energies

Article

How Does Electricity Affect Economic Growth? Examining the Role of Government Policy to Selected Four South Asian Countries

Mohammad Mafizur Rahman [1,*], Istihak Rayhan [2] and Nahid Sultana [1,2]

[1] School of Business, University of Southern Queensland, Toowoomba, QLD 4350, Australia
[2] Department of Economics, Jahangirnagar University, Dhaka 1340, Bangladesh
* Correspondence: mafiz.rahman@usq.edu.au

Abstract: Electricity consumption and government policy are two vital elements for economic growth. Thus, this study explores the roles of electricity use and government policy in the economic growth of the selected four South Asian countries over the period from 1980 to 2014. The study includes the government policy variable in the extended Cobb–Douglas production function of the electricity driven growth model, which was absent in earlier studies. The pooled mean group-based panel autoregressive distributed lag (P-ARDL) method is used for empirical investigation, while fully modified ordinary least squares (FMOLS) and dynamic ordinary least square (DOLS) methods are used for checking the sensitivity of the P-ARDL estimates. Our results reveal that the effects of electricity, government spending, financial development and capital formation have significant positive effects on the economic growth of South Asia. However, exports and imports are found to have detrimental effects. Causality test reveals a unidirectional causality from electricity consumption to economic growth that supports the growth hypothesis. Following the findings, important policy recommendations are made to foster the economic growth in the South Asian countries.

Keywords: economic growth; electricity use; government policy; panel ARDL; South Asian countries

Citation: Rahman, M.M.; Rayhan, I.; Sultana, N. How Does Electricity Affect Economic Growth? Examining the Role of Government Policy to Selected Four South Asian Countries. *Energies* **2023**, *16*, 1417. https://doi.org/10.3390/en16031417

Academic Editor: Seung-Hoon Yoo

Received: 22 December 2022
Revised: 21 January 2023
Accepted: 25 January 2023
Published: 1 February 2023

1. Introduction

Electricity is an important input to economic activities and its consumption is considered to be central to economic growth [1–5]. The production technology of modern economies is highly dependent on electricity. It is crucial for operating modern technological equipment, including electronics, computers, and various machines, in addition to being used for lighting, heating, and cooling. It is considered a lifeline for innovation which is contemplated to be the source of economic growth according to the new growth theories [6]. Lack of supply to electricity not only hampers economic activities but also lowers the pace of overall economic growth [1,7,8]. Therefore, this study has considered the consumption of electricity as a determinant of economic growth and examines its impact on economic growth in the context of government policies.

In South Asian region, the per capita consumption of electricity remains below the world average. It is only 705.32 kWh in the South Asian countries, while it is 3131.68 kWh for the World, 2508.46 kWh for the Arab World, 3677.50 kWh for the countries of East Asia and Pacific, 7749.50 kWh for the OECD member countries, and 13,253.82 kWh for the North American countries [9]. Since per capita electricity use is highly correlated with the per capita income, consequently the per capita income of this region is also very low ($1932.5, at constant 2010 US $) compared to the World average ($11,057.0), East Asia and Pacific average ($10,652.5), and the average of middle-income countries ($5269.8) [9]. Poverty is still a big concern for the South Asian countries since a significant percentage of people live below the extreme poverty line [10]. Hence, for achieving the sustainable development Goals of 'No Poverty' and 'Zero Hunger', it is essential to foster the per capita income of this region. Identification of the most suitable factors (internal and external) is the main task to adopt an appropriate policy for accelerating economic growth. China, the biggest developing country of the world, considers investment in electricity generation as a key policy to the economic development [7]. It can also be a strategy for South Asian countries due to its positive correlation to economic growth through the process of urbanization and industrialization. The present study explores the fact to this end by analyzing the policy measures taken by the government of the countries.

Governments initiate various policies and alter policy instruments aiming to stimulate economic growth. The widely used and most important instrument of the government is fiscal policy and utilizing this, governments can influence the national output. The Keynesians set the government spending as an exogenous policy instrument which can augment the growth rate of an economy by minimizing both the short run and long run fluctuations in the business cycle [11–13]. Government policy can also influence the supply of and demand for electricity in a country. By enacting new and effective energy policies, spending more on energy related research and activities, importing advanced technologies, and developing the energy related infrastructure, government can increase the production and consumption of electricity that ultimately leads to economic growth.

Against this backdrop, the present study aims to explore the role of electricity use and government policy on the economic growth of the South Asian countries, which is quite important but has received little attention in the past. For avoiding the specification bias problem, the study also includes some control variables in the production function. Observing the contributory role of financial development in the economic growth [14–17], the present study includes the financial development variable in the model. Financial sector is important for economic growth due to its role to the mobilization and allocation of savings that can enhance the investment. It also helps to flourish the exchange of goods and services by easing the transactions and flows of goods and services, mobilizing the savings and allocating it to the most desirable productive sector, monitoring and facilitating the investment, and executing the corporate governance [18,19]. This study also includes the export and import variables in the model due to their role in economic growth (see Dinç and Gökmen [20] and Kim et al. [21] for export; and Islam et al. [22] and Maitra [23] for imports). Export contributes to economic growth by increasing the inflows of foreign currencies, creating employment opportunities, and extending the volume of domestic production, while imports of raw materials, industrial inputs, and new technologies positively affect the economic activities. Although some studies have explored the role of electricity consumption in the South Asian countries, the role of government policy is absent in their models (see Raza et al. [24]; Shahbaz and Feridun [25]; and Ahamad and Islam [26]).

Therefore, the present study aims to explore the role of electricity use and government policy as the determinants of economic growth in the South Asian countries by controlling the impacts of capital stock, financial development, exports, and imports.

The main contributions of this study are: First, it is a novel attempt that explores the role of electricity use and government policy on economic growth in the South Asian countries by controlling the impact of capital stock, financial development, exports, and imports; the study includes the government policy variable in the electricity driven growth model, which was missing in the previous studies. Government policy not only directly affects the economic growth rate, but also works as a crucial factor to ensure the sufficient quantity and quality of electricity supply. Second, the present study includes a comparatively large panel dataset that covers 35 years (from 1980 to 2014). Third, the study has carried out some methodological improvements over some previous studies by employing the panel second generation estimation techniques instead of the panel first generation techniques. Since the first generation panel model is not capable of addressing the cross-sectional dependence, the second generation technique of this study provides more reliable elasticities which will help the policymakers to adopt a better growth-promoting policy. Fourth; the outcomes of the robust estimation techniques employed in the present study adds some new insights about the electricity-economic growth, government policy-economic growth, financial development-economic growth, exports-economic growth, and imports-economic growth nexuses in the South Asian economies; the control variables of this study are also different from those of other studies of the existing literature; and finally; and the present study recommends some policy suggestions for a sustained and balanced economic growth.

This study has been organized under five sections. After the introduction in Section 1, Section 2 contains the discussions of the relevant literature, Section 3 includes the empirical model, data, and econometric methodology, Section 4 elaborates and interprets the results, and attaches a brief discussion based on the findings, and finally Section 5 concludes the study by suggesting some policy implications.

2. Literature Review

The present study has discussed the relevant literature by four sub-sections as below.

2.1. Electricity Consumption and Economic Growth

The empirical findings of the electricity consumption and economic growth nexus can be categorized into four groups: (i) the growth hypothesis: which claimed that electricity consumption accelerated economic growth and predicted a causal direction from electricity to economic growth; (ii) the conservative hypothesis: which demonstrated that the economic growth augmented the energy use, and the causal direction moved from economic growth to electricity; (iii) the neutrality hypothesis: which advocated for no causal relationship between electricity consumption and economic growth; and finally (iv) the feedback hypothesis: which revealed a bidirectional causality between electricity use and economic growth.

The validity of the growth hypothesis was proved by Iyke [27] for Nigeria, Al-Mulali et al. [28] for GCC countries, Kumar et al. [29] for Gibraltar, Raza et al. [24] for four South Asian countries, Zhong et al. [4] for China, Samu et al. [3] for Zimbabwe, and Churchill and Ivanovski [5] for seven Australian States. These studies recorded the evidence of unidirectional causality from electricity consumption to economic growth.

Evidence of conservative hypothesis was found in the studies of Cowan et al. [30] for South Africa, Kyophilavong et al. [31] for Laos, Furuoka [32] for Baltic countries, Wang et al. [33] for China, and Rahman [34] for the top 10 electricity consuming countries. All these studies opined that economic growth upraised the electricity consumption. In a contrary to these results Cowan et al. [30] and Bah and Azam [35] found no evidence of causal relationship between electricity and economic growth and supported the existence of the neutrality hypothesis for Brazil, India, and China, and for South Africa.

Strong evidence was also found for feedback hypothesis in the empirical investigations by Tang et al. [36] for Portugal, Tang and Tan [37] for Malaysia, Polemis and Dagoumas [38] for Greece, Cowan et al. [30] for Russia, Abdoli et al. [39] for OPEC countries, Osman et al. [40] for panel of GCC countries, and Sekantsi and Okot [41] for Uganda where it was reported of a bidirectional causal relationship between electricity and economic growth. In this relation, Apergis et al. [42] included the feedback causality between hydroelectricity and economic growth in the literature.

Therefore, an admixture of findings exists in the literature regarding the causal direction between electricity and economic growth.

2.2. Government Policy and Economic Growth

Some empirical works have explored the relationship between government spending and economic growth, and two views are prominent in this regard: (i) Wagner's law, and (ii) Keynesian views.

Wagner's law postulated a positive association between government spending and economic growth, where the causal direction was running from economic growth to government spending. A reversed proposition came from the views of Keynes. The Keynesian views considered the government expenditure as an exogenous policy instrument that can accelerate the economic growth and minimize the cyclical fluctuations of business cycle both in the short and long runs.

Govindaraju et al. [43] found the evidence of Wagner's law in the context of Malaysia. Chow et al. [44] found the evidence of Wagner's law for U.K when money supply was included in the model with government spending and economic growth. This law was established for USA, UK, Japan, South Korea, and Taiwan, by Chang et al. [45], although no evidence of causal relationship was reported for Australia, New Zealand, Canada, South Africa, and Thailand by this study. A mixed evidence on the support of Wagner's law was found for central and western provinces of China by Narayan et al. [46]. Contrary to these findings, weak evidence of Wagner's law was reported by Adil et al. [47] for India and by Wahab [48] for OECD countries.

As an empirical evidence to the support of Keynesian views Sakyi and Adams [11] found a contributing role of government spending on economic growth of Ghana. Investigating on China Thanh and Canh [49] also found the similar contributing role of government expenditure. However, asymmetry in the government spending and economic growth relationship is found by Olaoye and Afolabi [13] for West African States (ECOWAS). This study has revealed the cumulative effect of an expansionary government spending shocks on economic growth as positive, and for the contractionary shocks it is negative. Contrary to these studies, dissimilar result was also reported in Connolly and Li [12] that examined the OECD countries and found no significant impact of government spending on the economic growth. Therefore, contradiction prevails in the relationship between government policy and economic growth.

2.3. Financial Development and Economic Growth

The contributory effects of financial development on economic growth was explored by Masoud and Hardaker [50] for the emerging markets and concluded that stock market development made significant positive contribution to the economic growth. Similar finding was also reported by Hamadi and Bassil [51] for the Middle East and North African (MENA) countries and found the positive influence of the stock markets and banks on economic growth. Rahman and Salahuddin [52] also experienced the same result for Pakistan.

Composite index was used (by using various indicators of financial development) to represent financial development by the studies of Rafindadi and Yusof [53]; Rahman et al. [54]; Muhammad et al. [19]; Bist [15]; and Malarvizhi et al. [16]. All these studies found the positive contributing role of financial development to economic growth. The summary of the study of Valickova et al. [55] which reviewed 67 studies revealed a strong positive impact of financial development on economic growth.

Exploring the contribution of financial development on economic growth in some South Asian countries Sehrawat and Giri [56] found that both the bank-based and market-based indicators of financial development augmented economic growth. Financial development was also identified as a contributing driver of economic growth by Jalil and Feridun [57] and Komal and Abbas [58] for Pakistan. An opposite view was revealed by Rahman et al. [54] who found that financial development exacerbated economic growth in both the high and low income regimes. Exploring the for the SAARC region, Sehrawat and Giri [56] found the augmenting role of financial development on economic growth of this region.

2.4. Export- and Import-Led Economic Growth

The export-led growth theory posits that not only labor and capital but also the expansion of exports can act as a contributing factor of economic growth. By creating more employment opportunities, enhancing the domestic production, and bringing the foreign currencies, the expansion of exports can act like an engine of economic growth for a country. Although the export-led hypothesis expects a unidirectional causality from exports to economic growth, the direction can be reversed or bidirectional. The unidirectional causality from exports to economic growth that supported the export-led growth theory was revealed by Kim et al. [21] for Myanmar. Opposite result was found by Gokmenoglu et al. [59] for Coasta Rica where export did not cause economic growth although economic growth granger caused export. A study on Brazil by Dinç and Gökmen [20] explored the evidence of export-led growth in the short-run and a bidirectional causality between these two in the long-run.

Besides exports, imports can also act as an influential driver of economic growth in the developing countries. By importing oil, essential raw materials and inputs, and new updated technologies, the developing countries can upgrade their production capacities and enhance economic activities. Therefore, investigation of import-led growth hypothesis is equally important such as exploring the export-led growth hypothesis. Islam et al. [22] found the evidence of import-led growth hypothesis for 62 countries.

Mixed results were also found in many empirical studies that included both the export and import in the production function in addition to labor and capital. Mishra et al. [60] studied on the Pacific islands (Fiji, Papua New Guinea, Solomon Islands, Tonga, and Vanuatu) and found feedback causality between export and economic growth, import and economic growth, and export and import. Quite similar findings were also reported in the study of Raghutla and Chittedi [61] that explored in the BRICS countries. The study found the export-led growth for Brazil and Import-led growth for Russia, while the study also reported that economic growth exacerbated export in India, South Africa, and China, and import in Brazil, India, China, and South Africa. Maitra [23] found the validity of import-led growth for India, although the study did not find the evidence of export-led growth. This study also found strong evidence that economic growth caused both export and import in India. The evidence of both export-led and import-led growth hypothesis was found by Moroke and Manoto [62] for South Africa. The above discussion clearly indicates that empirical evidence about the contribution of factors in economic growth is mixed and mostly inconclusive. Therefore, further study taking updated data period, relevant variables and using sophisticated methodological approaches is warranted to mitigate the current debate and formulate and execute the appropriate policies. Although the study of Carfora et al. [63] expands the replication of the energy-driven growth model by adding a variable for policies that indicates whether a nation has adopted a policy in favor of renewable energy sources, the current study makes an effort to fill up a gap in the literature by incorporating the government policy variable into the electricity driven growth model, which was absent in earlier studies. Government policy plays a significant role in ensuring that there is a sufficient supply of high-quality, reliable electricity, in addition to having a direct impact on economic growth. Additionally, by using panel second generation estimation techniques rather than panel first generation techniques, the study has made some methodological advancements over some prior studies.

3. Materials and Methods

3.1. Model Specification

Similar to previous works of Shahbaz et al. [64], Kumar et al. [65], and Le and Sarkodie [66], the present study has employed the extended Cobb–Douglas production function framework to develop the empirical model for estimation. Let $\mathrm{y_t}$, $\mathrm{A_t}$, and $\mathrm{k_t}$ stand for output per capita (proxy for economic growth), technology, and capital stock per capita, therefore, the growth model can be expressed as:

$$y_t = A_t k_t^{\alpha} e^{it},\ \alpha > 0 \quad (1)$$

Here, technology is a dynamic endogenous covariate that can be determined by various factors. Based on the previous theoretical and empirical findings, the present study has incorporated the electricity consumption, financial development, government expenditure (proxy for government policy), exports, and imports to represent the technology in the model. Therefore, technology can be expressed by the following function:

$$A_t = A_0 EU^{\beta} FD^{\gamma} G^{\delta} Ex^{\theta} Im^{\sigma} \tag{2}$$

where *EU*, *FD*, *G*, *Ex*, and *Im* stands for electricity use, financial development, government spending, exports, and imports, respectively. Incorporation of Equation (2) into (1) produces the following equation:

$$y_t = \left(A_0 EU^{\beta} FD^{\gamma} G^{\delta} Ex^{\theta} Im^{\sigma}\right) k_t^{\alpha} e^{it} \tag{3}$$

Now we will take log of all variables for having the elasticity directly from the coefficient values. The natural logarithmic transformation of all the variables sets the desired model of this study for estimation as follows:

$$LnY_t = \pi_{it} + \alpha\ LnK + \beta\ LnEU + \gamma LnFD + \delta LnG + \theta LnEx + \sigma LnIm + \varepsilon_{it} \tag{4}$$

In Equation (4), t denotes time and i represents the ith country in the panel. Moreover, here π represents the constant term and ε is the error term, while $\alpha, \beta, \gamma, \delta, \theta,$ and σ denote the elasticity of capital formation, electricity consumption, financial development, government spending, exports, and imports, respectively.

3.2. Data and Variables

The present study utilizes the yearly data of four South Asian countries named Bangladesh, India, Sri-Lanka, and Pakistan from 1980 to 2014. Nepal, Bhutan, Maldives, and Afghanistan are not included due to the lack of data. For this reason, this study examines the role of electricity use and government policy on economic growth to selected four South Asian countries instead of eight countries. Another limitation of this study is that electricity use data for these countries are not updated, so the dataset must be limited to 1980 to 2014. The study, however, makes an effort to get around this limitation by using an advanced panel data estimation technique which will produce estimates that are more trustworthy and aid in more accurate prediction. The prime objective of time series econometric analysis is reliable forecasting.

In this study, the data of GDP per capita (LnY), gross fixed capital formation per capita (LnK), and general government final consumption expenditure per capita (LnG) are measured in constant 2010 US dollars. Exports (LnEx) and imports (LnIm) of goods and services (percentage of GDP) are in percentage form, while the electric power consumption per capita (LnEU) is measured by kWh and financial development is accounted by an index. The financial development index data are collected from International Monetary Fund, while the data of all other variables are collected from the World Development Indicators of World Bank. Table 1 contains the information about the variables, their measurements, and sources of data.

Table 1. Description of Variables.

Variables	Measurement	Sources
LnY	GDP per capita (constant 2010 US$) (Proxy for economic growth)	World Development Indicators, World Bank
LnK	Gross fixed capital formation per capita (constant 2010 US$)	World Development Indicators, World Bank
LnEU	Electric power consumption (kWh per capita)	World Development Indicators, World Bank
LnG	General government final consumption expenditure (constant 2010 US$) per capita (Proxy for government policy)	World Development Indicators, World Bank

Table 1. *Cont.*

Variables	Measurement	Sources
LnFD	Financial Development Index	International Monetary Fund (IMF)
LnEx	Exports of goods and services (% of GDP)	World Development Indicators, World Bank
LnIm	Imports of goods and services (% of GDP)	World Development Indicators, World Bank

3.3. Econometric Methodology

3.3.1. Cross-Sectional Dependence

Identifying the cross-sectional dependence (CD) in a panel data analysis is important to find out the reliable estimates. We can illustrate the concept of CD by considering the event when a shock in any variable of a country affects the same variable of the rest of the countries [67,68]. If CD remains untreated in the model, the results may produce spurious estimates [69]. Therefore, for producing reliable estimates, proper econometric techniques that account for CD should be implemented. In this regard, the present study not only diagnoses cross-sectional dependence but also includes the estimation method that can address the issues of CD. The study has employed various cross-sectional dependence tests namely Breusch-Pagan LM test [70], Pesaran scaled LM test [71], Pesaran CD test [72], and Baltagi et al. [73] biased-corrected scaled LM test to scrutinize the dependence among the cross-sectional units.

3.3.2. Panel Unit Root Test

Unless cointegrated, regression of non-stationary series may deliver spurious regression [74]; therefore, identification of the proper order of integration of the variables is important. Some tests are available to check the stationarity of the panel data. For instance, Maddala and Wu [75] and Choi [76] modified ADF-Fisher Chi-square, and PP-Fisher Chi-square, and Im et al. [77] developed panel unit root tests. However, the main limitation of these tests is the incapability of accounting the CD issues and therefore these tests are commonly known as first generation panel unit root tests. Against this backdrop, to check the stationarity property of the variables in the presence of the CD, Pesaran [71] developed the Cross-sectional Augmented Dickey–Fuller (CADF) panel unit root test which is a second generation panel unit root test. The study includes the CADF panel unit root test to check stationarity of the variables by considering the CD issues.

3.3.3. Panel Cointegration Test

The residual-based Pedroni [78,79] and Kao [80] cointegration tests are known as the first generation panel cointegration tests and the main limitation of these tests is the incapability of accounting the CD issue. Since ignorance of CD leads to biased results, the study has employed the second generation Westerlund [81] panel cointegration test to evaluate the long run association of the variables. The Westerlund [81] cointegration test has four statistics, where the two-group mean statistics G_t and G_a are used to identify the cointegration in at least one cross-sectional unit while the two-panel statistics P_t and P_a explores the cointegration in the entire panel [66].

3.3.4. Panel Regression Analysis

The study has employed the panel autoregressive distributed lag (P-ARDL) method based on Pooled Mean Group (PMG) to evaluate the long run relationship between the variables. The main advantage of the PMG method is that it can address homogeneity in the long-run estimates, tolerating heterogeneity in the short-run estimates and error variances [82]. Therefore, incorporation of the cross-sectional information allowing data heterogeneity makes it more conductive to empirical study. Moreover, this method produces more reliable and robust estimates. This study also applies the Panel Fully Modified OLS (P-FMOLS) and Panel Dynamic OLS (P-DOLS) to check the sensitivity of the P-ARDL results. Since the long run estimates do not represent the causal direction between the variables, the study also applies panel causality test to explore the causal direction between the considered variables.

3.3.5. Panel Causality Test

The present study has applied the Dumitrescu–Hurlin [83] panel causality test, since it is superior to the conventional Granger causality test in the presence of CD and slope heterogeneity. The Dumitrescu–Hurlin causality test assumes the homogenous noncausality as the null hypothesis. Therefore, a significant *p*-value of the z-statistic is needed to reject the null hypothesis and conclude that the considered explanatory variable causes the dependent variable.

4. Results and Discussion

4.1. Descriptive Statistics

Descriptive analyses of the variables are tabulated in Table 2, where various statistics such as mean, median, standard deviation, Skewness, and Kurtosis are presented.

Table 2. Descriptive Statistics.

	LNY	LNK	LNEU	LNG	LNFD	LNEX	LNIM
Mean	6.744461	−15.11107	5.382490	4.196768	−1.424240	2.671826	3.012901
Median	6.702625	−15.26682	5.575206	4.291584	−1.490892	2.657077	3.004596
Maximum	8.162103	−12.05984	6.690238	5.538251	−0.717960	3.663964	3.904409
Minimum	5.884593	−17.99957	2.950270	2.840789	−2.051880	1.222673	1.943082
Std.Dev.	0.532586	1.800458	0.796108	0.681140	0.344290	0.571076	0.494511
Skewness	0.582814	0.169670	−0.987834	−0.327833	0.228405	−0.265000	−0.132670
Kurtosis	2.907380	2.055648	3.550222	2.450353	1.964719	2.351012	2.332279
Jarque-Bera	7.975717	5.873892	24.53503	4.270052	7.469480	4.095500	3.011497
Probability	0.018539	0.053027	0.000005	0.118242	0.023879	0.129025	0.221851
Sum	944.2246	−2115.549	753.5487	587.5475	−199.3936	374.0556	421.8062
SumSq.Dev.	39.42712	450.5892	88.09648	64.48922	16.47648	45.33175	33.99120
Observations	140	140	140	140	140	140	140

4.2. Cross-Sectional Dependence Test Results

At first, the study explores the independence status of the variables across the cross-sectional units because if cross-sectional dependence exits but remains unconsidered, it may provide serious misleading estimates. Therefore, this study employs Brusch–Pagan, Pesaran scaled, and Bias-corrected scaled LM test, besides the Pesaran CD test to detect the dependence. Table 3 demonstrates the results of all the CD tests and the results confirm the presence of CD in all series.

Table 3. The Results of Cross-Sectional Dependence Tests.

	Breusch-Pagan LM	Pesaran Scaled LM	Bias-Corrected Scaled LM	Pesaran CD
LnY	198.5468 ***	55.5835 ***	55.5247 ***	14.0864 ***
LnK	92.3690 ***	24.9326 ***	24.8738 ***	−2.3767 ***
LnEU	194.4380 ***	54.3974 ***	54.3385 ***	13.9382 ***
LnG	156.1745 ***	43.3516 ***	43.2928 ***	12.4118 ***
LnFD	64.6125 ***	16.9199 ***	16.8614 ***	7.4862 ***
LnEx	44.8266 ***	11.2083 ***	11.1495 ***	2.9521 ***
LnIm	49.0963 ***	12.4408 ***	12.3820 ***	−1.0336 ***

*** indicates 1% significance level.

4.3. Panel Unit Root Test Results

Since the first-generation panel unit root test is incapable to consider the CD issues, this study employs the second generation CADF panel unit root test to identify the exact order of integration of the variables. The result of the Pesaran CADF test is included in Table 4, where the results of the first-generation Im et al. [77], ADF-Fisher, and PP-Fisher panel unit root test are tabulated to make a comparison. Both first- and second-generation panel unit root tests reveal that all the variables are non-stationary at their level form but turns into stationary at their first difference form, which confirms the order of integration 1 for all variables.

Table 4. The results of Panel Unit root tests.

	First Generation						Second Generation	
	Im, Pesaran and Shin W-Stat		ADF-Fisher Chi-square		PP-Fisher Chi-Square		Pesaran's CADF	
	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.
LnY	8.2178 (1.0000)	−2.6786 *** (0.0037)	0.8219 (0.999)	22.1461 *** (0.0047)	2.3429 (0.969)	41.8882 *** (0.0000)	−2.415 (0.088)	−3.656 *** (0.000)
LnK	1.6638 (0.9519)	−5.1420 *** (0.0000)	1.7859 (0.9869)	41.3244 *** (0.0000)	3.5815 (0.8928)	87.6275 *** (0.0000)	0.015 (1.000)	−3.446 *** (0.000)
LnEU	0.1572 (0.5625)	−4.9072 *** (0.0000)	9.2136 (0.3246)	40.5423 *** (0.0000)	15.1585 (0.0561)	69.0824 *** (0.0000)	−1.576 (0.668)	−4.192 *** (0.000)
LnG	3.6495 (0.9999)	−4.7364 *** (0.0000)	1.5999 (0.9909)	38.0561 *** (0.0000)	1.6206 (0.9905)	83.2234 *** (0.0000)	−2.068 (0.270)	−3.507 *** (0.000)
LnFD	−0.3718 (0.3550)	−6.0873*** (0.0000)	7.7975 (0.4535)	50.3399 *** (0.0000)	6.8003 (0.5583)	75.8153 *** (0.0000)	−2.130 (0.228)	−4.293 *** (0.000)
LnEx	1.6242 (0.9478)	−6.0516 *** (0.0000)	2.5332 (0.9602)	51.1018 *** (0.0000)	3.3014 (0.9140)	101.683 *** (0.0000)	−1.863 (0.430)	−4.840 *** (0.000)
LnIm	0.7614 (0.7768)	−5.5494 *** (0.0000)	4.3739 (0.8219)	45.8541 *** (0.0000)	5.0423 (0.7531)	79.1949 *** (0.0000)	−1.291 (0.851)	−3.577 *** (0.000)

*** indicates 1% significance level.

4.4. Panel Cointegration Test Results

Since economic growth, electricity use, government spending, capital formation, financial development, exports, and imports are I(1) variables, the study goes for panel cointegration test to explore the long-run relationships among these variables. As the first-generation panel cointegration test is not suitable in the presence of CD, the study relies on the second generation Westerlund [81] panel cointegration test. Table 5 contains the statistics of the Westerlund cointegration test, where first generation Kao panel cointegration test is also included to make a comparison. The G_t statistic of the Westerlund cointegration test is significant at less than one percent level of significance, confirming the cointegration among the variables. The Kao cointegration test also confirms the presence of cointegration at less than one percent significance level. Therefore, both first and second generation cointegration tests confirm the authenticity of the long-run equilibrating relationships among the considered variables.

Table 5. The Results of Panel Cointegration Tests.

Kao Cointegration Test			Westerlund Cointegration Test			
Statistic	Value	*p*-Value	Statistic	Value	Z-Value	Robust *p*-Value
ADF	−4.1592 ***	0.0000	Gt	−4.469 ***	−3.399	0.005
			Ga	−2.876	3.191	0.555
			Pt	−2.262	2.686	0.805
			Pa	−2.087	2.495	0.805

*** indicates 1% significance level.

4.5. Long-Run Results and Discussion

The long-run elasticities of the pmg-based panel ARDL model are tabulated in Table 6, and the result reveals that all the slope coefficients are significant at less than one percent level of significance.

Table 6. Long-run Results from Panel ARDL.

Variables (Dependent Variable lnY.)	Panel ARDL
LnK	1.48 (0.0000) ***
LnEU	0.22 (0.0001) ***
LnG	0.15 (0.0001) ***
LnFD	0.06 (0.0004) ***
LnEx	−0.51 (0.0000) ***
LnIm	−0.83 (0.0000) ***

*** indicates 1% significance level.

The result reports that the impact of electricity use on real per capita income is positive and a 1 percent increase in electricity use augments the economic growth rate by 0.22 percent in the long run. This finding is consistent with some previous studies that reports similar positive impact of electricity consumption on economic growth (see Streimikiene and Kasperowicz [2] for EU countries; Samu et al. [3] for Zimbabwee; Zhong et al. [4] for China; and Churchill and Ivanovski [5] for seven Australian States). Previous study of Raza et al. [24] also reported the contributing role of electricity consumption on economic growth for the South Asian countries. This finding implies that the electricity can work as an important input into the production process to accelerate the economic growth in the South Asian countries. South Asia is a populous region where poverty is still a serious problem. Many rural areas have not the access to electricity till now, which deprived many people to extract the benefits of modern technologies. Therefore, the South Asian countries have an opportunity to foster the long-run economic growth by covering all the people in full time access of electricity.

The study also reveals that the impact of government policy on economic growth in the South Asian countries is positive and a one percent increase in government spending tends to accelerate the long-run economic growth by 0.15 percent. This finding is consistent with the studies of Sakyi and Adams [11] for Ghana; Connolly and Li [12] for OECD countries; and Olaoye and Afolabi [13] for ECOWAS. As the government spending seems an amplifying factor of economic growth for the South Asian countries, these economies have to spend more on productive sectors such as education, health, training, and research and developments to facilitate the long-run economic growth, in addition to investment in infrastructure development.

Statistically significant and positive impact of financial development on economic growth is also found in this study for the South Asian countries. The result reports that a one percent increase in financial development index leads to a 0.06 percent increment in economic growth. This finding is consistent with the findings of Sehrawat and Giri [14], Bist [15], Malarvizhi et al. [16], and Rahman et al. [17]. The expansion of the financial sector makes the transaction of goods and services easy, mobilizes savings and allocates them efficiently, encourages investment, and executes corporate governance. As a consequence, the economic growth accelerates. Since the financial sector in the South Asian countries are not well developed, there are ample scopes to foster the economic growth by developing the financial sector.

Surprising findings are observed for export and import variables in this study. The impact of exports and imports on the economic growth are found negative in the South Asian countries. The result reports that a one percent increase in exports deteriorates the economic growth by 0.51 percent and a one percent increase in imports declines it by

0.83 percent. Some previous studies also reported negative impacts of exports and imports on economic growth. For instance, the study of Bakari [84] reported the negative impact of exports on economic growth for Tunisia during 1965–2010, the study of Tahir et al. [85] found the negative impact of imports on economic growth for Pakistan over the period from 1977 to 2013, and the study of Hye and Lau [86] found that trade openness negatively affects the economic growth of India from 1971 to 2009. Moreover, previous study of Rahman et al. [87] reported insignificant impact of trade openness on economic growth for the South Asian region from 1975 to 2016, while the recent study of Rahman et al. [88] found significant negative impact of trade openness in the five South Asian countries. Therefore, the negative signs of export and import in the South Asian countries are consistent with some previous studies in this region. The South Asian countries import more than export. In 2019, the Export-GDP ratios in Bangladesh, India, Sri-Lanka, and Pakistan were, respectively, 15.32, 18.43, 23.13, and 10.12, while the Import-GDP ratios were, respectively, 21.44, 20.96, 29.25, and 20.32 [9]. Moreover, these countries import more consumer goods than the capital goods. These are the probable reasons for the negative impact of exports and imports on the economic growth.

The study also performed the P-FMOLS and P-DOLS to check the sensitivity of the P-ARDL estimates and the results of these methods are tabulated in Table 7. The signs of the coefficients are the same for all these three methods and the significance of the coefficients are also almost the same, which confirm the robustness and sensitivity of the long-run estimates.

Table 7. Sensitivity check of Panel ARDL by Panel FMOLS and DOLS.

Variables	Panel ARDL	Panel FMOLS	Panel DOLS
LnK	1.48 (0.0000) ***	0.38 (0.0000) ***	1.12 (0.0000) ***
LnEU	0.22 (0.0001) ***	0.13 (0.0510) *	0.14 (0.0365) **
LnG	0.15 (0.0001) ***	0.24 (0.0000) ***	0.23 (0.0002) ***
LnFD	0.06 (0.0004) ***	0.11 (0.0002) ***	0.08 (0.0112) **
LnEx	−0.51 (0.0000) ***	−0.28 (0.0000) ***	−0.43 (0.0000) ***
LnIm	−0.83 (0.0000) ***	−0.08 (0.1001)	−0.68 (0.0003) ***

***, **, and * indicate 1%, 5%, and 10% level of significance, respectively.

4.6. Panel Causality Test Results and Discussion

Although the panel ARDL method estimates the long-run elasticities, it does not reveal the causal direction between two variables. Therefore, aiming to explore the causal relationship between the variables, the present study has performed the Dumitrescu–Hurlin Panel Causality test and the results are tabulated in Table 8.

Table 8. The Results of Dumitrescu–Hurlin Panel Causality Test.

NullHypothesis	W-Stat.	Prob.	NullHypothesis	W-Stat.	Prob.
LNEU→LNY	4.18959 *	0.0801	LNFD→LNG	4.22504 *	0.0750
LNY→LNEU	1.55322	0.6056	LNG→LNFD	4.55866 **	0.0387
LNG→LNY	0.60238	0.1823	LNEX→LNG	3.72834	0.1759
LNY→LNG	11.3120 ***	0.0000	LNG→LNEX	1.76382	0.7374
LNFD→LNY	0.87742	0.2725	LNIM→LNG	3.39390	0.2864
LNY→LNFD	5.70692 ***	0.0023	LNG→LNIM	4.76738 **	0.0247
LNEX→LNY	2.01945	0.9080	LNK→LNG	4.85643 **	0.0202
LNY→LNEX	3.15194	0.3909	LNG→LNK	5.09052 **	0.0116
LNIM→LNY	3.20788	0.3649	LNEX→LNFD	4.16805 *	0.0833

Table 8. *Cont.*

NullHypothesis	W-Stat.	Prob.	NullHypothesis	W-Stat.	Prob.
LNY→LNIM	4.70969 **	0.0280	LNFD→LNEX	1.83733	0.7855
LNK→LNY	3.29114	0.3282	LNIM→LNFD	5.94470 ***	0.0011
LNY→LNK	8.96894 ***	0.0000	LNFD→LNIM	1.53285	0.5934
LNG→LNEU	2.08556	0.9532	LNK→LNFD	5.99112 ***	0.0010
LNEU→LNG	5.10003 **	0.0113	LNFD→LNK	2.14861	0.9964
LNFD→LNEU	1.10325	0.3664	LNIM→LNEX	14.0332 ***	0.0000
LNEU→LNFD	9.51701 ***	0.0000	LNEX→LNIM	5.03577 **	0.0132
LNEX→LNEU	1.21164	0.4179	LNK→LNEX	4.46757 **	0.0467
LNEU→LNEX	3.38469	0.2900	LNEX→LNK	5.43507 ***	0.0048
LNIM→LNEU	3.83419	0.1486	LNK→LNIM	3.49420	0.2492
LNEU→LNIM	4.92595 **	0.0172	LNIM→LNK	194.149 ***	0.0000
LNEU→LNK	5.83038 ***	0.0016	LNK→LNEU	1.30730	0.4668

***, **, and * indicate 1%, 5%, and 10% level of significance, respectively.

The result reveals a unidirectional causality from electricity consumption to economic growth, which supports the growth hypothesis. This finding is pertinent with the previous findings of Zhong et al. [4] for China, Samu et al. [3] for Zimbabwe, Churchill and Ivanovski [5] for Australia, and Raza et al. [24] for the South Asian countries. The existence of growth hypothesis implies the significance of electricity as an input to augment the economic growth in the South Asian countries. Moreover, the result reveals a unidirectional causality from economic growth to government spending that supports the Wagner's law. Previous studies of Chow et al. [44] for the UK, Chang et al. [45] for the USA, the UK, Japan, South Korea, and Taiwan, and Chandran Govindaraju et al. [43] for Malaysia also found the authenticity of the Wagner's law. The result also reveals a unidirectional causality from economic growth to financial development, which is pertinent with the findings of Ono [89] for Russia and Song et al. [90] for 142 countries, and economic growth to imports, which is consistent with the finding of Raghutla and Chittedi [61] where economic growth extends import in Brazil, India, China, and South Africa.

The Dumitrescu–Hurlin Panel Causality test results also report a unidirectional causality from electricity consumption to financial development, electricity to government spending, electricity to imports, government spending to imports, exports to financial development, imports to financial development, and imports to capital stock. Further, bidirectional causality is found between government spending and financial development, government spending and capital stock, exports and imports, exports, and capital stock in this study.

5. Conclusions

The present study examined the impact of electricity consumption on the economic growth in the presence of government policy. Four selected South Asian countries have been explored to this end by controlling the influence of capital stock, financial development, exports, and imports. The study included Bangladesh, India, Sri-Lanka, and Pakistan based on the data availability and spans over the period from 1980 to 2014. A good number of tests and econometric approaches were employed to the process of empirical investigation that finds a cross country dependence among the selected countries. Hence, the study employed the second generation CADF panel unit root test to check the stationarity of the variable and the second-generation panel cointegration test to assess the long run relationship among the variables. The panel ARDL estimator based on Pooled Mean Group is employed for obtaining long run estimates and the heterogeneous Dumitrescu–Hurlin panel causality test is utilized to explore the causal direction between the variables. The empirical result has confirmed that economic growth, electricity consumption, government expenditure, capital stock, financial development, exports, and imports are cointegrated. Therefore, the study explores the long run elasticities and has found significant positive impact of electricity consumption, government expenditure, financial development, and capital stock, on the economic growth, while the impact of exports and imports are found to be significantly negative. Based on these findings the present study draws the following recommendations:

(i) Since electricity consumption accelerates the economic growth, South Asian countries should consider electricity generation as a priority goal to expedite their pace of economic growth. Countries should prioritize the development of electric power industry in the development projects such as China. To address the issues of sustainability in the growth process, the source of electricity generation should be environmentally and socially justified. The projects should be backed by fair Environmental Impact Assessment (EIA) in order to avoid any undesired circumstances that may alter socio-economic productivity. Countries should develop and implement appropriate policies for ensuring a sustainable energy sector so that they can play effective role to the long run economic growth by exacerbating the access and use of electricity. Due to the abundances of natural resources (solar, wind, hydropower, geothermal) in South Asian region renewable sources of energy can be considered in electricity generation that can promote environment. Moreover of production, efficient distribution and monitoring system should be developed as part of efficient use of electricity.

(ii) South Asian countries can accelerate the long run growth by implementing an effective fiscal policy through an increase in government spending. By spending more on the productive sectors such as education, health, human capital, on R&D for technological innovations and infrastructural development, the government can foster the long run economic growth. Government investment on electricity generation, which is the key to all kinds of development projects, can be included in this spending chart since private investment often lacks fund for such a huge investment.

(iii) The financial sectors in South Asian countries need to be focused since they are not well developed. Policy should be implemented to develop a well-organized and well-structured financial sector which will be capable for financing big projects such as electricity power plants, and energy exploration projects. Financial services should be accessible to all sections of people so that it can encourage savings and facilitate productive investments that will increase economic activities.

(iv) To extract the benefits from exports and imports, the existing trade policy of the South Asian countries should be reformed. Export policy should focus on manufacture-based items rather than primary items by utilizing the abundant low-cost labor in this region. Instead of importing more consumption goods, more capital goods, raw materials, and technological equipment should be imported to enhance productivity. The revised import policy will provide strength to the export sector to compete with the foreign competitors, which in turn boosts up exports. A reformed and sustainable trade policy can turn the exports and imports as the contributing factors of economic growth in the South Asian countries.

Finally, this study is not free from limitations, like many other studies. Because of data unavailability, the study could not include all the South Asian countries and all policy related variables. However, this does not invalidate the current findings of the study or undermine the merit of the study. The study contributes to the existing literature by its evidence-based policy suggestions on the South Asian economic growth. Identification of common factors for economic growth will facilitate the countries to work in a collaborative manner to fight against the poverty and hunger of this region. This will also help the policymakers to adopt the appropriate strategies for a sustained and balanced growth of South Asia.

Author Contributions: M.M.R.: Idea, methodological approach, variables selection, interpretation of results, editing, supervision, and writing. I.R.: Data collection, variables and model selection, estimation, regression analysis and major writing. N.S.: Editing, polishing, and writing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data used in this study are publicly and freely available. These can also be available upon request to the authors.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Villanthenkodath, M.A.; Mahalik, M.K. Does economic growth respond to electricity consumption asymmetrically in Bangladesh? The implication for environmental sustainability. *Energy* **2021**, *233*, 121142. [CrossRef]
2. Streimikiene, D.; Kasperowicz, R. Review of economic growth and energy consumption: A panel cointegration analysis for EU countries. *Renew. Sustain. Energy Rev.* **2016**, *59*, 1545–1549. [CrossRef]
3. Samu, R.; Bekun, F.V.; Fahrioglu, M. Electricity consumption and economic growth nexus in Zimbabwe revisited: Fresh evidence from Maki cointegration. *Int. J. Green Energy* **2019**, *16*, 540–550. [CrossRef]
4. Zhong, X.; Jiang, H.; Zhang, C.; Shi, R. Electricity consumption and economic growth nexus in China: An autoregressive distributed lag approach. *Environ. Sci. Pollut. Res.* **2019**, *26*, 14627–14637. [CrossRef] [PubMed]
5. Churchill, S.A.; Ivanovski, K. Electricity consumption and economic growth across Australian states and territories. *Appl. Econ.* **2020**, *52*, 866–878. [CrossRef]
6. Gyedu, S.; Heng, T.; Ntarmah, A.H.; He, Y.; Frimppong, E. The impact of innovation on economic growth among G7 and BRICS countries: A GMM style panel vector autoregressive approach. *Technol. Forecast. Soc. Change* **2021**, *173*, 121169. [CrossRef]
7. Lin, B.; Liu, C. Why is electricity consumption inconsistent with economic growth in China? *Energy Policy* **2016**, *88*, 310–316. [CrossRef]
8. Costantini, V.; Martini, C. The causality between energy consumption and economic growth: A multi-sectoral analysis using non-stationary cointegrated panel data. *Energy Econ.* **2010**, *32*, 591–603. [CrossRef]
9. World Bank. World Development Indicators, World Bank. 2021. Available online: https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions (accessed on 29 November 2021).
10. World Bank 2018. Available online: https://worldbank.github.io/SARMD_guidelines/poverty-measures.html (accessed on 15 December 2021).
11. Sakyi, D.; Adams, S. Democracy, Government Spending and Economic Growth: The Case of Ghana, 1960–2008. *Margin J. Appl. Econ. Res.* **2012**, *6*, 361–383. [CrossRef]
12. Connolly, M.; Li, C. Government spending and economic growth in the OECD countries. *J. Econ. Policy Reform* **2016**, *19*, 386–395. [CrossRef]
13. Olaoye, O.; Afolabi, O. Government spending and economic growth: A trivariate causality testing. *Afr. J. Econ. Manag. Stud.* **2021**, *12*, 250–268. [CrossRef]
14. Sehrawat, M.; Giri, A.K. Financial development and economic growth: Empirical evidence from India. *Stud. Econ. Financ.* **2015**, *32*, 340–356. [CrossRef]
15. Bist, J.P. Financial development and economic growth: Evidence from a panel of 16 African and non-African low-income countries. *Cogent Econ. Financ.* **2018**, *6*, 1449780. [CrossRef]
16. Malarvizhi, C.A.N.; Zeynali, Y.; Mamun, A.A.; Ahmad, G.B. Financial Development and Economic Growth in ASEAN-5 Countries. *Glob. Bus. Rev.* **2019**, *20*, 57–71. [CrossRef]
17. Rahman, A.; Khan, M.A.; Charfeddine, L. Financial development–economic growth nexus in Pakistan: New evidence from the Markov switching model. *Cogent Econ. Financ.* **2020**, *8*, 1716446. [CrossRef]
18. Caporale, G.M.; Rault, C.; Sova, A.D.; Sova, R. Financial Development and Economic Growth: Evidence from 10 New European Union Members. *Int. J. Financ. Econ.* **2015**, *20*, 48–60. [CrossRef]
19. Muhammad, N.; Islam, A.R.M.; Marashdeh, H.A. Financial development and economic growth: An empirical evidence from the GCC countries using static and dynamic panel data. *J. Econ. Financ.* **2016**, *40*, 773–791. [CrossRef]
20. Dinç, D.T.; Gökmen, A. Export-led economic growth and the case of Brazil: An empirical research. *J. Transnatl. Manag.* **2019**, *24*, 122–141. [CrossRef]
21. Kim, B.; Kyophilavong, P.; Nozaki, K.; Charoenrat, T. Does the Export-led Growth Hypothesis Hold for Myanmar? *Glob. Bus. Rev.* **2020**, *23*, 48–60. [CrossRef]
22. Islam, F.; Muhammad Adnan Hye, Q.; Shahbaz, M. Import-economic growth nexus: ARDL approach to cointegration. *J. Chin. Econ. Foreign Trade Stud.* **2012**, *5*, 194–214. [CrossRef]
23. Maitra, B. Exploring Import-led Growth in India: Evidence from the Post-reform Period. *South Asian J. Macroecon. Public Financ.* **2020**, *9*, 87–113. [CrossRef]
24. Raza, S.A.; Jawaid, S.T.; Siddiqui, M.H. Electricity Consumption and Economic Growth in South Asia. *South Asia Econ. J.* **2016**, *17*, 200–215. [CrossRef]
25. Shahbaz, M.; Feridun, M. Electricity consumption and economic growth empirical evidence from Pakistan. *Qual. Quant.* **2012**, *46*, 1583–1599. [CrossRef]
26. Ahamad, M.G.; Islam, A.K.M.N. Electricity consumption and economic growth nexus in Bangladesh: Revisited evidences. *Energy Policy* **2011**, *39*, 6145–6150. [CrossRef]

27. Iyke, B.N. Electricity consumption and economic growth in Nigeria: A revisit of the energy-growth debate. *Energy Econ.* **2015**, *51*, 166–176. [CrossRef]
28. Al-Mulali, U.; Tang, C.F.; Tan, B.W.; Ozturk, I. The nexus of electricity consumption and economic growth in Gulf Cooperation Council economies: Evidence from non-stationary panel data methods. *Geosystem Eng.* **2019**, *22*, 40–47. [CrossRef]
29. Kumar, R.R.; Stauvermann, P.J.; Patel, A. Nexus between electricity consumption and economic growth: A study of Gibraltar. *Econ. Change Restruct.* **2015**, *48*, 119–135. [CrossRef]
30. Cowan, W.N.; Chang, T.; Inglesi-Lotz, R.; Gupta, R. The nexus of electricity consumption, economic growth and CO2 emissions in the BRICS countries. *Energy Policy* **2014**, *66*, 359–368. [CrossRef]
31. Kyophilavong, P.; Shahbaz, M.; Kim, B.; Oh, J.-S. A note on the electricity-growth nexus in Lao PDR. *Renew. Sustain. Energy Rev.* **2017**, *77*, 1251–1260. [CrossRef]
32. Furuoka, F. Renewable electricity consumption and economic development: New findings from the Baltic countries. *Renew. Sustain. Energy Rev.* **2017**, *71*, 450–463. [CrossRef]
33. Wang, J.; Zhao, J.; Li, H. The Electricity Consumption and Economic Growth Nexus in China: A Bootstrap Seemingly Unrelated Regression Estimator Approach. *Comput. Econ.* **2018**, *52*, 1195–1211. [CrossRef]
34. Rahman, M.M. Environmental degradation: The role of electricity consumption, economic growth and globalisation. *J. Environ. Manag.* **2020**, *253*, 109742. [CrossRef]
35. Bah, M.M.; Azam, M. Investigating the relationship between electricity consumption and economic growth: Evidence from South Africa. *Renew. Sustain. Energy Rev.* **2017**, *80*, 531–537. [CrossRef]
36. Tang, C.F.; Shahbaz, M.; Arouri, M. Re-investigating the electricity consumption and economic growth nexus in Portugal. *Energy Policy* **2013**, *62*, 1515–1524. [CrossRef]
37. Tang, C.F.; Tan, E.C. Exploring the nexus of electricity consumption, economic growth, energy prices and technology innovation in Malaysia. *Appl. Energy* **2013**, *104*, 297–305. [CrossRef]
38. Polemis, M.L.; Dagoumas, A.S. The electricity consumption and economic growth nexus: Evidence from Greece. *Energy Policy* **2013**, *62*, 798–808. [CrossRef]
39. Abdoli, G.; Farahani, Y.G.; Dastan, S. Electricity consumption and economic growth in OPEC countries: A cointegrated panel analysis. *OPEC Energy Rev.* **2015**, *39*, 1–16. [CrossRef]
40. Osman, M.; Gachino, G.; Hoque, A. Electricity consumption and economic growth in the GCC countries: Panel data analysis. *Energy Policy* **2016**, *98*, 318–327. [CrossRef]
41. Sekantsi, L.P.; Okot, N. Electricity consumption–economic growth nexus in Uganda. *Energy Sources Part B Econ. Plan. Policy* **2016**, *11*, 1144–1149. [CrossRef]
42. Apergis, N.; Chang, T.; Gupta, R.; Ziramba, E. Hydroelectricity consumption and economic growth nexus: Evidence from a panel of ten largest hydroelectricity consumers. *Renew. Sustain. Energy Rev.* **2016**, *62*, 318–325. [CrossRef]
43. Chandran Govindaraju, V.G.R.; Rao, R.; Anwar, S. Economic growth and government spending in Malaysia: A re-examination of Wagner and Keynesian views. *Econ. Change Restruct.* **2011**, *44*, 203–219. [CrossRef]
44. Chow, Y.-F.; Cotsomitis, J.A.; Kwan, A.C.C. Multivariate cointegration and causality tests of Wagner's hypothesis: Evidence from the UK. *Appl. Econ.* **2002**, *34*, 1671–1677. [CrossRef]
45. Chang, T.; Liu, W.; Caudill, S.B. A re-examination of Wagner's law for ten countries based on cointegration and error-correction modelling techniques. *Appl. Financ. Econ.* **2004**, *14*, 577–589. [CrossRef]
46. Narayan, P.K.; Nielsen, I.; Smyth, R. Panel data, cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces. *China Econ. Rev.* **2008**, *19*, 297–307. [CrossRef]
47. Adil, M.H.; Ganaie, A.A.; Kamaiah, B. Wagner's Hypothesis: An Empirical Verification. *IIM Kozhikode Soc. Manag. Rev.* **2017**, *6*, 1–12. [CrossRef]
48. Wahab, M. Economic growth and government expenditure: Evidence from a new test specification. *Appl. Econ.* **2004**, *36*, 2125–2135. [CrossRef]
49. Thanh, S.D.; Canh, N.P. Dynamics between government spending and economic growth in China: An analysis of productivity growth. *J. Chin. Econ. Bus. Stud.* **2019**, *17*, 189–212. [CrossRef]
50. Masoud, N.; Hardaker, G. The impact of financial development on economic growth: Empirical analysis of emerging market countries. *Stud. Econ. Financ.* **2012**, *29*, 148–173. [CrossRef]
51. Hamadi, H.; Bassil, C. Financial Development and Economic Growth in the MENA Region. *Comp. Econ. Stud.* **2015**, *57*, 598–622. [CrossRef]
52. Rahman, M.M.; Salahuddin, M. The determinants of economic growth in Pakistan: Does stock market development play a major role? *Econ. Issues* **2010**, *15*, 69–86.
53. Rafindadi, A.A.; Yusof, Z. Do the dynamics of financial development spur economic growth in Nigeria's contemporal growth struggle? A fact beyond the figures. *Qual. Quant.* **2015**, *49*, 365–384. [CrossRef]
54. Rahman, M.M.; Shahbaz, M.; Farooq, A. Financial development, international trade, and economic growth in Australia: New evidence from multivariate framework analysis. *J. Asia-Pac. Bus.* **2015**, *16*, 21–43. [CrossRef]
55. Valickova, P.; Havranek, T.; Horvath, R. Financial Development and Economic Growth: A Meta-Analysis. *J. Econ. Surv.* **2015**, *29*, 506–526. [CrossRef]

56. Sehrawat, M.; Giri, A.K. The impact of financial development on economic growth: Evidence from SAARC countries. *Int. J. Emerg. Mark.* **2016**, *11*, 569–583. [CrossRef]
57. Jalil, A.; Feridun, M. Impact of financial development on economic growth: Empirical evidence from Pakistan. *J. Asia Pac. Econ.* **2011**, *16*, 71–80. [CrossRef]
58. Komal, R.; Abbas, F. Linking financial development, economic growth and energy consumption in Pakistan. *Renew. Sustain. Energy Rev.* **2015**, *44*, 211–220. [CrossRef]
59. Gokmenoglu, K.K.; Sehnaz, Z.; Taspinar, N. The Export-Led Growth: A Case Study of Costa Rica. *Procedia Econ. Financ.* **2015**, *25*, 471–477. [CrossRef]
60. Mishra, V.; Sharma, S.S.; Smyth, R. Is economic development in the Pacific island countries export led or import led? *Pac. Econ. Bull.* **2010**, *25*, 46–63.
61. Raghutla, C.; Chittedi, K.R. Is there an export- or import-led growth in emerging countries? A case of BRICS countries. *J. Public Aff.* **2020**, *20*, e2074. [CrossRef]
62. Moroke, N.D.; Manoto, M. How applicable is export-led growth and import-led growth hypotheses to South African economy? The VECM and causality approach. *J. Gov. Regul.* **2015**, *4*, 15–24. [CrossRef]
63. Carfora, A.; Pansini, R.V.; Scandurra, G. The causal relationship between energy consumption, energy prices and economic growth in Asian developing countries: A replication. *Energy Strategy Rev.* **2019**, *23*, 81–85. [CrossRef]
64. Shahbaz, M.; Khan, S.; Tahir, M.I. The dynamic links between energy consumption, economic growth, financial development and trade in China: Fresh evidence from multivariate framework analysis. *Energy Econ.* **2013**, *40*, 8–21. [CrossRef]
65. Kumar, R.R.; Stauvermann, P.J.; Patel, A.; Kumar, R.D. Exploring the effects of energy consumption on output per worker: A study of Albania, Bulgaria, Hungary and Romania. *Energy Policy* **2014**, *69*, 575–585. [CrossRef]
66. Le, H.P.; Sarkodie, S.A. Dynamic linkage between renewable and conventional energy use, environmental quality and economic growth: Evidence from Emerging Market and Developing Economies. *Energy Rep.* **2020**, *6*, 965–973. [CrossRef]
67. Munir, Q.; Lean, H.H.; Smyth, R. CO_2 emissions, energy consumption and economic growth in the ASEAN-5 countries: A cross-sectional dependence approach. *Energy Econ.* **2020**, *85*, 104571. [CrossRef]
68. Murshed, M. Can regional trade integration facilitate renewable energy transition to ensure energy sustainability in South Asia? *Energy Rep.* **2021**, *7*, 808–821. [CrossRef]
69. Behera, J.; Mishra, A.K. Renewable and non-renewable energy consumption and economic growth in G7 countries: Evidence from panel autoregressive distributed lag (P-ARDL) model. *Int. Econ. Econ. Policy* **2020**, *17*, 241–258. [CrossRef]
70. Breusch, T.S.; Pagan, A.R. The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *Rev. Econ. Stud.* **1980**, *47*, 239–253. [CrossRef]
71. Pesaran, M.H. A simple panel unit root test in the presence of cross-section dependence. *J. Appl. Econom.* **2007**, *22*, 265–312. [CrossRef]
72. Pesaran, M.H. General diagnostic tests for cross-sectional dependence in panels. *Empir. Econ.* **2021**, *60*, 13–50. [CrossRef]
73. Baltagi, B.H.; Feng, Q.; Kao, C. A Lagrange Multiplier test for cross-sectional dependence in a fixed effects panel data model. *J. Econom.* **2012**, *170*, 164–177. [CrossRef]
74. Nathaniel, S.P.; Bekun, F.V. Electricity consumption, urbanization, and economic growth in Nigeria: New insights from combined cointegration amidst structural breaks. *J. Public Aff.* **2021**, *21*, e2102. [CrossRef]
75. Maddala, G.S.; Wu, S. A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxf. Bull. Econ. Stat.* **1999**, *61*, 631–652. [CrossRef]
76. Choi, I. Unit root tests for panel data. *J. Int. Money Financ.* **2001**, *20*, 249–272. [CrossRef]
77. Im, K.S.; Pesaran, M.H.; Shin, Y. Testing for unit roots in heterogeneous panels. *J. Econom.* **2003**, *115*, 53–74. [CrossRef]
78. Pedroni, P. Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxf. Bull. Econ. Stat.* **1999**, *61*, 653–670. [CrossRef]
79. Pedroni, P. Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the ppp hypothesis. *Econom. Theory* **2004**, *20*, 597–625. [CrossRef]
80. Kao, C. Spurious regression and residual-based tests for cointegration in panel data. *J. Econom.* **1999**, *90*, 1–44. [CrossRef]
81. Westerlund, J. Testing for Error Correction in Panel Data. *Oxf. Bull. Econ. Stat.* **2007**, *69*, 709–748. [CrossRef]
82. Lee, Y.-M.; Wang, K.-M. Dynamic heterogeneous panel analysis of the correlation between stock prices and exchange rates. *Econ. Res. -Ekon. Istraživanja* **2015**, *28*, 749–772. [CrossRef]
83. Dumitrescu, E.-I.; Hurlin, C. Testing for Granger non-causality in heterogeneous panels. *Econ. Model.* **2012**, *29*, 1450–1460. [CrossRef]
84. Bakari, S. The three-way linkages between export, import and economic growth: New evidence from tunisia. *J. Smart Econ. Growth* **2017**, *2*, 13–53.
85. Tahir, M.; Khan, I.; Shah, A.M. Foreign Remittances, Foreign Direct Investment, Foreign Imports and Economic Growth in Pakistan: A Time Series Analysis. *Arab. Econ. Bus. J.* **2015**, *10*, 82–89. [CrossRef]
86. Hye, Q.M.A.; Lau, W.-Y. Trade openness and economic growth: Empirical evidence from India. *J. Bus. Econ. Manag.* **2015**, *16*, 188–205. [CrossRef]
87. Rahman, M.M.; Rana, R.H.; Barua, S. The drivers of economic growth in South Asia: Evidence from a dynamic system GMM approach. *J. Econ. Stud.* **2019**, *46*, 564–577. [CrossRef]

88. Rahman, M.M.; Saidi, K.; Mbarek, M.B. Economic growth in South Asia: The role of CO_2 emissions, population density and trade openness. *Heliyon* **2020**, *6*, E03903. [CrossRef]
89. Ono, S. Financial development and economic growth nexus in Russia. *Russ. J. Econ.* **2017**, *3*, 321–332. [CrossRef]
90. Song, C.-Q.; Chang, C.-P.; Gong, Q. Economic growth, corruption, and financial development: Global evidence. *Econ. Model.* **2021**, *94*, 822–830. [CrossRef]