

Dynamics among Renewable Energy Consumption, Political Stability, Green Trade, and Economic Growth: New Evidence from BRICS Nations

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Abstract: - This study examines the short- and long-run effects of renewable energy consumption, political stability, and green trade on economic growth in BRICS nations. Using annual secondary data for Brazil, Russia, India, China, South Africa, and Indonesia from 2002 until 2023, sourced from the World Bank, IEA, UNCTAD, and IMF. The analysis applies a dynamic panel Generalized Method of Moments (GMM) model estimated in Stata 17. The findings indicate that renewable energy consumption has a positive and significant effect on economic growth in both the short and long term. Green trade also contributes positively and significantly by strengthening export competitiveness and foreign exchange earnings. In contrast, political stability does not show a significant effect on economic growth. These results highlight the importance of accelerating energy transition and expanding green trade to sustain growth in emerging economies.

Key-Words: - Renewable Energy Consumption, Political Stability, Green Trade, Economic Growth, Keynesian Theory, Generalized Method of Moments (GMM).

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1 Introduction

Economic growth remains one of the main indicators of a country's economic performance and continues to be a major concern in economic discussion. Some old time thinkers like Adam Smith and David Ricardo thought that markets could fix themselves and find a balance. Adam Smith said this back in 1776. David Ricardo said it in 1817. However John Maynard Keynes had an idea in 1936. He said that markets do not always work on their own to find a balance. Economic growth is still an issue, in economic development and people are still studying it.

Economic growth in developing countries is something that needs to be looked at closely. The group of countries called BRICS, which is made up of Brazil, Russia, India, China, South Africa and Indonesia is a big deal. BRICS is a group of countries that are getting more powerful and can really change the way the world economy works. The main goal of BRICS is to work more and not rely so much on Western countries for economic things. This is important for the countries in BRICS like Brazil, Russia, India, China, South Africa and Indonesia because it can help them grow and become more independent in the economy, which is what BRICS is all, about.

The World Bank has some data from 2002 to 2023. This data shows that the economic development of World Bank member nations like the BRICS countries is really up and down. Brazil had an economic growth rate. It was 2.11 percent on average. This is a lot lower, than the BRICS countries. The BRICS countries grew by 4.62 percent. Brazil economy had some years. Brazil economy also got smaller sometimes. Brazil had a tough time with the economy of Brazil in the year 2015 and the year 2016. The economy of Brazil actually got smaller in those years. It went down by 3.55 percent in 2015. Then by 3.28 percent in 2016. These numbers show that Brazil was having some problems, with its economy back then. The economy of Brazil was clearly struggling during that time. The economy of Brazil was really going through a time South Africa is similar to Brazil in this way. The economy of South Africa usually grows at a rate of 2.48 percent. In the year 2020 the South Africa economy had a really big decline. This decline was 6.17 percent, for the South Africa economy. These numbers show that Brazil and South Africa have had a lot of ups and downs in their economies over time. The World Bank data from 2002, to 2023 shows this. The economic development of the BRICS countries is something to think about.

Russia grew at a rate of 3.37 percent with big ups and downs. It grew by 8.50 percent in 2007. Then fell by 7.80 percent in 2009. Indonesia grew at 4.94 percent per year which's just more than the average. Its biggest fall was in 2020 when it dropped by 2.07 percent. India had growth at 5.56 percent on average. China grew the most at 8.66 percent on average. This shows China is leading in the regions growth. Chinas growth is much higher than the BRICS average. Russia, Indonesia and India also had growth. Not as high, as China.

Within the Keynesian framework, expenditure occupies a central position in the process of economic growth. This issue has long attracted scholarly attention, particularly with regard to the manner in which aggregate consumption expenditure influences national income and output. In this context, previous studies have examined the relationship between renewable energy consumption and economic growth, with specific attention to the role of aggregate expenditure, especially aggregate consumption expenditure, in shaping growth dynamics. From a Keynesian perspective, aggregate expenditure is regarded as a fundamental driver of economic expansion. The findings further indicate that renewable energy may function as an important catalyst for economic growth in high-income countries, [1], [2]. This finding is contrary to other studies which suggest that renewable energy use generally has a negative or negligible effect on economic development. This disparity may be attributed to technological constraints and high initial investment costs, [3], [4].

Government expenditure, particularly on military and security measures aimed at addressing violence and terrorism while maintaining political stability, remains a contentious issue in relation to its impact on economic development. Previous research indicates that political stability contributes to gross domestic product (GDP) growth by creating a favorable environment for economic activity, [5], [6]. There are contradictory findings in other studies, indicating that political stability does not influence economic development. Other studies further show that political stability has a negative and insignificant effect on economic development. In addition, some findings reveal that political stability has a substantial negative correlation with economic growth, [7], [8], [9].

Green trade, which encourages environmentally friendly practices and products, increases exports due to global demand for environmentally friendly products, thus boosting economic growth. Other studies indicate that green trade contributes positively to economic growth. Further findings also

show that green trade has a positive contribution to economic growth, [10], [11].

There are contradictory findings in other studies, indicating that green trade does not influence economic development in low-income countries, either in the short run or in the long run. Other studies further show that green economic models, including green trade, implemented in high-income countries cannot be directly adopted in low-income countries. In addition, some findings reveal that development disparities hinder the implementation of a green economy in low-income countries, [12], [13], [14].

The identified research gap lies in the theoretical foundation of previous studies, which predominantly emphasize neoclassical economic growth theory and remain focused on the classical Cobb–Douglas production function by incorporating only capital, labor, and energy consumption as the main determinants of economic growth, [15], [16]. In contrast, other studies adopts Keynesian growth theory, which argues that aggregate expenditure may promote economic growth, [17].

From a geographical perspective, a distinct research gap is evident due to limited regional coverage. Previous studies have focused exclusively on the European Union, covering 28 member countries over the period 2003 to 2014. These studies were confined to the European Union context and did not examine developments beyond that regional setting, [18], [19]. This gap is important to acknowledge, as it overlooks emerging countries, particularly those within the BRICS alliance. The methodological gap further indicates that previous studies continue to employ the Ordinary Least Squares (OLS) technique to analyze variable relationships and use Analysis of Variance (ANOVA), both of which are fundamentally based on linear analysis or basic regression approaches, [20]. This research used the Generalized Method of Moments (GMM) analytical model established by Blundell and Bond (1998), which is superior at addressing non-linearity, heteroscedasticity, and autocorrelation in the data, [21].

The urgency of this research is substantial, as BRICS serves as a strategic platform for developing countries to promote a more equitable economic and political order, thereby counterbalancing the dominance of Western countries. Previous studies further suggest that the use of cost-effective and efficient renewable energy may reduce household energy expenditures, lessen dependence on fossil fuels, and enhance aggregate demand and economic growth, [22], [23], [24]. However, data from the World Bank and the International Energy Agency

(IEA) shows that the average renewable energy consumption of BRICS member countries from 2002 to 2023 was only around 23.90%.

Further studies support the view that political stability is essential for fostering a favorable investment environment for renewable energy initiatives and economic growth, [25], [26]. World Bank data indicates that the average political stability index for BRICS nations is approximately 26.62. Supporting studies indicate that green trade contributes to strengthening industrial competitiveness, increasing foreign exchange earnings, and promoting economic growth through the export of environmentally sustainable products, [11], [27]. However, the average contribution of BRICS countries' green goods exports from 2002 to 2023 has been approximately 4.06%.

2 Literature Review

2.1 Keynesian Theory of Economic Growth

John Maynard Keynes made a model of growth in 1936. This model of growth is really important. John Maynard Keynes is very famous, for this model of growth. John Maynard Keynes is really important when it comes to economics. People still look at the growth model that John Maynard Keynes created. They use John Maynard Keynes model to see how economies can grow and change. Nonetheless, the Keynesian framework is regarded as the preeminent theoretical basis. The Keynesian economic growth theory is founded on three fundamental premises: (a) aggregate demand, which refers to the entire demand for goods and services within the economy, (b) government intervention aimed at stabilizing the economy, and (c) spending components that enhance production and national income, [19].

2.2 Economic Growth

Economic growth is the process of augmenting the production of commodities and services within an economy, quantified over a certain timeframe. Economic growth may be quantified by a rise in gross domestic product (GDP) or total national income. Military expenditure and trade variables also impact economic growth, which are included into GDP calculations, [28].

2.3 Renewable Energy Consumption

Renewable energy is energy that comes from things that can be replaced quickly. This includes things like energy, wind energy, biomass energy,

hydroelectric energy and geothermal energy. People think these energy sources are better for the earth, than fuels. Renewable energy sources are good for the earth because they do not put a lot of things into the air. Renewable energy is really great. It is good because it does not produce a lot of greenhouse gases. Sources of energy help the earth. They are helpful because they do not make climate change worse. They also do not hurt the environment. Renewable energy is good, for the earth. Renewable energy is helpful, to the earth. Renewable energy is beneficial owing to its sustainability, economic efficiency relative to fossil fuels, and rapid renewability, [29].

2.4 Political Stability

Political stability is a state in which a nation have an orderly, consistent, and dependable governmental structure, capable of averting conflicts or upheavals that may jeopardize the nation's integrity. Political stability pertains to the capacity to avert coercive transitions of power and encompasses resistance to conflicts that emerge among political and social elite factions vying for access to state resources, [30].

2.5 Green Trade

Green commerce, in this sense, is the exchange of products and services that adhere to stringent environmental criteria, including the safeguarding of natural resources and the mitigation of adverse effects on ecosystems. Green trade pertains to the implementation of trade policies and procedures grounded on environmental conservation, [31].

3 Method

This study employs quantitative research with an associative framework, using dynamic panel data from 2002 to 2023 across BRICS member nations. This group was formed in 2001 from a name made by Jim O'Neill from Manchester, United Kingdom. The name is for Brazil, Russia, India and China. The group consists of 11 countries. They are Brazil, Russia, India, China, South Africa, Indonesia, Saudi Arabia, Egypt, the United Arab Emirates, Ethiopia and Iran. Brazil, Russia, India and China are important, to us. We used a method where we picked countries that are doing something with energy. We looked at countries that have plans and programs for renewable energy. We also took a look at countries that have information on energy and that have been stable from the year 2002, to the year 2023. So we picked Brazil, Russia, India, China,

South Africa and Indonesia to look at. These BRICS nations are important, for energy. We want to see what these BRICS nations are doing with energy.

The time from 2002 to 2023 is what this paper is looking at. It is talking about things that happened all around the world that had an effect on the economy, energy and politics of the BRICS states. This time started in 2002. It really began in 2001 when Goldman Sachs came up with the term "BRIC". This marked the start of the BRICS states becoming stronger economically. From 2002, to 2005 something big took place. The Kyoto Protocol became official during that time. The Kyoto Protocol is what really got done. People started following it. The Kyoto Protocol was the thing that actually happened. People made the Kyoto Protocol. Then they started doing what it said. This meant that countries had to reduce the amount of carbon they were producing and start using energy sources.

Then in 2008 there was a problem with the economy all around the world. This was called the financial crisis. It was especially hard for China. China came up with a plan to help its economy. The Sustainable Development Goals are important because they make people think about the kind of development that lasts for a time and uses energy in a wise way.

really improving during this time. The economy was getting stronger. The BRICS states were doing this too. They were working on energy security and sustainability. The BRICS states were really trying to make a change.

Table 1 presents the definitions of the variables used in this study. The research's dependent variable is economic growth (EG), measured by GDP growth (annual %), while the independent variables comprise renewable energy consumption (RE), indicated by total final energy consumption; political stability (PS), assessed through a Violence/Terrorism ranking on a 0-100 percentile scale; and green trade (GT), represented by the total export of environmentally friendly goods. BRICS is a coalition of rising nations with considerable potential in the global economy, founded by economists. This research used data that was already collected by organizations. The data came from the World Bank, the International Energy Agency or IEA for short and from the United Nations Conference on Trade and Development which is commonly referred to as UNCTAD and the International Monetary Fund, which is known as IMF.

The study used 528 observations. This number follows the recommended sample size range of 30 to 500 in previous methodological studies. Therefore, 528 observations were selected for this study [32], [33]. Dynamic panel data estimate model using the Generalized Method of Moments (GMM). The statistical analysis was conducted using Stata 17 software. To analyze the short-run effects of renewable energy, political stability, and green trade on economic growth in the BRICS member countries Brazil, Russia, India, China, South Africa, and Indonesia over the 2002 until 2023 period, this study employs a dynamic panel framework estimated using GMM:

$$Y_{it} = \alpha + \gamma Y_{i,t-1} + \beta_1 RE_{it} + \beta_2 PS_{it} + \beta_3 GT_{it} + \epsilon_{it} \quad (1)$$

Which can be seen in equation (1), denotes where i indexes countries and t indexes years. Y_{it} denotes economic growth in country i at time t (e.g., annual GDP growth). RE_{it} captures renewable energy consumption, PS_{it} measures political stability, and GT_{it} represents green trade in country i and year t . The inclusion of the lagged dependent variable $Y_{i,t-1}$ accounts for growth dynamics; the coefficient γ measures the degree of growth persistence. The coefficients β_1 , β_2 , and β_3 are interpreted as short-run effects, as they capture the contemporaneous impact of RE_{it} , PS_{it} , and GT_{it} on

Table 1. Definition of Variables

Variable	Indicator	Scale	Data source
Economic Growth (EG)	Annual GDP growth rate (%)	Ratio / %	World Bank
Renewable Energy (RE)	Renewable energy consumption (% of total final energy consumption)	Ratio / %	World Bank; International Energy Agency (IEA)
Political Stability (PS)	Percentile rank (0–100) of Political Stability and Absence of Violence/Terrorism	Ordinal / 0–100 percentile rank	World Bank
Green Trade (GT)	Share of Environmental Goods (%)	Ratio / %	United Nations Conference on Trade and Development (UNCTAD); International Monetary Fund (IMF)

Source: created by the author

Then something big happened in 2020 the COVID-19 pandemic. It affected a lot of things including the Sustainable Development Goals and the economy of China. From 2021, to 2023 the economy started to get better. The economy was

Y_{it} after controlling for $Y_{i,t-1}$. Country fixed effects μ_i control for time-invariant cross-country heterogeneity, while time fixed effects λ_t absorb common shocks in each year. The idiosyncratic error term ε_{it} captures omitted country-year specific factors affecting economic growth.

Estimation relies on dynamic panel GMM because the presence of $Y_{i,t-1}$ generates dynamic endogeneity, making conventional estimators potentially biased. Under Difference GMM (Arellano–Bond), Equation (1) is transformed by first-differencing to eliminate μ_i , and endogenous or predetermined regressors are instrumented using appropriate lagged levels (typically $t - 2$ and earlier). Under System GMM (Blundell–Bond), the model is estimated jointly in first differences and in levels; lagged differences are used as additional instruments for the level equation, which strengthens the instrument set, particularly when the variables display persistence.

To assess the long-run effects of renewable energy, political stability, and green trade on economic growth in the BRICS member countries Brazil, Russia, India, China, South Africa, and Indonesia over 2002–2023, the long-run (steady-state) relationship is obtained from the dynamic short-run GMM model by deriving the long-run multipliers. Under the stability condition $|\gamma| < 1$, the long-run specification can be expressed as:

$$Y_{it} = \theta_1 RE_{it} + \theta_2 PS_{it} + \theta_3 GT_{it} \quad (2)$$

Which can be seen in equation (2), denotes where i indexes countries and t indexes years. Y_{it} denotes economic growth of country i in year t (e.g., annual GDP growth). RE_{it} is renewable energy consumption, PS_{it} is political stability, and GT_{it} is green trade in country i and year t . The parameters θ_1 , θ_2 , and θ_3 are long-run coefficients that represent the total cumulative (steady-state) effect of a sustained change in each explanatory variable on economic growth after all dynamic adjustments have fully unfolded. Consistent with the dynamic short-run model

$$Y_{it} = \alpha + \gamma Y_{i,t-1} + \beta_1 RE_{it} + \beta_2 PS_{it} + \beta_3 GT_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

the long-run effects are computed as the standard long-run multipliers:

$$\theta_1 = \frac{\beta_1}{1 - \gamma}, \theta_2 = \frac{\beta_2}{1 - \gamma}, \theta_3 = \frac{\beta_3}{1 - \gamma}.$$

This formulation links the contemporaneous short-run impacts (β) to the persistence of growth captured by γ , thereby summarizing the full adjustment path into a single steady-state response. In this long-run representation, the intercept and unobserved heterogeneity terms are absorbed into the steady-state level through the dynamic adjustment; specifically, the constant and fixed effects enter as $(\alpha + \mu_i + \lambda_t)/(1 - \gamma)$. Therefore, Equation (2) focuses on the structural long-run contribution of RE_{it} , PS_{it} , and GT_{it} to economic growth, while long-run coefficients θ are obtained directly from the estimated short-run GMM parameters β and γ .

Prior to generating estimates from the data, many phases of analysis must be conducted. The GMM model specification exam contains many essential assessments. The Instrument Validity Test (IV) seeks to confirm that the instrument is uncorrelated with the residual error term. The Instrument Validity Test (IV) employs the Sargan Test, asserting that if the p-value of the Sargan Test is above 0.05, the instrument is deemed genuine. The Arellano-Bond Consistency Test assesses residual autocorrelation. The foundation of this test is that if the p-value of the test exceeds 0.05, then second-order serial autocorrelation is absent. This signifies that the model is coherent. The Unusuality Test guarantees that the estimates derived are precise and conform to the true parameter values. The uniqueness of the GMM model is determined by comparing its estimated value to those derived from the CEM and FEM methodologies. If the GMM estimated outcomes are between the FEM and PLS estimated values, the GMM model is deemed impartial.

The Short-Term Significance Test (Z Test) plays a crucial role in identifying and quantifying the short-term effects of independent variables. Decision-making is predicated on the premise that if the p-value of the Z test result is less than the significance threshold (0.05), the independent variable has a substantial effect on the dependent variable in the near run. The Long-Term Significance Test (Wald Test) is used to assess the enduring link between independent and dependent variables. Decision-making is predicated on the premise that if the p-value from the Wald test is less than the significance threshold of 0.05, the independent factors have a substantial long-term effect on the dependent variable.

4 Results and Discussion

4.1 Results

The validity test findings of the Generalized Method of Moments (GMM) instrument demonstrate the practicality of the instrument used in the model assessing the impact of renewable energy consumption, political stability, and green trade on the economic development of BRICS member nations.

Table 2. Instrument Validity Test

Sargan test of overidentifying restrictions	
H0: Overidentifying restrictions are valid	
chi2(124)	= 123.424
Prob > chi2	= 0.4977

Source: Author analysis Stata Version 17 data

Instrument validity was assessed using the Sargan test of overidentifying restrictions, which evaluates whether the instrument set is jointly exogenous, meaning the instruments are uncorrelated with the structural error term and the moment conditions are correctly specified. As reported in Table 2, the Sargan statistic is $\chi^2(124) = 123.424$ with a probability value of 0.4977. Because this p-value is greater than 0.05 ($0.4977 > 0.05$), the test does not indicate any violation of instrument exogeneity at the 5% significance level. This implies that there is no statistical evidence that the instruments generate systematic bias, and the selected instrument set is therefore acceptable for the dynamic GMM estimation, supporting the consistency of the estimated parameters under the 0.05 significance criterion.

Table 3. Arellano Bond Consistency Test

Arellano–Bond test for zero autocorrelation in first-differenced errors			
H0: No autocorrelation			
Order		z	Prob > z
1		-1.9759	0.0482
2		-.26138	0.7938

Source: Author analysis Stata Version 17 data

The Arellano–Bond test result in Table 3 gives us a statistic. The statistic we are looking at has a probability value of 0.7938. The Arellano–Bond test also has a probability value of 0.7938 which's higher than what we consider to be the threshold of 0.05, for the Arellano–Bond test. This tells us that the Arellano–Bond test does not find any evidence of autocorrelation, in the process of the Arellano–Bond test. The Arellano–Bond test result is important because it shows that the GMM specification is

consistent. This consistency is good because it means the model is properly specified when it comes to serial-correlation diagnostics. The GMM specification being properly specified is useful, for the mechanism and the long-term effects of the estimated parameters of the GMM specification.

Table 4. Bias Diagnostic (Bounding Condition)

Variable	fdgmm	sysgmm	woman	pls
EG	.3671762	.41334035	.38318497	.64701486
L1.	5*	***	***	***
re	8.05567*	1.8559433	7.6388966	1.3729198
	*	**	*	
ps	.7187185	-2.2153098	.69336387	-1.5455905
	6			
gt	.9738656	1.7062378	.89077418	1.104279
	5	*		
_cons	4.231515	2.907115	-5.4793267	1.6959168
	4			
N	120	126	126	126

Source: Author analysis Stata Version 17 data

The bias diagnostic (bounding condition) in dynamic panel models assesses whether the coefficient on the lagged dependent variable, γ (i.e., the coefficient on $Y_{i,t-1}$), falls within the theoretical range implied by benchmark estimators. Pooled OLS typically provides an upper bound for γ because it ignores time-invariant country heterogeneity, whereas the fixed-effects (FE) estimator typically provides a lower bound due to finite-sample bias in dynamic panels. Under a credible instrument strategy, the System GMM estimate is expected to satisfy $\hat{\gamma}_{FE} < \hat{\gamma}_{sysGMM} < \hat{\gamma}_{OLS}$. Table 4 satisfies this criterion and, notably, the sysGMM estimate of 0.41334035 lies between the corresponding estimates from the benchmark methods, namely the Fixed Effects Model (FEM) = 0.38318497 and Pooled OLS (PLS) = 0.64701486, implying $0.38318497 < 0.41334035 < 0.64701486$.

This ordering indicates that sysGMM attenuates the downward bias associated with FEM and the upward bias associated with PLS; therefore, the estimated dynamic effect is identified within a theoretically plausible interval and is not dominated by estimator-induced bias. Overall, this pattern supports the interpretation that the GMM specification used in this study can be regarded as practically unbiased. Because the study relies on secondary dynamic-panel data, N refers to the number of country year observations used by each estimator; the difference between $N = 120$ and $N = 126$ reflects estimator-specific effective

observations after applying each method's data requirements, particularly the availability of lagged values and the construction of moment conditions under sysGMM.

Table 5. Short-Term Significance Test (Z Test)

EG	Coefficient	Robust std. err.	z	P> z	[95% conf.
eg L1.	.4133404	.1172023	3.53	0.000	.1836281
re	1.855943	.6516753	2.85	0.004	.5786831
ps	-2.21531	1.598481	1.39	0.166	5.348276
gt	1.706238	.7438929	2.29	0.022	.2482345
_cons	2.907115	2.28526	1.27	0.203	1.571912

Source: Author analysis Stata Version 17 data

Based on what the GMM estimation shows here is what the short-run equation looks like:

$$Y_{it} = 2,907115 + 0,4133404 EG_{it-1} + 1,855943 RE_{it} - 2,21531PS_{it} + 1,706238 GT_{it}$$

The information in Table 5 shows that economic growth is getting better over time. This is because the growth from the period has a big effect on the current period. For example if the economy grew by 1 percent time it will grow by about 0.41 percent this time. The use of energy is very important for the economy. If we use 1 percent renewable energy the economy will grow by about 1.85 percent. However political stability does not seem to have an impact on economic growth. Even though we thought it would the numbers do not show that it makes a difference. The numbers for stability are actually negative but they are not significant so we cannot say for sure if it really affects economic growth or not. Renewable energy and economic growth are related and renewable energy has a big impact, on economic growth.

Green trade has a good connection with economic growth. When green trade goes up by one percent the economy grows by one and a half percent too. This is based on some numbers that show this connection is strong. The starting point of this growth is at 2.9071. This means that even if we do not consider energy, how stable the government is and green trade the countries like Brazil, Russia, India, China and South Africa and also Indonesia still have a good base for growth. This is a thing because it means these countries can grow even without help from these areas. So green trade and renewable energy are not just about making sure the economy does not get worse they are actually about making the economy grow faster and better from

2002 to 2023. Green trade is really important, for this.

Table 6. Long-Term Significance Test (Wald Test)

E G	Coefficie nt	Robust std. err.	z	P> z	[95% conf.	interval]
re	3.163577	1.19412	2.6	0.00	.823137	5.50401
ps	-	2.94429	-	0.20	-	1.99456
gt	2.908395	1.00538	2.8	0.00	.937886	4.87890

Source: Author analysis Stata Version 17 data

Based on what the GMM estimation shows here is what the long-run equation looks like:

$$Y_{it} = 3,163577RE_{it} - 3,776141 PS_{it} + 2,908395 GT_{it}$$

The results from the Wald test in Table 6 are really important for the run. Renewable energy consumption does make a difference. The exact figure is 3.1635. This p value of 0.008 is really small it is than 0.05. So, renewable energy consumption actually affects development over time in countries such as Brazil, Russia, India, China, South Africa and Indonesia from 2002 to 2023. The use of energy consumption is really important here. Renewable energy consumption plays a role. Countries, like Brazil see the impact of energy consumption. Renewable energy consumption helps in development. Countries should focus on energy consumption. If renewable energy consumption goes up by 1 percent economic growth goes up by around 3.16 percent in the run. This shows that using renewable energy is linked to better economic growth in the long run. The number for stability is -3.7761. The p-value is 0.200, which is more than 0.05. This is really important to consider when we talk about stability and economic development. Political stability does not have an impact on development in the long run that is what the numbers tell us. The data we have does not show that political stability is really important, for development. We can see that political stability is not a factor when it comes to economic development over time. Green trade has a coefficient of 2.9084 with a p value of 0.004, which is below 0.05. This confirms a positive and statistically significant long run effect, implying that a 1 percent increase in green trade is associated with an approximately 2.90 percent increase in economic growth in the long run.

4.2 Discussion

4.2.1 The Impact of Consumption Renewable Energy on Economic Growth in BRICS Member Countries in Short and Long Term

The short-term test results show that the number is 1.8559 and the chance of it happening is 0.004. This is than 0.05 which is the level we use to decide if something is important. The results from the long-term test are much the same. The number for this test is 3.1635 and the chance that it will happen is 0.008. The long-term test results are similar, to what we expected. Both of these are than 0.05. This means that renewable energy has an effect on the economy of BRICS countries. It helps the economy grow. This is true for both the short term and the long term. Renewable energy is good for growth, in BRICS countries. This aligns with John Maynard Keynes' (1936) economic growth theory, which establishes a basic assumption in its formulation. The use of renewable energy (C) yields cheaper expenses compared to fossil fuels, hence possibly diminishing energy expenditures and enhancing expenditure efficiency. This liberates substantial financial resources formerly designated for energy, allowing their reallocation to other consumption sectors.

Using energy is an idea because it is cheaper and more reliable, than using fossil fuels. People who use energy do not have to worry much about the cost of energy. This is because energy is cheaper. So people who use energy can use the money to buy other things that people need. Using energy of fossil fuels is a good thing for people to do. When people buy things it helps the whole economy growth. The BRICS nations have a lot of energy sources like hydroelectric, solar and wind energy. This is a thing because it means they can use renewable energy to reduce their need for fossil fuels and invest more money in their own countries. If the BRICS nations switch to energy they will not have to spend as much money on expensive fossil fuels. This will help them make industries people will have more money to spend and the economy will grow. The renewable energy will help the BRICS nations grow economically in the term and, in the long term.

4.2.2 The Impact of Political Stability on Economic Growth in BRICS Member Countries in Short and Long Term

We did a short-term test. The result was -2.2153. The p-value for this test is 0.166. This p-value is higher than 0.05. The long-term test gave us a result

which is -3.7761. The p-value for the long-term test is 0.200. The p-value for the long-term test is also higher, than 0.05. This one is also higher than 0.05. These results tell us that political stability affects development in BRICS countries. It is not significant in the short term or long term. This is different from what John Maynard Keynes said in 1936 about development. He said that government help is important for an economy. When governments spend money it helps keep the economy stable. Political stability helps create an environment for investing in renewable energy in BRICS countries. Political stability is good, for development. It helps the economy. This allows big projects to happen without violence or terrorism. As a result market and investor confidence, in renewable energy grows. This in turn helps the economy grow overall.

The results confirm that BRICS nations invest resources on political stability, especially in combating violence and terrorism, to promote economic success. Nonetheless, this effect is significantly contingent upon the degree of diffusion of the influence. If terrorism or violence is confined to a particular area with little economic contribution, the resultant losses may be mitigated by development in other areas. In this situation, even if governments augment expenditures on security and stability, if the effects are confined to certain sectors or a restricted region, the influence on general economic development will be negligible.

4.2.3 The Impact of Green Trade on Economic Growth in BRICS Member Countries in Short and Long Term

The results of the short-term significance test (Z-Test) reveal a coefficient of 1.7062 and a p-value of 0.022, which is below the 0.05 significance level. The long-term significance test (Wald Test) indicates a coefficient of 2.9083 and a p-value of 0.004, both of which are below the 0.05 significance level. The results indicate that green trade significantly and positively influences economic growth in BRICS countries, both in the short and long term. This corresponds with John Maynard Keynes' economic growth theory (1936), which asserts that green trade is essential for augmenting the export capacity of environmentally sustainable products, [34]. Countries that make goods according to environmental standards have an advantage when they sell things to other countries. This means they can sell to people around the world. When countries can sell to people they get more money from selling things to other countries. This is good, for the country because it gets money from trade. Countries

that produce goods according to environmental standards are the ones that get this advantage. Countries may achieve trade surpluses and stimulate economic development by augmenting exports of eco-friendly items.

The findings demonstrate that increased exports of environmentally friendly items in BRICS countries bolster aggregate demand through elevated national income and foreign currency earnings, while controlled imports of green goods do not diminish the positive impacts of exports. In light of the increasing worldwide demand for sustainable products, BRICS states may use green commerce as a crucial driver for prompt economic growth, supported by improved net exports and heightened collective demand.

5 Conclusion

This study illustrates that renewable energy positively and significantly impacts economic growth in BRICS nations, both in the short and long term, by reducing household expenditure uncertainty and fostering economic stability. Green commerce significantly contributes to economic development by increasing foreign exchange revenues via the growth of exports of ecologically friendly items. Nonetheless political stability affects government security spending. It does not really help or hurt the economy. Political stability has little to no impact on development. It is impactful, on security spending.

This research helps us understand how the economy grows by looking at energy, political stability and green trade in a certain way. It gives policymakers ideas to help countries switch to renewable energy and increase green trade. This can help countries compete better with others and have a sustainable economy. Renewable energy and green trade are important, for growth. The research has limitations, particularly its sole focus on BRICS states and the confined timeframe of 2002-2023, which does not incorporate more recent changes. Future research must expand its scope to encompass other countries, particularly non-BRICS nations, and examine a broader spectrum of economic and non-economic variables, including investments in renewable energy and energy laws, to augment the analysis.

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