy Strategy Reviews, 2024. 55: p. 101519.
- [49] Qamruzzaman, M., N. Farzana, and P.M. Mindia, Unveiling the path to environmental sustainability through energy efficiency, environmental innovation, and institutional quality in Southeast Asian Countries. International Journal of Energy Economics and Policy, 2024. 14(6): p. 322-343.
- [50] Qamruzzaman, M., Navigating the Path to Environmental Sustainability: Insights From CIVETS on the Intersection of ICT Diffusion, Natural Resources, and Green Technological Innovation. Plos One, 2024. 19(12): p. e0309264.
- [51] Qamruzzaman, M., Environmental Sustainability in Bangladesh through renewable energy, foreign direct investment, and trade openness: Evidence from Load Capacity Factor and Inverted Load Capacity factor with Fourier Functions. 2024.
- [52] Qamruzzaman, M., Do natural resources bestow or curse the environmental sustainability in Cambodia? Nexus between clean energy, urbanization, and financial deepening, natural resources, and environmental sustainability. Energy Strategy Reviews, 2024. 53: p. 101412.
- [53] Qamruzzaman, M., Clarifying the nexus between Trade Policy Uncertainty, Economic Policy Uncertainty, FDI and Renewable Energy Demand. International Journal of Energy Economics and Policy, 2024. 14(2): p. 67-382.
- [54] Qamruzzaman, M., Urbanization, trade openness, and industrialization as a deterrent of clean energy consumption: Evidence from BRI nations. World Journal of Advanced Research and Reviews, 2024. 21(03): p. 1561-1574.
- [55] Qamruzzaman, M., Nexus between financial development, foreign direct investment, and renewable energy consumption: Evidence from SSA. GSC Advanced Research and Reviews, 2024. 18(03): p. 265-280.
- [56] Qamruzzaman, M., An assessment of the effect of gross capital formation and financial development on Renewable Energy Consumption in middle-income nations: Does FDI act as a boosting factor? Evidence from CS-ARDL and NARDL framework. World Journal of Advanced Research and Reviews, 2024. 21(1): p. 1053-1071.
- [57] Qamruzzaman, M., Nexus between foreign direct investment, gross capital formation, financial development and renewable energy consumption: evidence from panel data estimation. GSC Advanced Research and Reviews, 2024. 18(1): p. 182-200.

- [58] Mindia, P.M., M. Qamruzzaman, and N. Farzana, Exploring the Impact of Good Governance and Innovation on Export Earnings, Clean Energy, Remittances, and Zero Carbon Emissions in Sub-Saharan African Countries. *International Journal of Energy Economics and Policy*, 2024. 14(4): p. 265-284.
- [59] Kor, S. and M. Qamruzzaman, Decoding the environmental synergy in BRI nations: analyzing the influence of renewable energy adoption, financial evolution, FDI, and capital resilience on sustainability. *International Journal of Energy Economics and Policy*, 2024. 14(3): p. 582-599.
- [60] Guan¹, C. and M. Qamruzzaman, governance and globalization? *Environmental Risk and Corporate Behaviour*, 2024: p. 123.
- [61] Feng, T., et al., Bridging environmental sustainability and organizational performance: The role of green supply chain management in the manufacturing industry. *Sustainability*, 2024. 16(14): p. 5918.
- [62] Farzana, N., M. Qamruzzaman, and P.M. Mindia, Interplay of digital financial inclusion, technological innovation, good governance, and carbon neutrality in the top 30 remittance-receiving countries: The significance of renewable energy integration. *International Journal of Energy Economics and Policy*, 2024. 14(4): p. 408-425.
- [63] Deng, X., M. Qamruzzaman, and S. Karim, Unlocking the path to environmental sustainability: navigating economic policy uncertainty, ICT, and environmental taxes for a sustainable future. *Environmental Science and Pollution Research*, 2024: p. 1-27.
- [64] Yingyi, W., et al., DOES FINANCIAL DEEPENING FOSTER CLEAN ENERGY SUSTAINABILITY OVER CONVENTIONAL ONES? EXAMINING THE NEXUS BETWEEN FINANCIAL DEEPENING, URBANIZATION, INSTITUTIONAL QUALITY, AND ENERGY CONSUMPTION IN CHINA. 2023.
- [65] Yan, H., M. Qamruzzaman, and S. Kor, Nexus between green investment, fiscal policy, environmental tax, energy price, natural resources, and clean energy—a step towards sustainable development by fostering clean energy inclusion. *Sustainability*, 2023. 15(18): p. 13591.
- [66] Yan, H., M. Qamruzzaman, and S. Kor, Charting a Sustainable Future: The Impact of Economic Policy, Environmental Tax, Innovation, and Natural Resources on Clean Energy Consumption. *Sustainability*, 2023. 15(18): p. 1-30.
- [67] Wang, Y., et al., Does financial deepening foster clean energy sustainability over conventional ones? Examining the nexus between financial deepening, urbanization, institutional quality, and energy consumption in China. *Sustainability*, 2023. 15(10): p. 8026.
- [68] Wang, Y., M. Qamruzzaman, and S. Kor, Greening the future: Harnessing ICT, innovation, eco-taxes, and clean energy for sustainable ecology—Insights from dynamic seemingly unrelated regression, continuously updated fully modified, and continuously updated bias-corrected models. *Sustainability*, 2023. 15(23): p. 16417.
- [69] Tan, Y., M. Qamruzzaman, and S. Karim, An investigation of financial openness, trade openness, gross capital formation, urbanization, financial development, education and energy nexus in BRI: Evidence from the symmetric and asymmetric framework. *Plos one*, 2023. 18(12): p. e0290121.
- [70] Su, S., M. Qamruzzaman, and S. Karim, Charting a sustainable future: the impact of economic policy, environmental taxation, innovation, and natural resources on clean energy consumption. *Sustainability*, 2023. 15(18): p. 13585.
- [71] Serfraz, A., M. Qamruzzaman, and S. Karim, Revisiting the nexus between economic policy uncertainty, financial development, and FDI inflows in Pakistan during covid-19: does clean energy matter? *International Journal of Energy Economics and Policy*, 2023. 13(4): p. 91-101.
- [72] Qamruzzaman, M. and S. Kor, Nexus between technological innovation, trade, education and institutional quality: Evidence from dynamic SUR estimation. *World Journal of Advanced Research and Reviews*, 2023. 19(03): p. 153–171.
- [73] Aizenman, J. and H. Ito, Post COVID-19 exit strategies and emerging markets economic challenges. *Rev Int Econ*, 2022.
- [74] Qamruzzaman, M. and S. Kor, Institutional quality-led Technological Innovation in Lower-income nations: Does Trade and Education matter. *GSC Advanced Research and Reviews*, 2023. 16(03): p. 026-044.
- [75] Qamruzzaman, M. and R. Kler, Do clean energy and financial innovation induce SME performance?: clarifying the nexus between financial innovation, technological innovation, clean energy, environmental degradation, and

SMEs performance in Bangladesh. *International Journal of Energy Economics and Policy*, 2023. 13(3): p. 313-324.

- [76] Qamruzzaman, M., S. Karim, and S. Kor, Does environmental degradation matter for poverty? Clarifying the nexus between FDI, environmental degradation, renewable energy, education, and poverty in Morocco and Tunisia. *Environmental Science and Pollution Research*, 2023. 30(18): p. 52872-52894.
- [77] Qamruzzaman, M. and S. Karim, Clarifying the relationship between green investment, technological innovation, financial openness, and renewable energy consumption in MINT. *Heliyon*, 2023. 9(11).
- [78] Qamruzzaman, M. and S. Karim, Does public-private investment augment renewable energy consumption in BIMSTEC nations? Evidence from symmetric and asymmetric assessment. *Energy Strategy Reviews*, 2023. 49: p. 101169.
- [79] Qamruzzaman, M., Clean energy-led tourism development in Malaysia: Do environmental degradation, FDI, Education and ICT matter? *Heliyon*, 2023. 9(11).
- [80] Verma, S. and A. Gustafsson, Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of business research*, 2020. 118: p. 253-261.
- [81] Qamruzzaman, M., Nexus between environmental qualities, institutional quality and FDI inflows in Lower-income Countries. *World Journal of Advanced Research and Reviews*, 2023. 18(03): p. 321–345.
- [82] Qamruzzaman, M., Does financial innovation foster financial inclusion in Arab world? Examining the nexus between financial innovation, FDI, remittances, trade openness, and gross capital formation. *PloS one*, 2023. 18(6): p. e0287475.
- [83] Qamruzzaman, M., Do environmental and institutional quality attribute to inflows of FDI in Lower-Middle income Nations? Evidences from asymmetric investigation. *GSC Advanced Research and Reviews*, 2023. 15(3): p. 079-104.
- [84] Qamruzzaman, M., An asymmetric nexus between clean energy, good governance, education and inward FDI in China: Do environment and technology matter? Evidence for chines provincial data. *Heliyon*, 2023. 9(5).
- [85] Qamruzzaman, M., Does economic policy uncertainty influences personal remittances: Evidences from AARDL and NARDL. *World Journal of Advanced Research and Reviews*, 2023. 18(01): p. 14-34.
- [86] Qamruzzaman, M., Does Environmental Degradation –Led Remittances flow? Nexus between environmental degradation, Uncertainty, Financial inclusion and Remittances inflows in India and China. *International Journal of Energy Economics and Policy*, 2023. 13(2): p. 9-26.