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Revisiting the Role of Renewable Energy, Government Spending, Exports, and Imports, in Economic Growth: A Panel Data Analysis of Selected Asian Countries

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Abstract

Investing in renewable energy sources reduces a country's reliance on fossil fuel imports, enhancing energy security. By diversifying the energy mix, nations can mitigate the risks associated with price volatility and geopolitical tensions related to fossil fuel dependency. This stability in the energy supply promotes economic growth by ensuring a steady and affordable source of power for industries and businesses. Therefore, the present study examines the impact of renewable energy, government spending, exports, and imports on economic growth in selected Asian countries (namely, Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka) from 2000 to 2021. This study uses the Fixed Effects method of estimation based on the Hausman specification test. The findings reveal that renewable energy consumption, government spending, exports, and import have a positive effect on economic growth. Moreover, it is found that among these variables, renewable energy consumption and exports have maximum impact on economic growth in selected countries. Governments can allocate funds for the development, renewable energy project, and maintenance of infrastructure, such as transportation networks, roads, bridges, ports, and public utilities. It not only creates immediate job opportunities but also enhances productivity and growth.

Keyword: Government Consumption, Exports, Imports, Economic Growth, Fixed effect methods

JEL:

1. Introduction:

Renewable energy plays a key role in achieving the Sustainable Development

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Goals (SDGs) by promoting affordable and clean energy (SDG-7), mitigating climate change (SDG-13), fostering sustainable industrialization (SDG-9), and supporting inclusive and sustainable economic growth (SDG-8). A variety of issues are being explored on a global scale due to their effects on the growth of the world economy such as poverty, sluggish economic growth, population growth, health issues, energy crisis and climate change (Somoye et al., 2022). The findings of several studies have demonstrated that there is no causal link between Renewable energy consumption (REC) and Real GDP or that it can be either positive or negative. Part of the literature supports no causal connection or the neutrality hypothesis including (İnal et al. 2022; Bulut & Muratoglu. 2022; Chen et al., 2020), while other literature reported that a positive relationship or the growth hypothesis e.g. (Iqbal et al., 2022; Chang & Fang, 2022; Wang & Lee, 2022) and also part of the literature showed the negative connection (Namahoro et al., 2021; Chen et al., 2020).

Government spending (GS) is the term used to describe how much money the public sector spends on things like infrastructure, the military, healthcare, and education (Loo, 2023). Many researchers analyzed the impact of GS on economic growth (EG). The question arises what is the role of the government in EG. In 2008 the global financial crisis started in the U.S.A and then these crises shifted to the global market. Fiscal policy was adopted to encourage the economy by reducing the tax rate and increase government spending. The policymakers replied through different expansionary policies. According to pro-Keynesian the impact of government spending on economic growth is positive during recession (Ibrahim & Business, 2019). From the whole world, several governments have tried to encourage their economies through expanding government consumption, while some other European Union members criticized them (Larch et al., 2013). An increase in GE on public goods like Training, Infrastructure, and Healthcare are significant for better degrees of productivity. They increase the productivity of labor and increase national economic growth. And also decrease the production cost on infrastructure which will rise the EG. The finding showed that there is a positive link between GE and EG (Albatel, 2000; Al-Yousif, 2000; Dash & Sharma, 2008; Cooray, 2009). The increase of GE furthermore after a particular point will decrease the economic growth negatively (Tanzi & Zee, 1997). When the GE expenditure is less than 15%, then the connection between government size and EG was positive and when the size is greater than 15%, then the connection between EG and GS was negative (Sheehey,1993). The important tools for macroeconomic stabilization policy is Government spending (Ravn et al., 2012).

Exports (EXP) are defined as products and services created in one nation and sold to another nation (Investopedia, 2023a). Exports allow an economy to specialize in production which has a comparative advantage, resources are fully utilized and to increase productivity. Production possibility can be increased through its impact on competition, new technology, and new ideas. Imports also play a very impressive role in the output of a country. They allow access to new ideas, new technologies, and the skills of entrepreneurs. So the contribution of this is to produce more goods and to expand exports (Nidugala, 2000). International trade stimulates concentration in the production of export items, which will increase the economic growth of a country (Helpman & Krugman, 1985; Blomström, 1986). The whole

economy would gain because of the dynamic spillover of the export sector increase (Giles et al., 2000). It is a common debate that EXP and EG have a two-way causal relationship. Therefore, considerable literature emphasized the association between export and EG (Uğur et al., 2008). There is a positive connection between EXP and import and the effect of EXP and import on EG is also significant (Thirunavukkarasu et al., 2014).

Imports (IMP) refer to those goods & services which cannot be produced domestically but bought from another nation (Investopedia, 2023b). The imports sector is crucial for the EG in developing countries. Two schools of thought supported the contribution of imports to EG in developing countries as Imports are the main source of inputs (raw materials) for generating the production capacity of the economy (Malhotra, 2009). There is an efficient role of imports in price stability (Shirazi et al., 2004). Imports cannot directly affect economic growth, but imports can tangentially affect it (Kogid et al., 2011).

The consumption and production pattern and investment opportunity is different in South Asian Association for Regional Cooperation (SAARC) countries. Furthermore, the structure of the tax and non-tax system between these countries is also different. So based on comparative advantage, there is a greater opportunity to increases trade between these countries. SAARC countries should remove all barriers to stimulate trade relations. The performance of SAARC countries is significant to increase cooperation for the benefit of their trade and economic wellbeing (Zaheer et al., 2013). The finding indicates that there is a unidirectional causal association to export from EG for India and Bangladesh. Similarly, Srilanka and Afghanistan find a bidirectional causal connection to EXP from EG and there is no causal connection found for Pakistan, Nepal, the Maldives, and Bhutan (Sampathkumar et al., 2016). There are a long-run equilibrium association and Cointegration that exist between government consumption and economic growth in SAARC countries. In the short & long run, bidirectional causality exists between GE and EG except for Sri Lanka and Pakistan. The absence of GS may restrain EG in SAARC countries (Pradhan, 2011). This research aims to empirically investigate the impact of REC, GS, EXP, IMP on economic growth in selected Asian countries for the period 2000 to 2021. This study contributes to the existing literature in two ways: first this study simultaneously examined the effects of REC, GE, EXP and IMP on economic growth, which are not used in the previous literature. Finally, the outcome of this research provides useful policy recommendations to surge the economic growth in selected countries.

The remainder of this article is organized as follows; Section 2 presents the Literature review. Section 3 deals with the methodology and Data. Section 4 presents the results and discussion. Finally, section 5 deals with the conclusions of the study.

2. Literature Review:

Dudzeviciute et al. (2018) worked on the relationship between GS and EG in European countries during the period 1995 to 2015. The researcher used various methodologies to check the connection between government spending and EG. They used the Granger causality test. The result showed that there is a significant connection between GS and EG in eight European countries. Okoye et al., (2019) examined how GS affect EG in Nigeria from 1981 to 2017. The researcher used the ARDL method to estimate the data. The result

indicates that the ARDL method shows that lagged current spending has a negative short-run and significant impact on EG, and lagged capital expenditure has a strong positive impact on EG. The result did not find any long-run effect of government spending and EG. The finding also shows that in Nigeria GS is non-sustainable.

Leshoro (2017) investigated disaggregated government spending and EG in South Africa for the period 1976 to 2015. They used 40-year annual data and also the Auto distributed lag model (ARDL). They found that there is a positive short-run and long-run relationship between disaggregated government spending and EG during the considered period. Chandio et al., (2016) investigated the effect of GS on EG and the agriculture sector in Pakistan from 1983 to 2011. To analyze the data, they applied different tests (i) Augmented Dicky Fuller ADF test (ii) Ordinary Least Square OLS test and (iii) Johanson Cointegration test. The finding show that government expenditure and agriculture output have substantial effect on economic growth of Pakistan.

Bakari (2017) worked on the nexus among import, export, and EG in Tunisia from 1965 to 2016 using annual data. The Cointegration and Vector Error correction model was used for the analysis of data. The result indicated that there is a negative impact of EXP on EG in the long run. They also found that in the long run, IMP, and EXP have a positive effect on EG. The relationship between EXP and EG was bi-directional casual in the short run. The connection between EXP to IMP was uni-directional causality and the association between IMP to EG was also uni-directional causality. Mohsen et al. (2015) analyzed the connection between EXP, IMP and EG of Syria from 1980 to 2010. They used the Granger causality and Johansen Cointegration test. They reported that impact of EXP and IMP on GDP is positive. While the connection between IMP, EXP, and GDP is bi-directional causality. Akhter (2015) worked on the effect of EXP and IMP on EG in Bangladesh for the period from 1981 to 2012. The study showed that EXP and IMP have a positive and significant effect on EG. Hussain (2014) investigated the relationship between EG, IMP, and EXP, in Pakistan from 1976 to 2011 by using the Johansen Cointegration test. The results showed that EXP and EG connection is bidirectional causality and there is no causal connection between EXP and IMP and IMP and GDP.

Jahangir (2018) studied the effect of gross capital formation, GS, household consumption level, and EXP on the GDP of Pakistan and took 50-year annual data from 1967 to 2017 by using the OLS methods. The result showed that there is a positive effect of GS, household final consumption expenditure, and capital formation on the EG of Pakistan. Khan et al. (2014) investigated the determinants of EG in Pakistan and took 5 years of data from 2008 to 2012. They found that there is a negative correlation between IMP and EXP. Moreover, the result also revealed that there is a positive correlation between GS and EXP and a negative correlation with imports. Alhakimi et al. (2018) worked on the connection between export and EG in Saudi Arabia during the years from 1960 to 2018. The study used the Augmented Dickey-Fuller test, Granger causality test, and Johanson cointegration test to check the casualty association between EXP and EG. They showed that GDP significantly affects exports. The results also indicate that EXP has an insignificant effect on GDP. Riyath & Jahfer, (2016) analyzed the impact of EXP and IMP on EG in Sri Lanka from 1962 to 2015 by using the Vector error

correction technique. The result showed that in the long and short run, there is a Unidirectional causality between EXP and EG. While they also revealed that, export is more important for Sri Lanka EG than import. Ijaz (2021) worked on the connection between inflation and EG, by using the Engel Granger Co-integration test from 1990 to 2015. They found the connection between GDP growth and inflation in Pakistan.

Chaudhry et al. (2017) investigated the long-run connection between EXP and IMP in Pakistan from 1948 to 2013. The result showed the relationship between EXP and IMP is bidirectionally shown by Toda and Yamamoto causality test. A cointegration relationship exists between export and import shown by the Vector Error Correction model. Ali et al., (2017) examined the association between EXP and EG in Pakistan from 1990 to 2012 by using the OLS method to analyze the data. The result showed that export and EG have a positive relationship. The study also indicated that there is a strong effect between EG and EXP, and weak effect between export and economic growth.

Zang & Baimbridge (2012) studied the connection between EXP, IMP, and EG in Korea from 1963 to 2003 and Japan from 1957 to 2003 by using the VAR approach. In the short-run import has a positive effect on EG for both countries. Elbeydi et al. (2010) empirically analyze the association between EXP and EG for Libya from 1980 to 2007 by using the VECM technique. They found that a bidirectional connection between EXP and EG also indicated that EXP has a positive effect on EG. Nurlina & Ventura (2015) investigated the impact of GS on the EG of Indonesia for the period of 2004-2013. They found that GS and EG have a strong and positive correlation.

Uddin & Rehman (2022) examined the nexus between unemployment, corruption, and inflation and EG in 79 developing countries from 2002 to 2018. They used the panel ARDL, FMOLS and DOLS estimators. They reported that effectiveness of governance, rule of law, and inflation have a positive effect on EG, while political stability, corruption and unemployment have a negative effect on EG. Saad & Uddin (2021) worked on the nexus between inflation, money supply, financial development, population growth, unemployment and EG in Pakistan by using the ARDL model, from 1980-2019. The outcome showed that unemployment has a short-term, somewhat beneficial impact on Pakistan's real GDP per capita. The study also showed that the real GDP is significantly but favorably impacted by the money supply. This analysis also establishes that real GDP per capita is significantly but adversely affected by inflation. The results showed that FDI has a considerable and favorable impact on real GDP per capita.

Mohammadi et al. (2023) worked on renewable and non-renewable energy consumption and its impact on economic growth from 1993–2019 by using the FMOLS estimators. The results showed that energy consumption had a positive and significant effect on the economic growth. Hieu & Mai (2023) examined the impact of renewable energy on economic growth for 80 developing countries from all income over the 1990 to 2020 period. They used the methods of movement quantile regression approach and long-run coefficient estimations through fully modified ordinary least squares, fixed effects ordinary least squares, and dynamic ordinary least squares. They showed that nonrenewable energy and renewable energy

have a positive effect on impact economic growth.

According to the available literature, there is no or few research to examine the role of Renewable energy, Government Spending, Exports, and Imports, in Economic Growth: A panel data Analysis of selected Asian Countries, which requires further investigation.

3. Methodology

3.1. Model Specification

Solow (1956) developed the neoclassical growth model, which is becoming widely accepted, its general form in eq -a.

$$Y = f(K, AL) \quad (a)$$

Here, *Y* represents production (economic growth), while *K, L,* and *A* denote the levels of capital, labor, and technology, respectively. The term AL refers to the labor force efficiency unit, encompassing productivity and labor force size evaluated at the current technological level. A modified and extended version of the growth equation based on equation (a), which emerged from many elsewhile studies including (Ahmed & Azam, 2016; Azam et al., 2015; Somoye et al., 2022; Loo, 2023; Ravn et al., 2012; Thirunavukkarasu et al., 2014; Kogid et al., 2011; Ijaz, 2020) and can be written as follows:

$$GDPPC_{it} = \beta_0 + \beta_1 REC_{it} + \\ + \beta_2 GS_{it} + \beta_3 EXP_{it} + \\ + \beta_4 lnIMP_{it} + \mu_{it} \quad (1)$$

In Equation (1), *GDPPC, REC, GS, EXP* and *IMP* represent the gross domestic product per capita, renewable energy consumption, government spending, exports and imports respectively. μ_{it}, the subscript (i=1....n), and (t = 1....t) represent the error term, the countries, time periods. The dependent variable is *GDPPC* which is used as proxy for Economic growth also used by (Uddin & Rehman, 2022) while REC, GS, EXP and IMP are independent variables. β_0 is intercept, while $\beta_1 \, to \, \beta_4$ represent the slope of the respective independent variables. To avoid data sharpness, we convert all variables into a logarithmic form (Azam et al., 2022; Azam et al., 2023; Uddin et al., 2023).

3.2 Estimation Technique

The estimate of the suggested model has been done using the Fixed Effects (FE) method. Each cross-sectional entity (people, businesses, nations, etc.) may have unique features when using panel data analysis. These unique traits might or might not have an impact on the factors that have been described. The relationship between independent and explanatory variables inside an entity is investigated using the fixed effect model (individual, organization, country, etc.). Each entity has unique characteristics that might have an impact on the explanatory variables (renewable energy consumption, GS, EP, and IMP could have some influence on economic growth). By using FE, it is assumed that an internal component of an entity may influence or bias the controllable explanatory or explained variables. The consequences of those time-invariant traits are eliminated via FE (religion, race, culture, etc.). So, it is possible to calculate the independent variables' overall impact on the explanatory variables. Dummy variables can be used to estimate FE. Because dummy variables are used in the Fixed Effects Model for time-invariant qualities, it is also known as the Least Squares Dummy Variable Model method (Awan et al., 2018). The second underlying assumption of this method is that time-invariant features are exclusive to the individual unit and should not be related to other personal traits. Since each

entity is unique, the intercept that captures its unique traits and error should not be merged to other entities. The Fixed Effects Model permits various intercept terms and constant slopes for each cross-section unit, allowing for country-level variation. Although the intercept term may vary between countries, it does not change over time. It is time-independent (Awan et al., 2018). The fixed effects model offers a significant advantage by enabling us to account for all time-invariant omitted variables, especially those that are challenging or impossible to observe. However, a key drawback of this model is the need to estimate several additional parameters.

3.3. Model Specification Test

Various tests are offered with the aim of specifying the model among the pooling, fixed, and random effects models. The Hausman specification test and the redundant fixed effect test were employed in the current investigation.

3.3.1. The Hausman Test

The Hausman test (HT) is frequently used to choose the best model between an FE and a random effects (RE) model. Low Hausman chi-square statistics and (high p-value) favor the RE model, whereas high Hausman chi-square statistics (low p-value) favor the FE model. The null hypothesis (*Ho*) of the HT is that the RE model is appropriate, while the alternative hypothesis (*H1*) of HT is FE model is appropriate.

3.3.2. Redundant Fixed Effects Test

Redundant fixed effect (RFE) testing has been done to determine which model, between pooled and fixed effect models, is superior. The F-test is another name for this test. It investigates the following hypothesis. The *Ho* of the RFE model is that the pooled model is appropriate, while *H1* of the RFE model is that the FE model is appropriate.

3.4. Data

This empirical study examines the role of Renewable energy, Government Spending, Exports, and Imports on Economic Growth from 2000– 2021. The study period is considered based on the availability of the data for balanced panel data analysis. Table 1 presents the variables, measuring units and corresponding data sources.

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 shows the descriptive statistic of the variables, where the mean value of GDPPC, REC, GS, EXP and IMP are 23.50280, 4.58914, 23.02009, 22.43450 and 7.104665 respectively. The Maximum value of GDPPC, REC, GS, EXP and IMP are 27.23054, 5.23456, 27.10339, 26.52236 and 8.296965 respectively. Moreover, the Minimum value of

Table 1. Variables, measuring units, and data sources.

Notation	Variable	Unit of measurement	Data sources	Expected sign
GDPPC	Gross domestic product per capita	constant 2015 US$	WDI (2023)	+
REC	Renewable energy consumption	% of total final energy consumption	WDI (2023)	+
GS	Government spending	constant 2015 US$	WDI (2023)	+
EXP	Exports	constant 2015 US$	WDI (2023)	+
IMP	Imports	(constant 2015 US$	WDI (2023)	+/-

Table 2. Summary Statistics

Variables	Mean	Maximum	Minimum	Standard deviation	Obs
GDPPC	23.50280	27.23054	19.61460	1.904127	120
REC	4.58914	5.23456	1.35791	0.45566	120
GS	23.02009	27.10339	19.11383	2.077991	120
EXP	22.43450	26.52236	18.82615	2.034093	120
IMP	7.104665	8.296965	6.120906	0.58662	120

GDPPC, REC, GS, EXP and IMP are 19.61460, 1.35791, 19.11383, 18.82615 and 6.120906 respectively. Finally, the Standard deviation of GDPPC, REC, GS, EXP and IMP are 1.904127, 0.45566, 2.077991, 2.034093 and 0.58662 respectively.

4.2. Results of the Fixed and Random effect:

Table 3 shows the results of the fixed (FE) and random effect (RE) model, where the coefficient of renewable energy consumption, in the FE and RE model, is 0.903451 and 0.78446, indicating that 1% surge in renewable energy consumption leads to rise in the GDPC by 0.903451% and 0.78446% respectively in the FE and RE model. Investing in renewable energy sources reduces a country's reliance on fossil fuel imports, enhancing energy security. By diversifying the energy mix, nations can mitigate the risks associated with price volatility and geopolitical tensions related to fossil fuel dependency. This stability in energy supply promotes economic growth by ensuring a steady and affordable source of power for industries and businesses. The finding is consistent with the finding of (Mohammadi et al., 2023; Hieu & Mai, 2023). While the coefficient of government spending is 0.382259 and 0.350886 in the FE and RE model, examining that 1% rise in government spending leads to rise in GDPPC by 0.382259% and 0.350886% respectively, in the FE and RE model. The greater GS might have a multiplying impact. If GS helps the unemployed find employment, they will have more money to spend, which will increase the overall level of demand. When there is extra capacity in the economy, GS could boost GDP further than it did when it was first introduced. This finding is consistent with the finding of (Ibrahim et al., 2019; Larch et al., 2013; Albatel, 2000; Al-Yousif, 2000; Dash & Sharma, 2008; Cooray, 2009). The coefficient of exports is 0.476781 and 0.465978 in the FE and RE model, examining that 1% rise in the exports leads to rise in GDPPC by 0.476781% and 0.465978% respectively, in the FE and RE model. A country's GDPPC increases when there are more EXP since it means its factories and manufacturing facilities are operating at a high production rate and require a greater workforce to remain operational. The results are inconsistent with the findings of (Helpman & Krugman, 1985; Blomström, 1986; Uğur et al., 2008; Thirunavukkarasu, et al., 2014). The coefficient of imports, in the FE and RE model is 0.505730 and 0.502849 indicating that 1% surge in imports leads to rise in the GDPC by 0.505730% and 0.502849% respectively in the FE and RE model. It is even more favorable for a country if these IMP predominantly consist of productive assets like tools and equipment since, over time, productive assets

Table 3. Results of Fixed and Random effect Model

	Fixed Effect			Random effect		
Variable	***Coefficient***	***Std. Error***	***Prob.***	***Coefficient***	***Std. Error***	***Prob.***
C	-1.534367	1.556593	0.3264	-0.998162	0.663562	0.1352
REC	0.903451*	0.14556	0.00000	0.78446**	0.34546	0.0435
GS	0.382259*	0.150084	0.0122	0.350886*	0.065629	0.0000
EXP	0.476781*	0.054190	0.0000	0.465978*	0.049924	0.0000
IMP	0.505730*	0.103918	0.0000	0.502849*	0.057767	0.0000
R^2		0.99			0.92	
F-statistic		2379.635* (0.000			479.1513* (0.000)	

Note: * designates the significance level at 1%. Dependent variable: GDPPC

Table 4. Specification Tests

Effects Test	Tested	Statistics	p-value	Selection
F-test	Pooled/Fixed	39.941223*	0.000	Fixed
Hausman test	Fixed/Random	11.630755*	0.000	Fixed

Note: * designates the significance level at 1%.

will increase the production of the economy. When IMP is high, this leads to high EG and strong domestic demand. This finding is the similar to the empirical results of (Malhotra, 2009). Moreover, in the FE and RE model, value of R-Square is 0.99 and 0.92, which indicates that 99% and 92% variation in GDP growth is explained by explanatory variables. The overall model is best fit according to the F-statistic.

4.3. Specification Tests

Table 4 shows the estimates of the specification test by employing the F –test and Hausman test. Where the F statistics value is 39.941223 at 1% level of significance, it rejects the null hypothesis of the pooled model, thus it supports the FE model. While the Hausman test statistic is 11.630755, at a 1% level of significance, thus it supports the FE model.

4.4. Fixed effects with specific cross-section coefficient

Tables 5, 6, 7, & 8 shows the results of the fixed effects model for Renewable energy, government spending, exports and imports respectively. Table 5 shows the FE results for renewable energy consumption in selected countries. The coefficient of renewable energy is positive and statistically significant for all selected countries. Amongst these countries the coefficient of renewable energy has a more robust impact on GDPPC of Nepal and Bangladesh. Table 6 shows the FE results for government spending in selected countries. The government spending coefficient is positively connected to GDPPC in all countries. Amongst these nations, the coefficient of consumption has a more robust impact on the GDP growth of Nepal. Finally, table 7 presents the FE results for Exports and revels that Exports has a positive effect

Table 5. Fixed Effects results for Renewable energy

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.34567*	0.94848	13.01629	0.00000
BTN-REC-BTN	1.56674*	0.49496	3.16541	0.00000
PAK-REC-PAK	1.45668*	0.38459	3.78765	0.00000
BGD-REC-BGD	2.45457*	0.39496	6.21479	0.00000
IND-REC-IND	1.65768*	0.24456	6.77829	0.00000
NPL-REC-NPL	2.44547*	0.25568	9.56463	0.00000
SRI-REC-SRI	1.13381*	0.23568	4.81084	0.00000

Note: * designates the significance level at 1%. REC represent the renewable energy consumption. BTN, PAK, BGD, IND, NPL and SRI represent Bhutan, Pakistan, Bangladesh, India, Nepal, and Sri Lanka respectively. Dependent Variable: GDPPC

Table 6. Fixed Effects results for Government Spending

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.792868*	1.793857	-2.671822	0.0087
BTN-GS-BTN	0.818626*	0.098915	8.276058	0.0000
PAK-GS-PAK	1.024745*	0.216562	4.731871	0.0000
BGD-GS-BGD	0.903522*	0.065178	13.86240	0.0000
IND-GS-IND	1.036583*	0.081542	12.71234	0.0000
NPL-GS-NPL	2.058153*	0.329216	6.251676	0.0000
SRI-GS-SRI	1.580541*	0.233763	6.761301	0.0000

Note: * designates the significance level at 1%. GS represent the government spending. BTN, PAK, BGD, IND, NPL and SRI represent the Bhutan, Pakistan, Bangladesh, India, Nepal, and Sri Lanka respectively. Dependent Variable: GDPPC

Table 7. Fixed Effects results for Exports

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.247586	1.088884	-3.900863	0.0002
BTN-EXP-BTN	1.448712*	0.143476	10.09726	0.0000
PAK-EXP-PAK	0.626881*	0.106855	5.866668	0.0000
BGD-EXP-BGD	1.500133*	0.103035	14.55948	0.0000
IND-EXP-IND	1.481952*	0.108426	13.66788	0.0000
NPL-EXP-NPL	1.387848*	0.118602	11.70172	0.0000
SRI-EXP-SRI	1.003066*	0.136008	7.375035	0.0000

Note: * designates the significance level at 1%. EXP represent the exports. BTN, PAK, BGD, IND, NPL and SRI represent Bhutan, Pakistan, Bangladesh, India, Nepal, and Sri Lanka respectively. Dependent Variable: GDPPC

Table 8. Fixed Effects results for imports

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.78794*	0.562213	19.18834	0.0000
BTNIMP-BTN	1.247276*	0.122588	10.17458	0.0000
PAK-IMP-PAK	2.223817*	0.351434	6.327828	0.0000
BGD-IMP-BGD	2.085224*	0.143894	14.49142	0.0000
IND-IMP-IND	1.823131*	0.130673	13.95185	0.0000
NPL-IMP-NPL	2.431656*	0.196845	12.35317	0.0000
SRI-IMP-SRI	1.133814*	0.141206	8.029481	0.0000

Note: * designates the significance level at 1%. IMP represent the imports. BTN, PAK, BGD, IND, NPL and SRI represent Bhutan, Pakistan, Bangladesh, India, Nepal, Pakistan, and Sri Lanka respectively. Dependent Variable: GDPPC

on GDPPC in all countries, but the exports coefficient is more robust as compared to others nations. Finally, table 8 shows the FE results for imports in selected countries. The coefficient of imports is positive for all selected countries, while the coefficient of imports has a robust impact on the GDP growth of Nepal and Pakistan.

5. Conclusion:

The central objective of this empirical study is to examine the role of Renewable energy, Government Spending, Exports, and Imports, in Economic Growth in selected Asian countries from 2000 to 2021. This study employed the fixed effect model based on the Hausman test specification. The estimates showed that Renewable energy consumption, government spending, exports and imports have a negative effect on GDPPC. This study has several limitations which will give us the future direction of the research. This study only worked on some selected variables like GDPPC, EXP, IMP, GS and REC and ignored the other macroeconomics variables. We apply the fixed and random effect model but ignored the panel ARDL, FMOLS and DOLS.

5.1. Policy recommendations and limitations of the study

This empirical study has several policy recommendations for Selected Asian countries to boost their economic growth based on the finding: first: Governments can implement supportive policies that incentivize and facilitate the adoption of renewable energy. This includes establishing renewable energy targets, offering financial incentives such as feed-in tariffs or tax credits, streamlining permitting processes, and providing grants or low-interest loans to renewable energy projects. Clear and stable policies create a favorable investment environment, attracting private sector involvement and stimulating economic growth. Second, Infrastructure Investment: Governments can allocate funds for the development and maintenance of infrastructure, such as transportation networks, roads, bridges, ports, and public utilities. Infrastructure spending not only creates immediate job opportunities but also enhances productivity, efficiency, and competitiveness in the long term. It can attract private sector investment, facilitate trade, and support the growth of various industries

and overall economic growth. Third, Imports can provide access to crucial resources, raw materials, and inputs that are not readily available domestically or are cost-prohibitive to produce domestically. By importing these inputs, governments can support domestic industries by ensuring a steady supply of essential resources, thereby fostering their growth and enhancing productivity. Fourth, Governments can implement export promotion policies and programs to encourage domestic businesses to engage in international trade. This can include providing financial incentives, export financing, trade missions, and market intelligence support to help businesses access foreign markets. By supporting and promoting exports, governments can expand market opportunities for domestic industries, increase export volumes, and generate revenue that contributes to economic growth.

This study has several limitations which will give us future direction of the research. This study ignores the environmental, social, and political factors which also affect economic growth and also advance econometrics technique. Therefore, future research will use these variables and apply advanced techniques, such as second-generation econometric techniques. Finally, this study only worked on selected Asian countries and ignored the developed and developing countries.

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