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Nexus among Energy Consumption, Financial Development, Trade Openness and Economic Growth: Evidence from South Asian Countries

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Abstract

Energy is the economy's oxygen and the lifeblood of progress, particularly in developing economies that are undergoing widespread industrialization. In growth theories, it is frequently suggested that energy, like labor and capital, should be regarded as inputs. The current study aims to look into this contrivance in the context of South Asian countries. Panel data has been utilized for Pakistan, Bangladesh, India, Sri Lanka, and Nepal. The analysis has been done through theoretical reasoning, descriptive statistics, panel unit root tests, panel co-integration, panel fully modified ordinary least squares (FMOLS), and panel homogeneous causality test. Various factors have been used as determinants of energy consumption. The results of the panel unit root test show that the variables are integrated of order I(1) which makes panel co-integration a relevant technique for the econometric analysis. For robustness check, two tests of panel co-integration namely padroni co-integration, and the Johansen Fisher Panel Co-integration test, have been used. The results of panel co-integration show that variables have a long-run relationship. To find the long-run coefficients of the variables, panel FMOLS have been applied. The results of the FMOLS show that consumption of energy, trade openness, and financial development all altogether affect economic growth in the countries under consideration. The results of panel homogenous causality uncover that economic growth and energy consumption have unidirectional causality, with energy consumption stimulating economic growth.

Key Words: Energy consumption, Financial development, Economic growth

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1. Introduction

Energy is seen as a fundamental component of an economy's economic activity. Energy is a key source of economic growth because many production and consumption activities involve energy as a basic input. Energy is one of the most important inputs for economic development. From a physical viewpoint, the use of energy drives economic productivity and industrial growth and is central to the operation of any modern economy. Energy improves the efficiency of industrial components. The majority of countries rely on the energy industry, in their growth processes, and the global energy consumption is increasing (Le & Sarkodie, 2020). Energy could be blamed for an economy's macroeconomic stability and aspirations for everyday luxuries. As a result, energy is critical for economic and social progress. Energy is the economy's oxygen and the lifeblood of development, particularly during the mass industrialization period. The concept of energy consumption has grown in tandem with the growth of the economy. The importance of energy for an economy cannot be overstated, as it affects both demand and supply. Energy is required to generate goods and services in a country, as well as to meet the demand for these commodities and services. Economic growth may be fueled by energy accessibility and quality. Energy, like labor and capital, might be regarded an input, according to Stern (2004; 2011), but it has yet to be assigned its place in growth theories.

The importance of energy is stressed by physics, but it also requires a substantial role in economic theories. Stern (2004; 2011) proposed a Solow Growth Model-based model that included labor and energy as inputs. When technology is regarded as an influencing factor, capital and energy are inadequate alternatives. The model allows for independent effects of technological progress on labor and energy (Belke, Dreger, & Haan, 2010). Energy development is linked to economic development. It is frequently stated that increasing the amount of energy available in developing countries will be beneficial. Agriculture and industry will benefit greatly from the enhanced energy supply. Oil and other energy resources play a critical role in shaping economies and their destiny. The indirect and induced effects of energy on the economy can be separated into two groups. The term "indirect effect" highlights the impression of the energy sector on other industries. The energy sector purchases its machinery and inputs, resulting in the creation of a market. The induced impact is the result of the employers in the energy sector. They generate demand, which has an impact on the economy's other marketplaces.

According to growth theory, the interest rate plays a key role in balancing an economy's savings and investment. Advancement and enhancement of new financial administrations create new possibilities for investors and savers, resulting in self-sustaining economic growth. It is widely believed that countries with international exposure are more useful than those that focus on the local commercial sector. Furthermore, international trade promotes the productive allocation of assets and can lead to increased development.

In literary words, it very well might be presumed that energy consumption, financial development, and trade openness are critical for economic expansion and maintaining a central position in economic activity. Their contribution to economic growth is critical, as each of them acts as a trigger. In the realm of developing countries, energy, is an imperative pillar of modern economic and social development. The export-oriented economic model in many developing countries is aided by their abundant agricultural, mineral, and oil resources. Scholars, however, are still concerned about the economy's ability to grow gradually in the face of increased trade openness and increasingly severe energy consumption limits. Previous research has not focused much on the relationship between these characteristics. As a result, it is important to understand where this connection comes from. This research paper aims to examine the relationships between energy consumption, financial development, trade openness, and economic growth for a group of South Asian countries.

2. Theoretical Framework

Some work already has been done which depicts the relation between financial development (FD) and economic growth (EG) (Levine, 1997). There is difference of opnion about the relation between FD and EG. One point of view is that FD enhances the rate of EG (Shaw, 1973; Schumpeter, 1911; McKinnon, 1973; Goldsmith, 1969). As per the theory, the quality and quantity of financial institutions make a difference in having different levels of EG. Two channels are mainly discussed in the literature by which FD can have an effect on EG (Fung, 2009). One of the channels is productivity of factor by which FD may lead to higher EG. This channel works through financial novelties and new techniques, which enhances the information flow and leads to better planning and monitoring of investment projects (Baier *et al.*, 2004; Townsend, 1979; King & Levine, 1993). The financial expansion increases risk sharing which may reduce the cost of equity and enhances the investment level and eventually leads to a higher level of EG (Bekaert *et al.*, 2001, 2002, 2005; Bekaert & Harvey, 2000).

The other channel through which FD may lead to higher EG is factor accumulation. This channel highlights the need for expansion of the planned financial

system through self-finance. A planned financial system enhances efficiency and less productive assets are put to best use (Xu, 2000; Bell & Rousseau, 2001; Gurley & Shaw, 1955; Bencivenga & Smith, 1991). As per this point of view, that FD enhances the level of EG is the probability that energy consumption should be increased by the increase in FD. A greater level of FD makes saving, borrowing, and investment easier for households and businesses. With the FD taking place in the developing economy, it is easy and less expensive to borrow money and purchase goods and services. When consumers buy some of the big items like houses, and automobiles, it directly upturns the demand for energy as automobiles use fuel and in houses, there is energy demand for heating, cooking, and cooling purposes. FD makes the availability of cheaper and easier funds to businesses via lower borrowing costs or with the help of new sources of funding, which may be in the form of equity financing as an economy's stock market grows. It can be used to increase existing activities or build new industries. All these activities increase the energy demand.

There is another point of view, and as per this point of view, EG leads to FD (Stern, 1989; Robinson, 1952; Lucas, 1988). FD increases due to the reason that as EG takes place the demand for financial amenities increases and resultantly to match the increased demand for financial services, FD takes place. According to this point of view, FD depends upon EG. As per this point of view, the energy demand will be based on EG rather than depending upon FD. As there are contradicting views about the direction of relation/causality, to resolve this ambiguity in this paper, causality tests have been applied.

As per Heckscher-Ohlin's theory, the economies can specialize in the production and foreign trade of those commodities in which they have plentiful resources. In this perspective a country may specialize in labor-intensive production techniques if the country has labor abundance, on the other hand, a country can specialize in capital-intensive techniques of production if the country has capital abundance, in this way international trade can be beneficial for international trade. In these two cases, countries can enhance the energy demand to fuel production activities and transportation. Due to an increase in transnational trade, production and transport activities may lead to the use of higher levels of energy as compared to a situation where there is no international trade taking place.

Due to international trade, it may be good to discuss Pollution Haven Hypothesis. This hypothesis states that dirty industry may be shifted from developed economies to less developed economies to get the benefit of cheap labor and weak environmental regulations (Mahmood *et al.*, 2018). Under such circumstances, energy

consumption can increase in less developed economies due to the transfer of production capital. On the other hand, (Zarsky, 1999) has another point of view that with an increase in industry size, the production techniques may also change as a result of international trade by the transfer of such technologies which are more energy efficient. So under such circumstances, energy consumption may not increase due to trade openness. The impact of transnational trade on energy consumption may also be taken into consideration from the level of EG. Trade openness depicts that a country reduces tariffs and non-tariffs, trade barriers/taxes on trade to enhance the level of international trade.

On the other side, transnational trade may enhance the level of EG and a higher level of EG may increase energy consumption due to a higher level of economic activities. At some point in economic development, the country may be able to install energy-efficient techniques through the transfer of technology due to international trade and may adopt a production process that is less energy intensive and under such circumstances, the level of energy consumption may be reduced after achieving a particularly level of economic development and a higher level of EG.

3. Methodology

3.1. Data Collection And Model Specification

The data is drawn from a panel of countries in the South Asia. The nations chosen are determined by data availability. Bangladesh, Pakistan, Nepal, Sri Lanka, and India are among the countries studied. World Development Indicators provide the data. The model employed in this study's general form is as follows:

$$GDP_{it}=\alpha +\beta_1 EC_{it}+ \beta_2 TO_{it}+ \beta_3 FD_{it}+ \beta_4 INF_{it}+ \beta_5 GFCF_{it}+ \mu$$

Where, i denotes cross-section dimension and t denotes the time series dimension.

3.2 Variable Description

The description of variables included in the study is given as

3.2.1 Economic Growth (GDP)

The word, economic growth describes a country's economic performance. It may also be defined as the economy's expanding ability to provide better and improved quantities of goods and services. The provision contrasts with the circumstances of the previous year. In this study, it is calculated using constant 2005 pricing.

3.2.2. Energy Consumption (EC)

Energy consumption is often referred to as an economy's lifeblood. Nothing can be produced, built, or consumed without energy in today's world. For its people, businesses, and future development, an economy needs energy in various forms. Energy consumption refers to the amount of energy consumed by individuals, corporations, nations, and other entities. Energy use kg of oil equivalent per capita is used in the current study.

3.2.3. Financial Development (FD)

The expression "financial sector advancement" alludes to both quantitative and qualitative highlights of the financial sector. Expansion of the financial sector is viewed as a method adopted by the private sector to boost the economy's economic growth. Organizations, tools, and markets make up the financial sector in general. It also includes the legal and administrative framework that permits transactions to be done through credit expansion. Domestic credit given by the financial industry as a percentage of GDP is used in this study.

3.2.4. Trade Openness (TO)

In today's global economy, trade is one of the most important cornerstones. Because no country can survive on its own, trade provides an economy with reasons to live and thrive. The openness of commerce is a measure for deciding the significance of trade in a given economy. It is the sum of imports and exports, while openness is a proportion of the impact of this aggregate on economic activity. Additionally, the index of openness is an economic indicator inferred as the ratio of a nation's commerce to total production.

$$Sum\ of\ exports\ plus\ imports\ to\ country's\ GDP = \{(Exports + Imports) / (Gross\ Domestic\ Product)\} * 100$$

3.2.5. Inflation (INF)

Inflation is a measure of an economy's stability and the purchasing power of its citizens. Inflation is defined as a prolonged and continuing rise in an economy's overall price level. The GDP deflator is used as a proxy for inflation, which gauges the macroeconomic stability of a country's economy.

3.2.6. Gross Fixed Capital Formation (GFCF)

Gross fixed capital formation has been used as a proxy for investment.

3.3. Regression Analysis

For applying the appropriate econometric technique for regression analysis, it is necessary to check the stationarity of the variables. For checking the order of integration of variables various panel unit roots tests are applied, the details are as under.

3.3.1 Panel Unit Root Test

To remove series trends and non-stationarity, unit root testing has become a standard approach that is not only used in time series analysis, but also in panel data analysis. Various panel unit root tests are applied to check the order of integration of variables. This is done to avoid the issue of spurious regression. If the variables have an integrated order of I(1), then the panel co-integration technique is applied.

3.3.2 Panel Cointegration Test

The need to investigate the spurious regression issue is intrinsically linked to the purpose of testing the order of integration. The problem of spurious regression only occurs when non-stationarity is present. A co-integration test between two variables is a strategy to investigate in this way; A spurious regression model in which both variables (Xit and Yit) are part of the same order of integration, usually I (1)) and the residuals contain a stochastic pattern by relapsing Yit on Xit. Engle and Granger (1987) co-integration relationships are mostly considered in board co-combination testing. The null hypothesis is that the variables are not co-integrated, i.e. H_0: No co-integration, as opposed to alternative H_1: Co-integration.

3.3.3 Panel Causality Test

The next step in the investigation is the establishment of causality between variables for which the modern form of Granger causality has been used. This version was designed by Venet and Hurlin (2001), and the case panel homogeneous causality was examined. The generic model used in causality can be stated in the same way as a bivariate model:

$$y_{it} = \alpha_{it} + \sum_{i=1}^{n} \beta_i \, x_{t\text{-}i} + \sum_{j=1}^{m} \gamma_j \, y_{t\text{-}j} + \varepsilon_{it}$$

$$x_{it} = \alpha_{it} + \sum_{i=1}^{n} \delta_i \, y_{t\text{-}i} + \sum_{j=1}^{m} \theta_j \, x_{t\text{-}j} + \varepsilon_{it}$$

Where t represents the time period and i represent the cross sections. The generic paradigm for causality can be seen in the equations above. The remainder of the

requirements is determined by the approach used. Panel homogeneous non-causality is the technique applied here.

3.3.4 Panel Homogenous Causality

Dumitrescu-Hurlin (2012) devised a method for varying all coefficients across cross-sections. The basic Granger causality technique is used to compute the homogenous non-causality hypothesis. First and foremost, regressions are computed separately for each cross-section followed by the calculation of the test statistic w-bar. The standardized statistic is generated by taking the average of this statistic, which follows a normal distribution. The Z-bar statistic is given to them. This approach asserts that no causality can be detected in any cross-section. i.e.,

$$\forall\, i\ \in (1\ N)\, E(y_{it}/y`_{it}\,,\ \alpha_{it}) = E(y_{it}/y`_{it}\,, x`_{it}, \alpha_{it})$$

Then H_0 becomes;

$$H_0: \beta_i^{(K)} = 0\ \forall\ i \in\{1, \mathrm{N}\}, \forall\ k\ \in \{1, p\}$$

H1, on the other hand, asserts that homogeneous causality exists. The next step is to determine the H0 for each pairwise homogeneous causality.

4. Results and Discussion

Summary statistics are provided below in Table.1. The average value, maximum, minimum values, and standard deviation are reported.

Table 1. Summary Statistics

	GDP	Trade openness	Financial Development	Energy use per capita	Gross fixed capital formation	Inflation
Mean	24.49	40.44	42.49	339.96	21.34	8.89
Maximum	27.96	88.64	76.83	623.72	33.64	24.89
Minimum	21.70	12.00	16.64	102.56	12.52	0.15
Std. Dev.	1.58	19.07	13.12	122.09	4.54	4.42

Table 2 presents the results of the panel unit root test. Im, Pesran, and Shin (IPS) and Fisher Type Augmented (FTA) are two important three-unit root tests. Dicky Fuller (ADF) and Philip Perren has been used for validating the order of integration of variables. Results demonstrate that all of the variables are non-stationary at the level but stationary at the first difference, indicating that the order of integration for all of the variables is I (1). Since the integration orders of all variables is the same, I (1), panel co-integration is regarded as the most appropriate technique for an estimate. To double-

check the results, we used two alternative panel co-integration approaches (Pedroni and Johansen Fisher types).

Results of padroni co-integration are provided in Table 3. The co-integration of the variables within the cross-sectional units is checked using four distinct tests (panel v-statistics, panel rho statistics, panel Philip Perron statistics, and panel augmented dicky fuller statistics). Out of four tests, three confirmed the presence of co-integration. The three tests to check for co-integration among the variables between cross-sections include Panel rho statistics, panel Philip Perron statistics, and panel augmented dicky fuller statistics. Results demonstrate that two out of three tests reveal co-integration among the variables. So, with five out of eight tests supporting the claim that the variables in the study are co-integrated, we may conclude that the variables in the study are co-integrated. We also used Johansen Fisher Panel Co-integration to verify the Pedroni co-integration test results.

Table 2. Panel Unit Root Test

		Level		First Difference		
Variables	**Test**	**Statistic**	**P-Values**	**Statistic**	**P-Values**	**Integration Order**
GDP	IPS	2.41	0.99	-2.02	0.022***	I(1)
	ADF	3.04	0.98	22.89	0.011***	
	PP	4.84	0.90	38.09	0.00***	
Energy Consumption	IPS	6.61	1.00	-2.82	0.00***	
	ADF	2.09	0.99	24.55	0.00***	I(1)
	PP	2.90	0.98	57.59	0.00***	
Financial Development	IPS	1.42	0.92	-5.96	0.00***	
	ADF	7.43	0.68	54.83	0.00***	I(1)
	PP	8.14	0.61	92.87	0.00***	
Capital Formation	IPS	0.60	0.72	-5.98	0.00***	
	ADF	8.81	0.55	53.50	0.00***	I(1)
	PP	10.50	0.39	108.9	0.00***	
Inflation	IPS	2.49	0.99	-3.99	0.00***	
	ADF	4.33	0.93	35.86	0.00***	I(1)
	PP	3.43	0.96	58.69	0.00***	
Trade	IPS	0.41	0.65	-5.31	0.00***	
	ADF	6.70	0.75	45.32	0.00***	I(1)
	PP	12.72	0.24	200.09	0.00***	

Table 3. Pedroni Panel Co-integration

Alternative hypothesis: Common AR coefs. (within-dimension)				
	Statistic	**Prob.**	**Weighted Statistic**	**Prob.**
Panel v-Statistic	60.92	0.00***	44.035	0.00***
Panel rho-Statistic	0.587	0.72	-0.06	0.48
Panel PP-Statistic	-3.854	0.00***	-4.38	0.00***

Panel ADF-Statistic	-3.802	0.00***	-4.37	0.00***
Alternative hypothesis: Individual AR coefs. (between-dimension)				
	Statistic	**Prob.**		
Group rho-Statistic	1.038	0.85		
Group PP-Statistic	-5.43	0.00***		
Group ADF-Statistic	-4.45	0.00***		

Since the null of no co-integration equation up to five co-integrated equations can be rejected, the results of Johansen Fisher Panel Co-integration (trace and Maximum Eigenvalue tests) suggest that there are five co-integrated vectors (at most 4). Individual cross-sections are also subjected to the Johansen Fisher Panel Co-integration test, with the results presented in Table 5.

Table 4. Johansen Fisher Panel Co-Integration Test

Unrestricted Co-integration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Fisher Stat.* (trace test)**	**Prob.**	**Fisher Stat.* (max-eigen test)**	**Prob.**
None	229.8	0.00***	130.3	0.00***
At most 1	128.1	0.00***	75.15	0.00***
At most 2	65.90	0.00***	47.06	0.00***
At most 3	28.86	0.00***	19.71	0.03***
At most 4	18.02	0.05**	19.79	0.03***
At most 5	6.356	0.78	6.35	0.78

The null of one co-integration equation is rejected in all cross sections, as is the null of two and three (at most two) co-integration equations, according to the results of Johansen Fisher Panel Co-integration for individual cross sections. However, only India and Bangladesh are rejected when four co-integrations (at most three) equations are included. Only in the case of India is the null rejected when there are five co-integration equations (at most four). It is rejected in neither of the cross sections when there are six co-integration equations (at most five). We can deduce that there are three co-integration equations in all cross sections, four in two (India and Bangladesh), and five in one (India).

After establishing a long-run relationship using Padroni and Johansen Fisher Panel Co-integration, the next step is to determine the long-run coefficients of the variables. For this, a more efficient technique called panel completely modified least squares (FMOLS) has been used. The FMOLS results are presented in Table 6. The findings show that trade openness has a statistically significant positive impact on economic growth. It is widely believed that countries with international exposure are more useful than those that focus on the local commercial sector. Similar finding was

found by (Siregar & Widjanarko, 2022). Furthermore, international trade promotes the productive allocation of assets and can lead to increased development. Financial development has a major and favorable impact on economic growth. Financial development is desired for a well-functioning finance market, which is a necessary component of smooth economic activity in line with the conclusion with draw by past studies (Bibi, 2022).

Energy consumption is the major variable of interest, and it has a positive and large impact on economic growth, supporting Stern's (2004) argument that energy is an important component of economic growth and should be incorporated in the production function. However, Khan *et al.*, (2022) found a bidirectional relation between energy consumption and economic growth.

Table 5. Individual Cross-Section Results of Johansen Fisher Panel Co-Integration

Individual cross-section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no co-integration				
Bangladesh	223.35	0.00***	93.82	0.00***
India	206.05	0.00***	79.88	0.00***
Nepal	190.63	0.00***	90.51	0.00***
Pakistan	151.04	0.00***	54.75	0.00***
Sri Lanka	156.43	0.00***	60.66	0.00***
Hypothesis of at most 1-co-integration relationship				
Bangladesh	129.52	0.00***	53.38	0.00***
India	126.16	0.00***	62.44	0.00***
Nepal	100.11	0.00***	40.59	0.00***
Pakistan	96.28	0.00***	39.47	0.00***
Sri Lanka	95.76	0.00***	43.77	0.00***
Hypothesis of at most 2-co-integration relationship				
Bangladesh	76.13	0.00***	42.65	0.00***
India	63.71	0.00***	26.45	0.06**
Nepal	59.52	0.00***	33.76	0.00***
Pakistan	56.81	0.00***	34.04	0.00***
Sri Lanka	51.99	0.01***	26.65	0.06**
Hypothesis of at most 3-co-integration relationship				
Bangladesh	33.47	0.01***	23.59	0.02***
India	37.26	0.00***	20.05	0.07**
Nepal	25.76	0.13	17.68	0.14
Pakistan	22.77	0.25	11.84	0.56
Sri Lanka	25.33	0.14	13.30	0.42
Hypothesis of at most 4-co-integration relationship				
Bangladesh	9.88	0.28	8.66	0.31
India	17.20	0.02***	16.82	0.01***
Nepal	8.07	0.45	8.07	0.37
Pakistan	10.92	0.21	10.66	0.17
Sri Lanka	12.03	0.15	11.52	0.12
Hypothesis of at most 5-co-integration relationship				

Bangladesh	1.21	0.27	1.21	0.27
India	0.38	0.53	0.38	0.53
Nepal	0.00	0.99	0.00	0.99
Pakistan	0.26	0.60	0.26	0.60
Sri Lanka	0.50	0.47	0.50	0.47

Note: Prob**MacKinnon-Haug-Michelis (1999) p-values, **w**hereas **, *** represents 5 and 10 percent level of significance respectively.

Similarly, gross fixed capital formation influences economic growth in a positive and statistically significant way. Inflation has a negative but statistically small influence on economic growth; the explanation for this may be that the average rate of inflation throughout the time period under examination remained in the single digits, indicating that inflation was not damaging to economic growth.

Table 6. Panel Fully Modified Least Squares (FMOLS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Trade Openness	0.01	0.00	2.06	0.04***
Financial Development	0.01	0.00	1.89	0.06**
Energy Consumption	2.52	0.16	15.62	0.00***
Gross fixed Capital formation	0.03	0.01	2.68	0.00***
Inflation	-0.01	0.00	-1.25	0.21

Note: ***, ** represent 1 and 5 percent level of significance respectively.

Table 7. Panel Homogeneous Causality

		Gross Domestic Product	Energy Consumption	Financial Development	Gross fixed Capital Formation	Trade Openness	Inflation
Gross Domestic Product	W stat		0.98	3.54	6.05	4.88	2.07
	Z Stat		-1.11	1.33	3.73	2.62	-0.07
	Prob.		0.26	0.18	0.00***	0.00***	0.93
Energy Consumption	W stat	5.60		3.84	3.23	4.22	2.07
	Z Stat	3.26		1.59	1.01	1.95	-0.09
	Prob.	0.00***		0.11	0.31	0.05***	0.92
Financial Development	W stat	4.4	4.51		3.24	2.53	8.78
	Z Stat	2.20	2.23		1.04	0.36	6.37
	Prob.	0.02***	0.02***		0.29	0.71	2.E-10
Gross fixed Capital formation	W stat	4.91	3.50	4.08		4.44	1.29
	Z Stat	2.6	1.26	1.84		2.19	-0.82
	Prob.	0.00***	0.20	0.06**		0.02***	0.41
Trade Openness	W stat	5.27	4.71	2.12	2.46		2.27
	Z Stat	2.99	2.41	-0.02	0.29		0.11
	Prob.	0.00***	0.01***	0.97	0.76		0.90
Inflation	W stat	5.27	5.03	4.14	5.65	1.75	
	Z Stat	2.99	2.78	1.91	3.35	-0.38	
	Prob.	0.00***	0.00***	0.05**	0.00***	0.70	

Note: *** represent 1 percent level of significance.

Results of Panel Homogeneous Causality are introduced in Table 7. The discoveries of board homogenous causality uncover bi-directional causality among GDP and Gross Fixed Capital Formation, GDP and trade openness, and trade openness, and energy consumption. There is unidirectional causality from energy consumption to GDP, Financial Development to GDP, Inflation to GDP, Financial Development to energy consumption, inflation to energy consumption, Financial Development to Gross Fixed Capital Formation, and Financial Development to Gross Fixed Capital Formation.

5. Conclusion

Energy is the economy's oxygen and the lifeblood of progress, particularly in developing economies undergoing widespread industrialization. In growth theories, it is frequently suggested that energy, like labor and capital, should be regarded as an input. In the instance of south Asian countries, the current study attempts to determine the correlation between energy consumption, financial development, trade openness, and economic growth. Panel data was utilized for the South Asian nations including Pakistan, Bangladesh, India, Sri Lanka, and Nepal. For the investigation, panel co-integration and panel fully modified ordinary least squares (FMOLS) were utilized. Results of panel co-integration show that the factors are interconnected. The FMOLS discoveries show that energy consumption, trade openness, and financial development all essentially affect economic growth in the countries contemplated. The energy area in South Asian nations requires exceptional consideration.

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