International Research Journal of MMC (IRJMMC)
ISSN 2717-4999 (Online) | 2717-4980 (Print)
Volume 6, Issue 1 | March 2025

Piloting the Impact of Government Expenditure, Inflation, Unemployment, Trade Openness and Environmental Quality on Economic Growth: Empirical Insights from G7 Countries

Arjun Kumar Dahal[1] | **Prem Bahadur Budhathoki**[2] | **Ganesh Bhattarai**[3]
Sagar Pokhrel[4]

[1]Lecturer of Economics
Mechi Multiple Campus, Bhadrapur, Jhapa, Nepal
Email: arjun.dahal@memc.tu.edu.np

[2]Associate Professor
Saraswati Multiple Campus, Tribhuvan University, Kathmandu, Nepal

[3]Associate Professor
Nepal Commerce Campus, Tribhuvan University, Kathmandu, Nepal
Email: ganesh@ncc.edu.np

[4]Teaching Assistant
Mechi Multiple Campus, Bhadrapur, Jhapa, Nepal
Email: sagar.inform@gmail.com

Corresponding Author
Prem Bahadur Budhathoki
Email address: prem.budhathoki@mahmc.tu.edu.np

To Cite this article: Dahal, A. K., Budhathoki, P. B., Bhattarai, G., & Pokhrel, S. (2025). Piloting the impact of government expenditure, inflation, unemployment, trade openness and environmental quality on economic growth: Empirical insights from G7 countries. *International Research Journal of MMC*, *6*(1), 85–111. https://doi.org/10.3126/irjmmc.v6i1.77550

Submitted: 27 January 2025 **Accepted:** 15 February 2025 **Published:** 31 March 2025

Abstract

This study navigates the impact of government expenditure, unemployment, inflation rate, trade openness, and environmental quality in terms of carbon emissions on economic growth in G7 countries. It uses secondary data from seven-member countries of G7 spanning from 1990 to 2023. The unbalanced panel data were collected from various International Monetary Fund and World Bank reports. It covered 266 data points. The causal correlational research design was used. The

positivist research philosophy, deductive reasoning, and quantitative analysis guided it. Some statistical tools like descriptive statistics, correlation analysis, Johnsen-Fisher and Kao residual panel cointegration test, Granger and Dumitrescu-Hurlin panel causality test, and Robust least square method were used to explore the impact of variables. The trade openness was not statistically significant in determining G7 countries' economic growth. The unemployment and inflation rates were individually significant in determining economic growth. One unit change in unemployment and inflation rate resulted in a 0.117 and 0.028 unit decrease in economic growth in G7 countries. Likewise, government expenditure had a positive and statistically significant (P=0.00) impact on economic growth. One unit increase in government expenditure results in a 0.044 increase in economic growth. Similarly, carbon emissions were also significant in determining economic growth. The carbon emissions and economic growth were simultaneously increased. The value of the R-squared was 0.653; it indicates that a nearly 65.3 percent variation in economic growth depended on unemployment, inflation rate, trade openness, government expenditure, and environmental quality regarding carbon emissions. To promote sustainable economic growth, policymakers in G7 nations should prioritize reducing unemployment and inflation while strategically boosting government spending and tackling carbon emissions, considering their substantial economic effects.

Keywords: deductive, robust least square, economic growth, association, causality, cointegration

JEL Classification: E_{62}, E_{31}, F_{43}, Q_{56}

1. Introduction

Economic growth is the increase in per capita income; it is possible with the rise in Gross Domestic Product (Dahal et al., 2024). Economic growth is the primary concern of every country. Economic growth has been a primary focus of macroeconomic study, with several variables contributing to its dynamics. Among these characteristics, government spending, inflation, unemployment, trade openness, and environmental quality have attracted particular attention owing to their differing consequences across various countries. Understanding these dynamics is vital for sophisticated economies like the G7 countries—Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States—and is vital for successful policy-making (Gurdal, 2020).

Government spending significantly affects economic activity by boosting demand, providing public goods, and supporting infrastructure development. Keynesian economics, for instance, proposes that more government expenditure may enhance economic growth, especially during economic downturns (Afonso & Sousa, 2012). However, the efficiency of public spending and its influence on long-term growth remain questioned, with some believing that excessive spending might drown out private investment and lead to fiscal imbalances (Barro, 1990).

Inflation, another crucial macroeconomic indicator, has a complicated connection with growth. While moderate inflation is frequently linked with better economic activity, excessive

inflation may confuse pricing signals and restrict investment, eventually harming growth (Bruno & Easterly, 1998). Recent research has indicated that the link between inflation and growth may be non-linear, with the impacts varying depending on the amount of inflation and the economy's institutional framework (Mubarik, 2005; Sarel, 1996).

Unemployment, indicating wasted labor resources, is inversely connected with economic growth in the near run. Okun's Law states that more excellent unemployment rates often correlate with lower production levels (Okun, 1962). In the G_7 setting, where labor markets are generally mature, the link between unemployment and growth remains an important subject of concern, especially in light of recent economic disturbances such as the COVID-19 epidemic (Blanchard, 2020).

Trade openness, defined by the liberalization of trade policy and inclusion into the global economy, has primarily driven economic progress. Open economies gain from access to broader markets, knowledge transfer, and competition that encourages efficiency (Edwards, 1998). However, the growth gains of trade openness are not automatic and rely on variables such as institutional quality, the structure of the economy, and the degree of diversity (Rodrik, 2001).

Environmental quality, increasingly acknowledged as a major factor of sustainable development, is especially significant in the context of climate change and environmental deterioration. The Environmental Kuznets Curve (EKC) concept claims that as economies expand, environmental degradation first increases but gradually improves as societies get more prosperous and more capable of investing in cleaner technology (Grossman & Krueger, 1995). However, new empirical studies question this approach, demonstrating that the link between environmental quality and development is more nuanced and context-dependent, especially in highly industrialized nations like the G_7 (Kaika & Zervas, 2013).

This study aims to navigate the impact of government expenditure, inflation, unemployment, trade openness, and environmental quality on economic growth in G7 Countries. It searches the individual and joint effects of public spending, inflation, unemployment, trade openness, and environmental quality in terms of carbon emissions on economic expansion in G7 countries. Based on the objectives, the following research questions have been developed.

i. What is the impact of government expenditure on the economic growth of G7 countries?
ii. How does inflation influence economic growth in G7 countries?
iii. What is the relationship between unemployment rates and economic growth in G7 countries?
iv. How do trade openness and environmental quality interact to influence economic growth in G7 countries?

This study is divided into six segments. The remaining sections of this study are as follows: Segment two reviews the theoretical and empirical kinds of literature related to the topic. Research methodology is included in segment three. Sections four and five include the presentation and analysis of data and result discussions. The last six segments comprise the study's conclusion, policy implication, and study limitations.

2. Literature Review

The theoretical relationship between government expenditure, inflation, unemployment, trade openness, environmental quality, and economic growth reflects the complexity of financial systems. Each variable can influence growth in multiple ways, and their effects often depend on broader economic conditions and policy contexts. This section reviews theoretical kinds of literature in the beginning and empirical literature in the meta table.

2.1 Government Expenditure and Economic Growth

Several economic theories acknowledge that government spending is a crucial determinant of economic development. Keynesian economics asserts that government expenditure, especially on infrastructure and public services, may invigorate demand and promote economic growth, particularly during economic recessions (Keynes, 1936). In contrast, advocates of classical and neoclassical economics contend that excessive government expenditure might displace private investment and result in inefficiencies, delaying long-term development (Barro, 1991).

Table 1: *Summary of Previous Studies on Navigating the Impact of Government Expenditure and Economic Growth.*

Authors	Data (Country)	Dependent variable	Independent variable	Method	Results
Rahaman et al. (2023)	2011-2020 (SAARC countries)	Economic growth	Government expenditure	Cointegration test, Granger causality test, and Panel ordinary least square	Government spending has a strong positive correlation between government expenditure and economic growth. Unidirectional causality was found between GDP and economic growth.
Okunlola et al. (2024)	1999-2021(15 ECOWAS countries)	Real economic growth	Government expenditure	Panel OLS, FMOLS, and DOLS	Government expenditure positively affects real economic growth in ECOWAS countries.
Poku et al. (2022)	1970-2016 (Ghana)	Economic growth	Public sector expenditure, capital formation, FDI, population control	ARDL	Government expenditure has a positive impact on economic growth in the short run.
Onifade et al. (2020)	1981-2017 (Nigeria)	Economic growth	Capital and recurrent expenditure	Pesaran's ARDL	Recurrent government expenditure negatively and significantly impacts economic growth, while the positive impact of government capital

					expenditure was not statistically significant.
Nauyen and Bui (2022)	2002-2019 (16 Emerging markets and developing economies)	Economic growth	Government expenditure corruption control	GMM, threshold regression model.	Government expenditure and corruption control hurt economic growth.
Arawatari et al. (2023)	1990-2018 (United States)	Economic growth	Government expenditure	Endogenous growth model	The change in government expenditure has a limited impact on economic growth.

The predominant approach for assessing the influence of government spending on economic development is the panel OLS methodology, as shown in the research of Rahaman et al. (2023) and Okunlola et al. (2024). The ARDL model is often used to evaluate both short-term and long-term impacts, as shown in the studies by Poku et al. (2022) and Onifade et al. (2020). Specific research, such as Nguyen and Bui (2022), use sophisticated methodologies such as GMM and threshold regression to address difficulties such as corruption control. The principal results reveal various effects, ranging from robust positive correlations to little or adverse impact, contingent upon the nation and circumstances. Arawatari et al.'s (2023) research demonstrates that government expenditure changes in the United States have a weak effect on economic growth, thereby suggesting that other variables could be more important in stimulating economic growth. This also implies that simply raising or lowering government spending might be inadequate to guarantee noticeable economic growth in the U.S., a developed economy.

2.2 Inflation and Economic Growth

The influence of inflation on economic development is a highly contested subject in macroeconomics. The Phillips Curve originally proposed a trade-off between inflation and unemployment, indicating that moderate inflation may facilitate economic growth by lowering unemployment (Phillips, 1958). Nevertheless, the long-term perspective, particularly from monetarists such as Friedman (1968), indicates that inflation above a certain threshold undermines economic stability and diminishes growth. Excessive inflation induces uncertainty, deterring savings and investment, while deflation may inhibit consumption and output (Fischer, 1993).

Table 2: *Summary of Previous Studies on Navigating the Impact of Inflation Rate and Economic Growth.*

Authors	Data (Country)	Dependent variable	Independent variable	Method	Results
Poudel and Raut (2022)	1976-2019 (Nepal)	Economic growth	Inflation	Logistic smooth transition regression	Non-linear relationship between inflation and economic growth. Positive relationship with economic growth up to

					threshold level (6.38±1.36) and then negative impact of inflation on economic growth.
Gregorio (2022)	1951-1985 (12 Latin Amirian Countries)	Long-run economic growth	Inflation	Simple panel regression model	Non-linear relationship between inflation rate and long-run economic growth
Ezako (2023)	1990-2020 (Burundi)	Economic growth	Inflation, investment, consumption	ARDL, Threshold regression model	There is a negative and significant impact in the short run, but after a 15 percent threshold, there is a negative relation between inflation and economic growth.
Karki et al (2020)	1996/97-2017/18 (Nepal)	Economic growth	Inflation	Average, percentage, line graph, correlation,	Inflation hurts economic growth after the 6 percent threshold.
Lubeniqi et al (2023)	1995-2022 (Developing European Countries)	Economic growth	Inflation	GMM, Random effect model	One percent increase in the inflation rate results in a 0.017 percent decrease in economic growth in European developing countries.
Maiga (2024)	1990-2021 (Tanzania)	Economic growth	Inflation	Reduced from regression equation (ILS)	A significant negative correlation exists between inflation and economic growth, i.e., a higher inflation rate reduces GDP growth.

Where ILS= Instrumental variable least squares (Two-stage least squares, 2SLS)

The studies demonstrate a non-linear relationship between inflation and economic growth, with inflation positively influencing growth up to a certain threshold, after which it negatively affects growth. Various methods such as ARDL, panel regression, and threshold regression highlight that inflation above a certain level, typically between 6 percent and 15 percent, significantly harms economic growth. In developing economies, inflation tends to have a more substantial negative impact, especially in the long run, reducing GDP growth.

2.3 Unemployment and Economic Growth

The relationship between unemployment and economic growth is traditionally explained by Okun's Law, which posits an inverse relationship between unemployment and growth (Okun,

1962). As economies grow, labor demand increases, leading to lower unemployment rates. Conversely, higher unemployment reflects underutilized labor, which drags economic growth. However, this relationship may not always hold. Technological advancement and structural changes in economies may sometimes lead to jobless growth. It appears when economic output increases without corresponding reductions in unemployment. Furthermore, long-term unemployment can lead to a loss of skills, reducing human capital and negatively affecting productivity and growth (Blanchard & Wolfers, 2000).

Table 3: *Summary of Previous Studies on Navigating the Impact of Unemployment Rate and Economic Growth.*

Authors	Data (Country)	Dependent variable	Independent variable	Method	Results
Hjazeen et al. (2021)	1991-2019 (Jorden)	Economic growth	Unemployment, education, female population, and urban population	ARDL	Long-run cointegration between unemployment and economic growth. There is a negative relationship between
Acharya (2020)	1991-2021 (Nepal)	Macroeconomic variables	Unemployment, trade, rate of interest, GDP	Ordinary least square	Increasing GDP, trade openness, money supply, and inflation will decrease Nepal's unemployment rate.
Zhorzholiani (2024)	1990-2022 (Georgia)	Economic growth	Unemployment. Income inequality, social and welfare programs	Simple regression analysis	An increase in unemployment negatively affects the economy. One percent increase in unemployment results from a 0.2543 percent decrease in GDP growth.
Niyongoba and Zhong (2023)	1990-2021 (Burundi)	Economic growth	Unemployment, inflation, FDI, gross capital formation	ARDL	Industrialization is highly encouraged to reduce unemployment and promote economic growth.
Omitogun and Longe (2017)	1986-2015 (Nigeria)	Economic growth	Unemployment	VAR approach	The impact of unemployment varies over time as an

					effort towards eradicating the government policy.
Sekwati and Dagume (2023)	1994-2018 (South Africa)	Economic growth	Unemployment, inflation	Johnsen cointegration test	Inflation and unemployment hurt economic growth

These studies highlight the strong negative relationship between unemployment and growth: GDP growth decreases as unemployment increases. Using different techniques like ARDL and regression analysis, various results confirm that a decrease in unemployment enables economic growth, especially in developing countries. Besides, the policies of industrialization, trade openness, and increasing money supply are other essential ways to fight unemployment and support growth.

2.4 Trade Openness and Economic Growth

The theory of trade openness posits that economies open to international trade experience faster growth due to more efficient resource allocation, access to larger markets, and technological spillovers (Krueger, 1997). Trade openness stimulates competition, innovation, and investment, which is essential for economic growth (Grossman & Helpman, 1991). The classical Ricardian model of comparative advantage suggests that countries benefit by specializing in producing goods where they have a comparative advantage, thus enhancing overall economic welfare.

Table 4: *Summary of Previous Studies on Navigating the Impact of Trade Openness and Economic Growth.*

Authors	Data (Country)	Dependent variable	Independent variable	Method	Results
Koho and Wang (2017)	1965-2014 (Cote d'Ivoire)	Economic growth	Trade openness, capital stock	ARDL bound testing, Toda Yamamoto Granger causality	Trade openness positively affects economic growth both in the short and long run.
Neupane (2023)	1990-2021 (Nepal)	Economic growth	Trade openness, human capital, and capital formation	VECM	Trade openness has no significant impact on economic growth.
Nguyen et al. (2023)	2011-2019 (20 Asian Countries)	Economic growth	Trade openness. Inflation stability	ARDL	Trade openness is negatively associated with growth stability

Oppong-Baah et al. (2022)	1998-2017 (Ghana and Nigeria)	Economic growth	Trade openness, inflation, exchange rate, investment	Pooled OLS, Hausman test	Trade openness has a positive and significant impact on economic growth.
Fatahi-Vehap et al. (2015)	1996-2012 (10 South East European (SEE) countries	Economic growth	Trade openness, FDI, Capital formation	Generalized method of moments (GMM)	Trade openness positively affects economic growth, but conditions like initial PCI and other factors influence it.
Setana et al. (2023)	1995-2019 (Indonesia)	Economic growth	Trade openness, FDI, Corruption	ARDL and path analysis method	Trade openness negatively affected economic growth in the short run and long run.

The mixed results, as derived from these studies, show that trade openness affects economic growth negatively or insignificantly. It was positive for countries like Cote d'Ivoire, Ghana, and Nigeria, though negative in regions like Indonesia and several Asian countries, when the influence was on the stability of the economic growth. Other variables such as inflation, exchange rate, and corruption further adjust this influence of trade openness to economic growth.

2.5 Environmental Quality and Economic Growth

The link between environmental quality and economic growth is increasingly relevant in light of the global sustainability agenda. The Environmental Kuznets Curve (EKC) hypothesis suggests an inverted U-shaped relationship between environmental degradation and economic growth. According to this theory, environmental degradation increases in the early stages of economic growth as countries prioritize industrialization. However, as income rises, societies become more aware of ecological issues and allocate resources to reduce pollution, improving environmental quality at higher income levels (Grossman & Krueger, 1995).

Table 5: *Summary of Previous Studies on Navigating the Impact of Environmental Quality and Economic Growth.*

Authors	Data (Country)	Dependent variable	Independent variable	Method	Results
Dahal (2023)	1988/89-2021/22 (Nepal)	Environmental Quality	Economic growth, transport energy consumption	Ordinary least square correlation analysis	Economic growth and environmental quality regarding carbon emissions have a high positive correlation.
Yan et al. (2022)	1986-2018 (China)	Economic Growth	Environmental pollution	Non-linear MS(M)-VAR(P) model	Economic growth increases environmental pollution emissions,

					intensifying and hindering economic growth.
Fakher and Abedi (2017)	1983-2013 (Developing countries)	Economic Growth	Environmental performance index, FDI, Trade openness	ARDL bound testing	It was found that the environmental performance index has a positive and significant impact on economic growth.
Bansal (2015)	1990-2013 (NA)	Economic Growth	Environmental Quality	Regression analysis	There is bidirectional causality between environmental quality and economic growth.
Islam et al. (2023)	1996-2020 (Top 20 remittance earning countries)	Economic Growth	Remittance, environmental quality, financial development	Generalized least square (GLS) method	Remittance, regularity quality, and environmental quality combined affect economic growth—bidirectional causality between economic growth and environmental quality.
Abdouli and Hammami (2017)	1990-2012 (MENA countries)	Economic Growth	FDI, Environmental Quality	Generalized Method of Moments (GMM)	Economic growth negatively impacts on environmental quality.

Where MENA= Middle East and African Countries

The studies point out that economic growth and environmental quality may be in a complex relationship. They could hurt environmental quality by resulting in higher pollution and emissions, as documented for developing countries or MENA economies. At the same time, other factors may exist that could positively affect growth and environmental sustainability, implying causality in both directions, such as the environmental performance index or remittances. Generally, though economic growth is usually accompanied by environmental degradation, proper policies and external factors such as FDI and trade openness can offset such growth with improvements in environmental quality**.**

Most of the previous studies focused on separate studies of variables to find the impact on economic growth. Most of the researchers focused on a particular country or developing country. It searches for the effects of inflation on economic growth using a holistic approach, whereas other studies were based on the threshold effect. It searches for the impact of environmental quality on economic growth, but most surveys focus on the effects of economic growth on environmental quality. It searches how unemployment affects economic growth in developed countries. This study searches the individual and joint impact of public spending, inflation, unemployment,

effectiveness of government, and corruption control on economic growth in the seven most developed countries of the world.

The following research hypotheses were developed based on the study's objectives and included variables.

H_{01}: Government expenditure has no significant effect on the economic growth of G7 countries.

H_{02}: Inflation does not significantly influence the economic growth of G7 countries.

H_{03}: Unemployment rates do not significantly affect economic growth in G7 countries.

H_{04}: Trade openness and environmental quality have no significant combined impact on the economic growth of G7 countries.

3. Research Methodology

3.1 Research Design

This study was based on the causal correlational research design. It examined the relationship between two or more variables without implying causation, focusing on the strength and direction of the association. The positivist research philosophy, deductive reasoning, and quantitative analysis guided this study. It established the cause-and-effect relationship between variables.

3.2 Source of Data and Data Processing

This study was based on secondary data collected from the reports of the International Monetary Fund, the World Bank, and economic surveys of respective countries. It used unbalanced panel data of seven-member countries of G7. It covered 266 data points from 1990 to 2023. The countries and data points included are presented in Table 6.

Table 6: *Members of G7 Countries and Included Data Points*

Countries	Crossed	Data points	Duration	Source of data
Canada	1	34	1990-2023	Reports of the World Bank, International Monetary Fund (2024), and economic surveys of respective countries
France	2	34	1990-2023	
Germany	3	33	1991-2023	
Italy	4	34	1990-2023	
Japan	5	34	1990-2023	
United Kingdom	6	34	1990-2023	
United States	7	23	2001-2023	
Total	7	266		

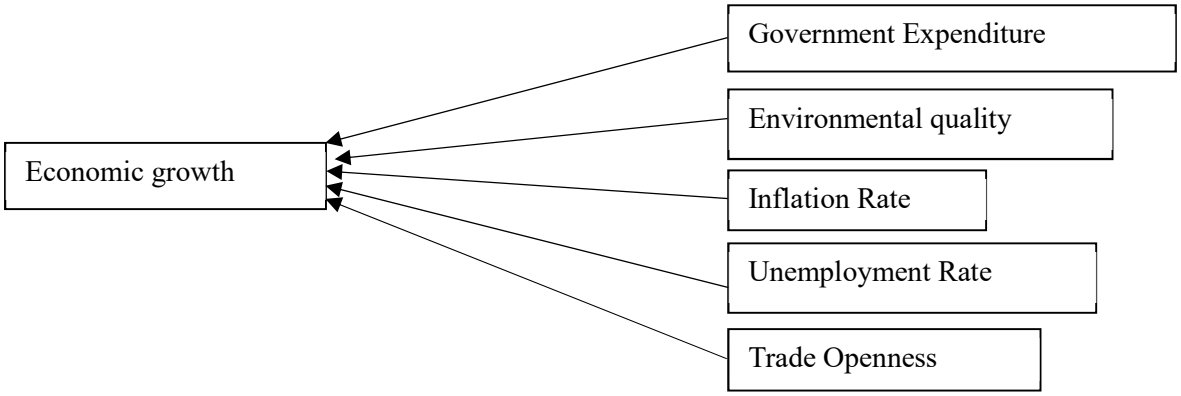
Source: *Reports of World Bank, International Monetary Fund (2024), and economic surveys of respective countries*

The data were analyzed by using Eviews12. The statistical and econometric tools were used to establish the cause-and-effect analysis. It used descriptive statistics, covariance and correlation analysis, test for equality of means, Grander and Dumitrescu-Hurlin panel causality test, Johnsen-Fisher and Kao residual panel cointegration test, and robust least square test to search the impact of independent variables on the dependent variable. Residual plots and normality diagnostics were used to test the model's validity.

3.3 Variable Specification

In this study, six variables were used. Economic growth was a dependent variable, and the unemployment rate, inflation rate, trade openness, government expenditure, and environmental quality regarding carbon emissions were independent variables. The conceptual framework of the study, depending upon the included variables, is developed as given below:

Figure 1: *Variables specification and conceptual framework*



3.4 Model Specification

The concept of the study is that the economic growth of G7 countries depends upon government expenditure, trade openness, inflation rate, unemployment rate, and environmental quality. In this sense, the model is specified as given below:

Economic growth = f (Government expenditure, Trade openness, Unemployment rate, Inflation rate, environmental quality) (1)

In Symbol, the equation (1) can be written as:

$GDPRG = f(GOVEXP, TOPN, UNPG_7, G_7INF, CO2KG_7)$ (2)

3.5 Robust Least Square Method

The robust least square method is a regression analysis type designed to be robust or less sensitive to outliers. The outliers occur due to typing errors, measurement errors, unusual values, transmissions, and unnatural variable variations (Bakar and Midi, 2015). The robustness of an estimator means an estimator is resistant to a small change or modification caused by outliers in the data set; it can be measured based on the breakdown point (Bramati & Crox, 2007). Ordinary

least square aims to minimize the sum of the squared residuals, which can lead to more significant errors if the data contains outliers. Still, the robust least square seeks to reduce the influence of these outliers on the model (Ji et al., 2022).

The robust least squares regression modifies the loss function to reduce the influence of outliers. Huber loss function, least absolute deviations, and Interactive reweighted least square are the approaches to robust regression. The Huber loss function combined the best aspects of the absolute error and squared error. The Huber loss function can be specified as:

$$\underset{\beta_0\beta_1}{Min} \sum_{i=1}^{n} L.\langle Y_1 - \beta_0 - \beta_1 X_i \rangle \quad (3)$$

L(.) is the Huber loss function defined below.

$$L(u) = \begin{cases} \frac{1}{2}u^2, for\ |u| \leq \partial \\ \partial(|u| - \frac{1}{2}\partial, for|r| > \partial \end{cases} \quad (4)$$

Equation (4) ∂ denotes the threshold parameter determining the switch between the squared and linear losses.

The Least Absolute deviations (LAD) minimize the sum of absolute residuals instead of squared residuals.

$$\underset{\beta_0\beta_1}{Min} \sum_{i=1}^{n} L.|Y_1 - \beta_0 - \beta_1 X_i| \quad (5)$$

The M-estimator penalizes the residuals.

$$\underset{\beta_0\beta_1}{Min} \sum_{i=1}^{n} \rho.\langle Y_1 - \beta_0 - \beta_1 X_1 \rangle \quad (6)$$

In equation (6) $\rho(.)$ is a loss function designed to reduce the impact of large residuals, such as the Tukey bi-weight function of the Huber loss.

The iterative reweight least square (IRLS) adjusts the weights based on the residuals from the previous iteration.

$$\underset{\beta_0\beta_1}{Min} \sum_{i=1}^{n} \omega_i.\langle Y_1 - \beta_0 - \beta_1 X_i \rangle^2 \quad (7)$$

The weights are based on the residuals.

$$r_i = Y_1 - \beta_0 - \beta_1 X_i \quad (8)$$

$$\omega_i = \frac{1}{Max(\varepsilon_i|r_i|)} \quad (9)$$

The general regression model is expressed as follows:

$$LGDPRG_{it} = \beta_0 + \beta_1 TOPN_{it} + \beta_2 UNPG7_{it} + \beta_3 GOVEXP_{it} + \beta_4 G7INF_{it} + \beta_5 LCO_2KG7_{it} + \alpha_i + \gamma_t + \mu_{it} \quad (10)$$

In equation (10), i indexes the cross-section units, t indexes time, α_i represents the unit-specific fixed effect, γ_t represents time-specific fixed effects, and μ_{it} is the error term. β0 is the

intercept and β1 β2, β3, β4, and β5 are the coefficients of respective variables. When $\overline{\beta_1}, \overline{\beta_2}$ ... . $\overline{\beta_5}$ are the robust coefficients, the robust least square regression model specified as:

$LGDPRG_{it} = \overline{\beta_o} + \overline{\beta_1}*TOPN_{it} + \overline{\beta_2}*UNPG7_{it} + \overline{\beta_3}*GOVEXP_{it} + \overline{\beta_4}*G7INF_{it} + \overline{\beta_5}*LCO_2KG7_{it} + \varepsilon_{it}$ (11)

Where ε_{it} is the robust residuals calculated iteratively. The weighted residuals ε_{it} are:

$\varepsilon_{it} = LNGDPRG_{it} - (= \overline{\beta_o} + \overline{\beta_1}*TOPN_{it} + \overline{\beta_2}*UNPG7_{it} + \overline{\beta_3}*GOVEXP_{it} + \overline{\beta_4}*G_7INF_{it} + \overline{\beta_5}*LCO2KG7_{it})$ (12)

The robust least square regression method aims to mitigate the impact of outliers in the regression model by modifying the loss function.

4. Presentation and Analysis

In this chapter, the results are explored, analyzed, and described. The panel cointegration test, Granger causality test, and the Robust Least square method are used to examine and analyze the result.

4.1 Descriptive Statistics

Descriptive statistics provides the key information about the data set of study variables. It gives information about measuring the data distribution's central tendency, dispersion, and nature, i.e., positively or negatively skewed, leptokurtic, Mesokurtic, or platykurtic. The key information of data of study variables is presented in Table 7.

Table 7: *Key Information about Study Variables*

Variables	$\bar{X}$	Md	Max	Min	σ	Skp	K	N
LGDPRG	28.62	28.54	30.94	27.08	0.81	0.78	3.69	266
TOPN	51.33	52.71	99.88	15.72	18.29	-0.005	2.48	266
$UNPG_7$	7.07	7.42	12.77	2.092	2.57	-0.06	1.99	266
GOVEXP	44.20	44.18	61.42	29.22	7.49	0.15	1.95	266
G_7INF	2.08	1.82	9.12	-1.33	1.82	1.49	6.08	266
LCO_2KG_7	13.43	13.20	15.56	12.06	0.81	1.39	4.36	266

where, $\bar{X}$= Mean, Md= median, Max= Maximum value, MIN= Minimum value, σ= Standard deviation, SKp= skewness, K= Kurtosis and N= Number of observations

Note: LGDPRG indicates the Gross domestic product of G_7 countries after taking log (original data is in current USD), TOPN stands for trade openness as a percent of GDP, UNPG7 shows the unemployment rate (percent of the total labour force), GOVEXP reflects the government expenditure as a percent of GDP, G_7INF shows the annual inflation rate of G_7 countries, and LCO_2KG_7 shows the condition of carbon emissions in G7 countries after taking Log {original data is in Kiloton (Kt)}

Source: *Authors' own calculation, 2024*

Table 7 presents key descriptive statistics of six study variables related to the economic and environmental conditions of G7 countries. It reports the mean ($\bar{X}$), median (Md), maximum

(Max), minimum (Min), standard deviation (σ), skewness (Skp), kurtosis (K), and the number of observations (N = 266) of all study variables. Therefore, the mean values provided the central tendency, while the standard deviations reflect the dispersion of each variable. The government expenditure had a mean of 44.20 with a relatively low standard deviation of 7.49; therefore, spending by the G7 nations was relatively homogenous. The standard deviation of economic growth and carbon emissions had the lowest standard deviation (0.81) value. So, they had the most representative mean value. The standard deviation varies at a higher degree for trade openness (TOPN), which records 18.29, while the rest of the variables record closer standard deviations. Skewness and kurtosis depict the shape of the distribution, showing that most of the variables were positively skewed, and the right tail of the distribution was longer. In contrast, kurtosis was mixed, showing a variation in its peakedness.

4.2 Covariance and Association Analysis

The covariance value indicates the direction of change of pairs of variables. At the same time, correlation measures the strength and direction of change between variables. Table 8 shows the outcomes of covariance and correlation analysis by checking the significance level at five percent.

Table 8: *Analysis of Covariance and Association of Pair of Variables*

		LGDPRG	TOPN	UNPG7	GOVEXP	G7INF	LCO_2KG7
LGDPRG	Covariance	0.653					
	Correlation	1.000					
	Probability	-----					
TOPN	Covariance	-7.109	333.323				
	Correlation	-0.481	1.000				
	Probability	0.000	-----				
UNPG7	Covariance	-1.092	9.900	6.582			
	Correlation	-0.526	0.211	1.000			
	Probability	0.000	0.0014	-----			
GOVEXP	Covariance	-2.528	56.156	12.821	55.936		
	Correlation	-0.418	0.411	0.668	1.000		
	Probability	0.000	0.000	0.000	-----		
G7INF	Covariance	-0.147	6.313	0.193	1.636	3.306	
	Correlation	-0.100	0.190	0.041	0.120	1.000	
	Probability	0.133	0.0041	0.534	0.071	-----	
LCO2KG7	Covariance	0.526	-8.480	-0.917	-3.701	-0.167	0.643
	Correlation	0.811	-0.578	-0.445	-0.616	-0.114	1.000
	Probability	0.000	0.000	0.000	0.000	0.085	-----

Note: LGDPRG indicates the Gross domestic product of G_7 countries after taking log (original data is in current USD), TOPN stands for trade openness as a percent of GDP, UNPG7 shows the

unemployment rate (percent of the total labour force), GOVEXP reflects the government expenditure as a percent of GDP, G_7INF shows the annual inflation rate of G_7 countries, and LCO_2KG_7 shows the condition of carbon emissions in G7 countries after taking Log {original data is in Kiloton (Kt)}

Source: *Authors own calculation, 2024*

Table 8 shows the covariance and correlation between variables related to G7 countries, including economic expansion, inflation rate, unemployment, government expenditure, and environment quality regarding CO_2 emissions. The carbon emissions and economic growth had a high degree (0.811) positive correlation. It suggests that CO_2 emissions increased with the expansion of economic activities in G7 countries. Conversely, economic growth was negatively correlated (-0.482) with trade openness and unemployment (-0,526), indicating that operations and economic growth site direction of change. Without inflation, rate and economic growth had no statistical (p=0.133) associations, but the rest of the variables were statistically significant, with the dependent variable.

4.3 Test for Equality of Means

The test of equality of mean is used to determine whether two or more populations have the same mean. It is specially used in testing hypotheses. It helps determine whether observed differences in sample means are due to random variation or if they reflect actual differences in the populations. When there are differences between group means, the data can be used to conclude. In other words, the null hypothesis of saying there is no difference between group means must be rejected to be predictable data. Table 9 shows the results of the test of equality of means between series.

Table 9: *Test for Equality of Means Between Series*

Method	df	Value	Probability
ANOVA F-test	(5, 1350)	1384.925	0.0000
Welch F-test*	(5, 598.701)	14000.92	0.0000
*Test allows for unequal cell variances			
	Analysis of Variance		
Source of Variation	df	Sum of Sq.	Mean Sq.
Between	5	464210.6	92842.13
Within	1350	90500.82	67.03765
Total	1355	554711.5	409.3812

Source: *Authors' own calculation, 2024*

Table 9 shows the test outcomes for equality of means between different data sets employing the ANOVA F-teat and Welch F-test. The ANOVA F-stat assumes equal variances across the groups. The ANOVA F-test value is 1384.93 with a probability value of 0.00, indicating a highly significant result. It suggests a statistically significant difference in mean between the groups. The same result can be obtained from the Welch F-test. Recall that the Welch F-test

accounts for unequal variance. The analysis of variance (ANOVA) shows the variance between groups. The more considerable between-group variation relative to within-group variation further supports the findings is significant. So, the series can be used for further analysis; it has predictor capacity.

4.4 Granger and Dumitrescu-Hurlin Panel Causality Test

The Granger and Dumitrescu-Hurlin panel causality test analyze and identifies causal links between variables. This approach is based on Granger causality, which examines the ability of previous values of one variable to forecast the future values of another. This methodology may be used to explore the correlation between social factors. The Dumitrescu-Hurlin Panel Causality Test is a robust method for investigating causality in panel data, enabling researchers to evaluate one variable's presence and degree of effect on another across many entities. Table 10 displays the results of the Granger and Dumitrescu-Hurlin panel causality test.

Table 10: *Outcomes of Granger and Dumitrescu-Hurlin Panel Causality Test*

Pair of Variables	Pairwise Granger causality panel causality		Dumitrescu-Hurlin panel causality		
	H0: Doesn't Granger cause		H0: Doesn't homogeneously cause		
	F-Stat	Prob.	W-stat	Zbar stat	Prob.
TOPN to LGDPRG	1.58	0.208	5.417	3.589	0.0003
LGDPRG to TOPN	1.05	0.353	2.307	0.142	0.887
$UNPG_7$ to LGDPRG	0.698	0.499	3.651	1.631	0.103
LGDPRG to $UNPG_7$	0.847	0.430	2.552	0.413	0.679
GOVEXP to LGDPRG	4.726	0.009	3.951	1.964	0.049
LGDPRG to GOVEXP	0.035	0.966	2.807	0.696	0.487
G_7INF to LGDPRG	0.251	0.799	2.279	0.112	0.911
LGDPRG to G_7INF	0.836	0.435	2.039	-0.154	0.878
LCO_2KG_7 to LGDPRG	2.041	0.132	4.087	2.116	0.034
LGDPRG to LCO_2KG_7	10.852	0,003	2.762	0.646	0.518

Source: *Authors' own calculation, 2024*

Table 10 shows the results of the Granger causality test. The Government expenditure granger causal effect on economic growth at a 5 percent significance level. This means that the past value of government expenditure helped predict future economic growth. However, economic growth did not cause government expenditure, indicating no reverse causality. Carbon emissions were granger caused by economic growth at a 5 percent significance level. It suggests that GDP growth helped predict future carbon emissions, but carbon emissions did not predict GDP growth. Other variables had no significant Granger causality, indicating that these variables couldn't expect economic growth, nor did economic growth predict them.

According to the Dumitrescu-Hurlin Panel causality test, trade openness homogeneously causes economic growth at a 5 percent significance level. It implies that trade openness

consistently influences economic growth across the panel, but the reverse is not valid, as economic growth does not homogeneously cause trade openness. The government expenditure also homogeneously causes GDP growth, with significance at 5 percent (P=0.049), suggesting that government expenditure consistently positively impacts economic growth across the member countries of G7. Similarly, carbon emissions homogeneously cause economic growth with a P-value of 0.0344. However, GDP growth does not homogeneously cause carbon emissions. Unemployment inflation rates are not statistically significantly homogeneous in terms of economic growth.

4.5 Panel Cointegration Test

The Johansen-Fisher and Kao residual panel cointegration tests are used to analyze the presence of long-term equilibrium among several variables in a panel data setup. This Johansen-Fisher test combines various individual-level Johansen-Fisher cointegration tests across sections to reach a general conclusion about the overall cointegration in the panel, while the Kao test tests for the presence of cointegration by analyzing the residuals that emanate from a panel regression. These tests are beneficial in finding out whether variables move together through time, which is an essential feature for long-run economic analysis and policy formulation. The Johnsen-Fisher and Kao residual panel cointegration test results are presented in Table 11.

Table 11: *Outcomes of Johnsen-Fisher and Kao Residual Panel Cointegration Test*
Series: LGDPRG TOPN UNPG$_7$ GOVEXP G$_7$INF LCO$_2$KG$_7$
Trend assumptions: Linear deterministic change

Method						
Johnsen-Fisher panel cointegration test (unrestricted Cointegration test (trace and Max-Eigen value)					Kao residual cointegration test Ho: No cointegration	
Hypothesis: No. of CEs	Fisher Stat Trace test*	Prob.	Fisher stat Max-Eigen test	Prob.	Trend assumptions: No deterministic trend	
None	224.8	0.00	145.2	0.00	ADF	
At most 1	119.8	0.00	84.9	0.00	t- stat	-0.539
At most 2	59.6	0.00	41.7	0.00	Prob.	0.295
At most 3	30.9	.006	14.9	0.38	Residual variance = 0.006	
At most 4	27.00	0.019	21.64	0.09	HAC Variance=0.009	
At most 5	27.40	0.017	27.6	0.02		

*Probabilities are calculated using an asymptotic Chi-square distribution
Source: *Authors' own calculation, 2024*

In Table 11, the Johnsen-Fisher and Kao residual test results are displayed. The results of the Johnsen-Fisher Cointegration test indicate strong evidence of cointegration among the study variables like economic growth, environment quality, inflation rate, unemployment rate, government expenditure, and trade openness. The trace and Max-Eigen tests show significant results (P=0.00) up to at most two cointegrating equations.

The Kao residual cointegration test failed to reject the null hypothesis of saying there is no cointegration with a P-value of 0.295. It tests for cointegration by examining the residuals from a panel regression. If the residuals were stationary or they did not have a unit root, this suggests that the variables were cointegrated. The residuals were not cointegrated. Overall, the panel cointegration test results indicate the long-run cointegration of variables, i.e., they shared a common long-run trend.

4.6 Panel Robust Least Square Method

The Robust least square method is designed to improve the traditional least square method, which is highly influenced by the outliers. The robust least square method aims to reduce the impact of outliers and violations of assumptions in regression analysis. It reduces the influence of extreme observations, making the model more robust. The robust least square method solves the problems of outliers by down-weighting the influence of extreme values. The outcomes of the Robust least square method are listed in Table 12.

Table 12: *Outcomes of Robust Least Square Method*

Method: Robust Least Squares, Included Observations: 266
Method: MM-estimation, Dependent Variable: LGDPRG
S settings: tuning=1.548, breakdown=0.5, trials=200, refine=2, compare=5
M settings: weight=Bi-square, tuning=4.684 (Huber Type1 standard errors & covariance)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
TOPN	-0.002	0.002	-1.121	0.262
UNPG7	-0.117	0.014	-8.331	0.000
GOVEXP	0.044	0.005	8.071	0.000
G7INF	-0.028	0.014	-1.937	0.052
LCO2KG7	0.880	0.047	18.563	0.000
C	15.841	0.793	19.955	0.000
Robust Statistics				
R-squared	0.653	Adjusted R-squared		0.642
Rw-squared	0.811	Adjust R_w-squared		0.811
Akaike info criterion	254.927	Schwarz criterion		276.748
Deviance	29.147	Scale		0.345
Rn-squared statistic	713.289	Prob (Rn-squared stat.)		0.000
Non-robust Statistics				
Mean dependent var	28.625	S.D. dependent var		0.810
S.E. of regression	0.405	Sum squared resid		36.103

Source: *Authors Calculation, 2024*

Table 12 summarizes the results of a Robust least square regression model using MM estimation. MM estimation combines two types of estimators, i.e., M-estimators and S-estimators.

Table 12 indicates three aspects of the robust least square method, i.e., methodology and setting, regression output, and robust and non-robust statistics.

The Robust least square method with MM estimation is designed to minimize the influence of outliers in the regression model. The s-settings control the robustness of the estimators. The turning was 1.548. it controls the efficiency of the robust estimates. The breakdown value of 0.5 indicates that the method could handle 50 percent of the data being outliers. The weight (Bi-square) was a robust weighting function that reduced the influence of outliers and turning (4.684), related to the Huber type standard error and covariance.

The trade openness is not statistically significant in determining G7 countries' economic growth. The unemployment and inflation rates were individually significant in determining economic growth. One unit change in unemployment and inflation rate resulted in a 0.117 and 0.028 unit decrease in economic growth in G7 countries. Likewise, government expenditure had a positive and statistically significant (P=0.00) impact on economic growth. One unit increase in government expenditure resulted in a 0.044 increase in economic growth. Similarly, carbon emissions were also significant in determining economic growth. The carbon emissions and economic growth were simultaneously increased.

The value of the R-squared was 0.653; it indicates that a nearly 65.3 percent variation in economic growth depended on unemployment, inflation rate, trade openness, government expenditure, and environmental quality regarding carbon emissions. The Rw-squared and adjusted R_w-squared show a Robust version of R-squared, indicating that after accounting for the influence of outliers, 81.1 percent variance was explained by independent variables. The deviance and scale measured by the model fit precisely with the robust method. The scale measures the spread or dispersion of the residuals. It had a lower value (0.345). So, it indicates a more precise fit of the model.

The robust regression equation is estimated as follows:

$$LGDPRG = 15.81 - 0.002(TOPN) - 0.117(UNPG7) + 0.044\ (GOVEXP) - 0.028\ (G7INF) + 0.880(LCO2KG7) \quad (13)$$

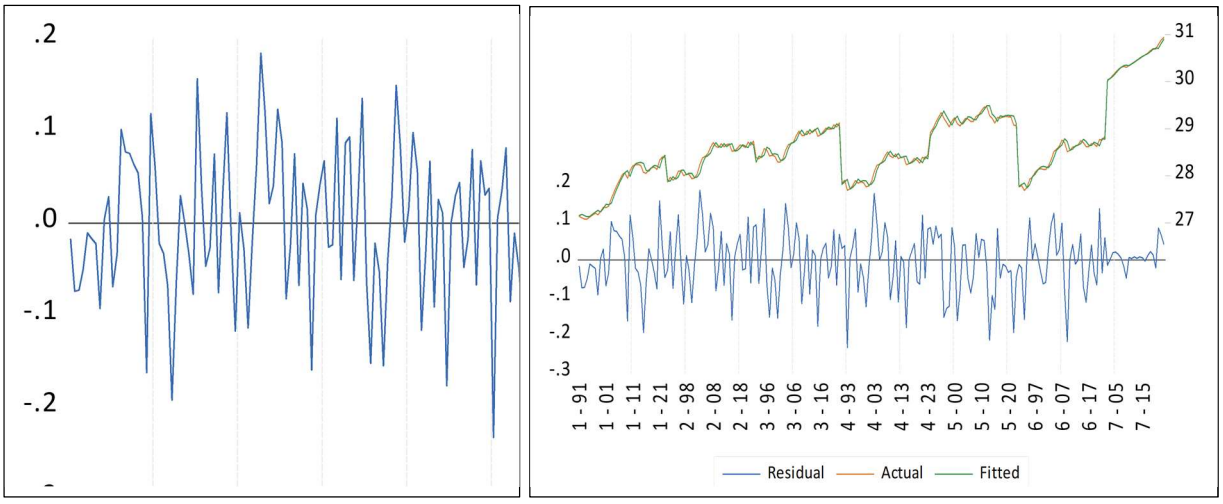
In equation (13), unemployment, government expenditure, environmental quality regarding carbon emissions, and intercepts are statistically significant. But the inflation rate was marginally significant (P= 0.052). The trade openness does not significantly impact the economic growth of G7 countries.

4.7 Residual Diagnostic of the Model

Figure 2 displays two panels, i.e., the left and right panels. The left panel shows the residuals of the dependent variable (Economic growth, LGDPRG). There was some variability in the residuals, but there did not appear to be a strong autocorrelation or trend, which suggests that the model was reasonably well-fitted. The right panel shows the residual, actual, and fitted diagram. The green line (fitted values) closely follows the red line (actual values), indicating that the model performs well in fitting the data. The blue lines represent the residuals, primarily small and fluctuating around zero, representing that the errors were minors and randomly distributed.

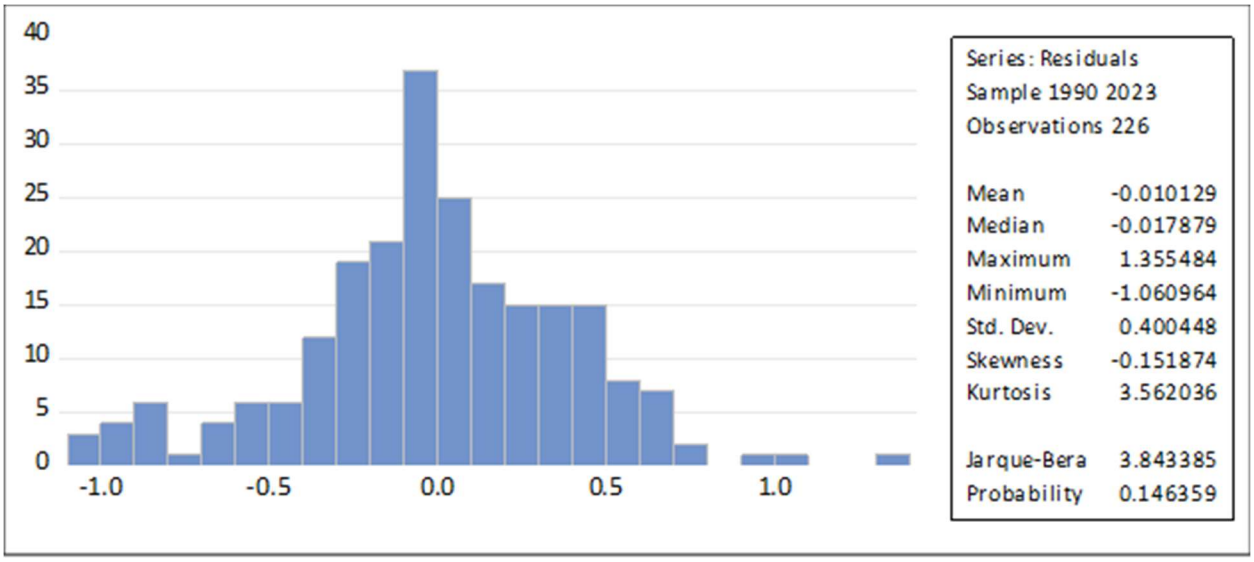
There was no indication of heteroscedasticity or autocorrelation in the residual. It indicates no significant issues with the model's assumptions being violated.

Figure 2: *Residual Plot and Actual Fitted. Residual Plots*



Normality diagnostic determines whether the data set follows a normal distribution. It helps assess if the data is symmetrical around the mean. It indicates that most values are around the mean, and fewer are extreme. If the P-value is more than 0.05, then there is no problem of normality. Figure 3 shows the diagram and statistical values of the normality diagnostic of the model. The histogram shows the distribution of residuals (observed value- predicted value) from the Robust least square regression model. The Jarque-Bera value was approximately 3.84, and its probability value was P=0.146, more significant than 0.05. So, the residual analysis indicated that there was no problem with the normality of the model.

Figure 3: *Normality Diagnostic of the Model*



5. Result Discussions

The trade openness is not statistically significant in determining G7 countries' economic growth. The unemployment and inflation rates are individually significant in determining economic growth. One unit change in unemployment and inflation rate results in a 0.117 and 0.028 unit decrease in economic growth in G7 countries. Poudel and Raut (2022), Eako (2023), and Karki et al. (2020) also found the negative impact of inflation on economic growth. However, Gregorio (2022) found the positive effect of inflation before the threshold. The findings of Acharya (2020), Zhorzholiani (2024), and Sekwati and Dagume (2023) found a negative impact of unemployment on economic growth. Likewise, government expenditure has a positive and statistically significant (P=0.00) impact on economic growth. One unit increase in government expenditure results in a 0.044 increase in economic growth. The research findings of Rahaman et al. (2023), Okunlola et al. (2024), and Poku et al. (2022) align with this finding. But, the findings of Nguyen and Bui (2022) and Arawatari et al. (2023) do not fully align with this finding.

Similarly, carbon emissions are also significant in determining economic growth. The carbon emissions and economic growth are simultaneously increased. Dahal (2023), Yen et al. (2022), and Islam et al. (2023) found that economic growth negatively impacts environmental quality. Trade openness has not had a statistically significant impact on GDP growth. The findings of Koho et al. (2017), Oppong _Baah et al. (2022), and Fatahi-Vehap et al. (2015) show the positive impact of trade openness on economic growth. But the finding of Nguyen et al. (2023) and Setana et al. (2023) shows the adverse effects of trade openness on economic growth. The value of the R-squared is 0.653; it indicates that a nearly 65.3 percent variation in economic growth depends on unemployment, inflation rate, trade openness, government expenditure, and environmental quality regarding carbon emissions.

6. Conclusions, Policy Implications, and Limitations

This study has navigated the impact of government expenditure, trade openness, inflation rate, unemployment, and environmental quality in terms of carbon emissions on economic growth concerning the most developed seven countries of the world or G7 countries. The carbon emissions and economic growth data had the lowest variation, whereas trade openness fluctuated highly. Government expenditure, trade openness, inflation rate, unemployment, environmental quality, and economic growth have long-run cointegration, move together, or share a long-run trend. Trade openness has no statistically significant effect on economic development in the G7 nations. Individually, unemployment and inflation rates have a substantial impact on economic growth. In G7 nations, a one-unit shift in unemployment and inflation rates reduces economic growth by 0.117 and 0.028 units, respectively. Similarly, government spending has a positive and statistically significant effect (P=0.00) on economic growth. One unit increase in government spending leads to a 0.044 rise in economic growth. Similarly, carbon emissions have a significant impact on economic growth. Carbon emissions and economic growth are increasing together. The R-squared result is 0.653, indicating that almost 65.3 percent of the variance in economic growth is

determined by unemployment, inflation, trade openness, government spending, and environmental quality in terms of carbon emissions in G7 countries.

Therefore, this paper's findings indicate several policy implications for G7 countries. Since the impact of unemployment and inflation on economic growth is appreciatively negative, there is a need for the authorities to make sure that stabilization in the labor market and price stability are maintained through appropriate fiscal and monetary policies. The significant positive relationship between government spending and economic growth suggests that long-term economic progress requires public sector investment. The apparent association of growth and carbon emissions is something that also needs to be considered in environmental policies. This is where its focus needs to highlight that though economic growth is imperative and so essential, it must be balanced with sustainable ecological plans. Policymakers should, therefore, encourage green technology and low-carbon solutions in such a way as to ensure that economic growth is not achieved at the expense of environmental destruction. Finally, the insignificant impact of trade openness on growth suggests that evaluation of trade policies themselves is to be made, and their interaction with other structural variables is sought so that the potential benefit of trade policies for economic growth is maximized.

This study only includes six variables. Economic growth is supposed to be highly affected by government spending, trade openness, inflation rate, unemployment rate, and environmental quality concerning carbon emissions. It is based on the secondary data of seven member countries of G7. It includes only 266 observations, spanning from 1990 to 2023. The robust least square method explores the impact on economic growth. There are so many untouched matters in this study. Therefore, further research is necessary by using more countries, variables, data points, methods, and techniques to make it more comprehensive and reliable.

References

1. Acharya, K. R. (2020). Macroeconomic determinants of unemployment in Nepal. *NCC Journal*, *5*(1), 39–44. https://doi.org/10.3126/nccj.v5i1.56946
2. Abdouli, M., Hammami, S. (2017). The impact of FDI inflows and environmental quality on economic growth: An empirical study for the MENA countries. *Journal of The Knowledge Economy, 8*, 254–278. https://doi.org/10.1007/s13132-015-0323-y
3. Afonso, A., & Sousa, R. M. (2011). The macroeconomic effects of fiscal policy. *Applied Economics*, *44*(34), 4439–4454. https://doi.org/10.1080/00036846.2011.591732
4. Arawatari, R., Hori, T., & Mino, K. (2023). Government expenditure and economic growth: A heterogeneous-agents approach. *Journal of Macroeconomics, 75,* 103486. https://doi.org/10.1016/j.jmacro.2022.103486
5. Bansal, S. (2015). Environmental quality: impact of economic growth. *Environment and Development Economics*, *20*(5), 673–696. doi:10.1017/S1355770X14000564
6. Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(S5): 103-125. https://doi.org/10.1086/261726

7. Barro, R. J. (1991). Economic growth in a cross-section of countries. *The Quarterly Journal of Economics*, 106(2), 407-443. https://doi.org/10.2307/2937943
8. Bakar, N. M., & Midi, H. (2019). The applications of robust estimation in fixed effect panel data model. Proceedings of the 1st Aceh Global Conference (AGC 2018) https://doi.org/10.2991/agc-18.2019.54.
9. Blanchard, O., & Wolfers, J. (2000). The role of shocks and institutions in the rise of European unemployment: the aggregate evidence. *Economic Journal*, 110(462), 1-33. https://doi.org/10.1111/1468-0297.00518
10. Blanchard, O. (2020). Is there deflation or inflation in the future? *Peterson Institute for International Economics*. https://shorturl.at/vbF8x
11. Bramati, M. C., & Croux, C. (2007). Robust estimators for the fixed effects panel data model. *The Econometrics Journal*, *10*(3), 521–540. http://www.jstor.org/stable/23126789
12. Bruno, M., & Easterly, W. (1998). Inflation crises and long-run growth. *Journal of Monetary Economics*, *41(1),* 3-26. https://doi.org/10.1016/S0304-3932(97)00063-9
13. Dahal, A. (2023). Economic growth, transport energy consumption, and environmental quality nexus: Assessing the evidence from Nepal. *The Journal of Knowledge and Innovation*, *9*(2), 10–17. https://doi.org/10.3126/jki.v9i2.67236
14. Dahal, A. K., Budhathoki, P. B., & Bhattarai, G. (2024). Nexus between unemployment, income inequality, political stability, and economic growth: An empirical study of the Nepalese economy. *Valahian Journal of Economic Studies, 15(1)*, 1-14. https://doi.org/10.2478/vjes-2024-0001
15. Edwards, S. (1998). Openness, productivity, and growth: What do we really know? *The Economic Journal*, *108*(447), 383–398. http://www.jstor.org/stable/2565567
16. Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics*, 110(2), 353-377. https://doi.org/10.2307/2118443
17. Grossman, G. M., & Helpman, E. (1991). Innovation and growth in the global economy. *MIT Press*. https://shorturl.at/OUYgF
18. Fakher, H., & Abedi, Z. (2017). Relationship between environmental quality and economic growth in developing countries (based on Environmental Performance Index). *Environmental Energy and Economic Research*, *1*(3), 299-310. https://doi.org/10.22097/eeer.2017.86464.1001
19. Ezako, J. T. (2023). Analyze the relationship between inflation and economic growth in Burundi. *Cogent Economics & Finance*, *11*(1). https://doi.org/10.1080/23322039.2023.2210914
20. Fetahi-Vehapi, M., Sadiku, L., & Petkovski, M. (2015). Empirical analysis of the effects of trade openness on economic growth: Evidence for South East European Countries. *Procedia Economics and Finance, 19*. 17-26. https://doi.org/10.1016/S2212-5671(15)00004-0
21. Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, *32*(3), 485-512. https://doi.org/10.1016/0304-3932(93)90027-D

22. Friedman, M. (1968). The role of monetary policy. *American Economic Review, 58(1),* 1-17. https://www.aeaweb.org/aer/top20/58.1.1-17.pdf
23. Hjazeen, H., Seraj, M., & Ozdeser, H. (2021). The nexus between the economic growth and unemployment in Jordan. *Future Business Journal, 7,* 42. https://doi.org/10.1186/s43093-021-00088-3
24. Gregorio, D.. (1992). The effects of inflation on economic growth: Lessons from Latin America. *European Economic Review, 36(2),* 417-425. https://doi.org/10.1016/0014-2921(92)90098-H
25. Gurdal, T., Aydin, M., & Inal, V. (2021). The relationship between tax revenue, government expenditure, and economic growth in G7 countries: new evidence from time and frequency domain approaches. *Economics Change Restricting, 54, 305–337.* https://doi.org/10.1007/s10644-020-09280-x
26. Islam, M. S., Rahaman, S. K. H., & Akhtar, T. (2024). Impact of remittance on economic growth and environmental quality in energy use, regulatory quality, and financial development. *Natural Resources Forum*, *48*(3), 903–924. https://doi.org/10.1111/1477-8947.12353.
27. Ji, A. bing, Wei, B. wen, & Xu, L. ying. (2022). Robust estimation of panel data regression models and applications. *Communications in Statistics - Theory and Methods*, *52*(21), 7647–7659. https://doi.org/10.1080/03610926.2022.2050403
28. Karki, S., Banjara, S., & Dumre, A. (2020). A review on impact of inflation on economic growth in Nepal. *Archives of Agriculture and Environmental Science*, *5*(4), 576-582. https://doi.org/10.26832/24566632.2020.050402
29. Kaika, D., & Zervas, E. (2013). The Environmental Kuznets Curve (EKC) theory—Part A: concept, causes, and the CO_2 emissions case. *Energy Policy*, 62, 1392-1402. https://doi.org/10.1016/j.enpol.2013.07.131
30. Kapoor, R (2023). Group of Seven (G7) - 2022 Summits highlights, history, aim, composition, challenges & criticism. UPSC Preparation: Free Study Materials & IAS Notes. https://testbook.com/ias-preparation/g7-countries
31. Keynes, J. M. (1936). *The general theory of employment, interest, and money*. Macmillan. https://www.files.ethz.ch/isn/125515/1366_KeynesTheoryofEmployment.pdf
32. Keho, Y., & Grace Wang, M. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance*, *5*(1). https://doi.org/10.1080/23322039.2017.1332820
33. Krueger, A. O. (1997). Trade policy and economic development: How we learn. *American Economic Review*, 87(1), 1-22. https://econpapers.repec.org/RePEc:aea:aecrev:v:87:y:1997:i:1:p:1-22
34. Lubeniqi, G., Haziri, A. & Avdimetaj, K. (2023). Impact of inflation on economic growth in developing European countries. *Review of Economics and Finance, 21*. 1389-1396. https://doi.org/10.55365/1923.x2023.21.152.

35. Maiga, Y. (2024). Impact of inflation on economic growth: Evidence from Tanzania. *Journal of Agricultural Studies, 12.* 77-100. https://doi.org/10.5296/jas.v12i2.21708.
36. Mubarik, Y. A. (2005). Inflation and growth: An estimate of the threshold level of inflation in Pakistan. *State Bank of Pakistan Research Bulletin*, 1(1), 35-44. https://ideas.repec.org/p/sbp/wpaper/08.html
37. Neupane, D. (2023). Trade openness and economic growth of Nepal: An econometric analysis. *Journal of Business and Management*, *7*(02), 32–45. https://doi.org/10.3126/jbm.v7i02.62585
38. Nguyen, M. T., & Bui, N. T. (2022). Government expenditure and economic growth: Does the role of corruption control matter? *Helion, 8(10),* e10822. https://shorturl.at/xyJ4N
39. Nguyen V. M. H, Ho T. H., Nguyen, L. H., & Pham A. T. H. (2023) The impact of trade openness on economic stability in Asian Countries. *Sustainability*,15(15), 11736. https://doi.org/10.3390/su151511736
40. Niyongabo, C., & Zhong, T. (2023) Econometric analysis of the impact of unemployment on Burundi economic growth. *Journal of Service Science and Management*, *16*, 711-724. https://doi.org/10.4236/jssm.2023.166038.
41. Okun, A. M. (1962). Potential GNP: Its measurement and significance. *American Statistical Association, Proceedings of the Business and Economic Statistics Section*, 98, 89-104. https://shorturl.at/TcAak
42. Okunlola, O.C., Sani, I.U., Ayetigbo, O.A., & Oyadeyi, O. O. (2024). Effect of government expenditure on real economic growth in ECOWAS: Assessing the moderating role of corruption and conflict. *Humanities and Social Sciences Communications, 11*, 768. https://doi.org/10.1057/s41599-024-03285-x
43. Omitogun. O., & Longe, A., E. (2017). Unemployment and economic growth in Nigeria in the 21st Century: VAR Approach**.** *Œconomica, 13(5),* https://shorturl.at/FxBPM
44. Onifade, S.T., Cevik, S., Erdogan, S., Asongu, S., & Bekun, F. V. (2020). An empirical retrospect of the impacts of government expenditures on economic growth: New evidence from the Nigerian economy. *Economic Structures* 9, 6. https://doi.org/10.1186/s40008-020-0186-7
45. Oppong-Baah, T., Bo, Y., Twi-Brempong, C., Amoah, E., Prempeh, N., & Addai, M. (2022). The impact of trade openness on economic growth: The case of Ghana and Nigeria. *Journal of Human Resource and Sustainability Studies*, *10*, 142-160. https://doi.org/10.4236/jhrss.2022.101010.
46. Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957. *Economica*, *25*(100), 283–299. https://doi.org/10.2307/2550759
47. Poku, K., Opoku, E., & Agyeiwaa Ennin, P. (2022). The influence of government expenditure on economic growth in Ghana: An ARDL approach. *Cogent Economics & Finance*, *10*(1). https://doi.org/10.1080/23322039.2022.2160036

48. Paudel, H. P., & Raut, N. K. (2022). Non-linear impact of inflation on economic growth in Nepal: A smooth transition regression approach. *Nepal Public Policy Review*, *2*(1), 235–260. https://doi.org/10.3126/nppr.v2i1.48676
49. Rahman, M., Nath, S., Siddqu, M., & Hossain, S. (2023) The impact of government expenditure on economic growth: A study of SAARC countries. *Open Journal of Business and Management*, *11*, 1691-1703. https://doi.org/10.4236/ojbm.2023.114095.
50. Rodrik, D. (2001). *The global governance of trade is as if development really matters.* Project report submitted to *UNDP*. https://shorturl.at/56gvF
51. Sarel, M. (1996). *Non-linear effects of inflation on economic growth.* IMF Staff Papers, 43(1), 199-215. https://ideas.repec.org/a/pal/imfstp/v43y1996i1p199-215.html
52. Sekwati, D., & Dagume, M. A. (2023). Effect of unemployment and inflation on economic growth in South Africa. *International Journal of Economics and Financial Issues*, *13*(1), 35–45. https://doi.org/10.32479/ijefi.13447
53. Setiana, N., Hutagaol, M. P., & Novianti, T. (2023). Examining the effect of trade openness, foreign direct investment and corruption on economic growth: An evidence from Indonesia. *International Journal of Advances in Social Sciences and Humanities*, *2*(2), 84–94. https://doi.org/10.56225/ijassh.v2i2.142
54. Urom, C., Abid, I., Guesmi, K., & Ndubuisi, G. (2021). Renewable energy consumption, globalization, and economic growth shocks: Evidence from G7 countries. *The Journal of International Trade & Economic Development*, *31*(2), 204–232. https://doi.org/10.1080/09638199.2021.1961845
55. Yan, C., Li, H., & Li, Z. (2022). Environmental pollution and economic growth: Evidence of SO_2 emissions and GDP in China. *Frontiers in public health*, *10*, 930780. https://doi.org/10.3389/fpubh.2022.930780
56. Zhorzholiani, T. (2024). The impact of unemployment on economic development: Georgia's example. *European Scientific Journal, ESJ*, *20*(37), 235. https://doi.org/10.19044/esj.2024.v20n37p235