

A Thesis
on
Evaluating the Impacts of Urban and Rural Electricity Use on GDP in
Three South Asian Countries: Bangladesh, India, and Nepal

This report is submitted to the Department of Accounting, Faculty of Business Studies, Hajee Mohammad Danesh Science and Technology University, Dinajpur for the fulfillment of the degree of Master of Business Administration (MBA) program



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I hereby declare that the concerned report on '*Evaluating the Impacts of Urban and Rural Electricity Use on GDP in Three South Asian Countries: Bangladesh, India, and Nepal*' is a work by Md. Arif Hossain, Student ID-1603054, MBA in Accounting and Information Systems, Department of Accounting, Faculty of Business Studies, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200. He has completed his research program under my supervision and submitted for the fulfillment of the requirement of the degree of Master of Business Administration (MBA) in Accounting and Information Systems at HSTU, Dinajpur.

I wish him every success in life.

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Student's declaration

I hereby declare that the study entitled '*Evaluating the Impacts of Urban and Rural Electricity Use on GDP in Three South Asian Countries: Bangladesh, India, and Nepal*' embodies the result of my own works and efforts, prepared under the supervision of Dr. Shaikh Mostak Ahammad, Professor, Department of Accounting, Hajee Mohammad Dansesh Science and Technology University, Dinajpur.

I further confirm that the effort and material presented in this thesis report are original and have not been submitted to any other university or institution for degree or any other reason.

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Abstract

This study utilizes panel data to evaluate the impacts of urban and rural electricity use on GDP in three South Asian countries: Bangladesh, India, and Nepal. The World Bank Development Indicators data is utilized for the study, which spans the years 1997 to 2020. It uses statistical analysis to interpret the data, using EViews 10 software. This study undertakes a panel unit root test and panel cointegration analysis to investigate the long-run relationship among variables. The results of the study showed that there is a significant positive relationship among urban electricity use, rural electricity use, and GDP growth. Furthermore, panel impulse response functions (IRFs) are used to investigate the short- and long-term relationships as well as the impact of responses among GDP and both urban and rural electricity use. This study also shows that electricity use in urban and rural areas in the countries of Bangladesh, India, and Nepal has a positive impact on economic growth.

Keywords: GDP, Panel cointegration analysis, Urban and rural electricity use.

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CHAPTER 1

Introduction

As electricity is Bangladesh's main source of energy, it is essential to the growth of the country's economy. The expansion of the power industry aims to promote environmental sustainability, assist economic development, and provide energy to the general public. Supporting economic development is essential in developing nations. Electricity use makes a significant contribution to the industrialization and expansion of urbanized economies. The main objective of this analysis is to add something new to the body of knowledge already known about the relationship between Bangladesh's growing electricity consumption and the nation's economy. Also, helpful would-be guidance on how Bangladesh could save energy, improve energy effectiveness, and accomplish long-term economic development.

Components such as household size, population, level of education, cooking habits and lifestyle, access to energy, and cost all play a role in determining a home's overall energy use. Numerous factors, such as tariff, household income, family size, occupation, appliance use, housing structure, location or climate, demographic characteristics, and the intensity of electricity-using device use, may explain why rural and urban areas have such different patterns of energy consumption. In rural regions, people fulfill their energy needs with fuels like wood, charcoal, and kerosene, and they only utilize a limited quantity of electricity for brightness. Modern fossil fuels and electricity are gradually replacing biomass as the primary source of energy in developing countries. The economic level and energy availability of families also influence their choice of energy. At the household level, household fuel choices are significantly influenced by income. Changes in income level result in a shift in power consumption habits. Energy access and use are crucial in the fight against poverty in emerging countries. Income, age, education, gender, access to electricity, and geography all have a role in whether or not a household opts for cleaner fuels for lighting, cooking, and heating. Clean energy usage is more common in urban areas, among higher-income and more-educated households, and less likely among lower-income and less-educated households.

Energy is one of the key variables necessary for the running of any civilized society and the improvement of the country's lifestyle and socioeconomic growth. Around half of the world's population lives in rural areas, where they use biomass as their primary source of energy because they don't have access to other, more efficient options. Almost 70% of total energy consumption in numerous developing Asian countries, including India, Nepal, and Bangladesh,

is accounted for by rural family use. Households, which may be found in both rural and urban areas, as well as among those with lower and higher incomes, are the primary consumers of biomass and commercial energy. Energy in Bangladesh comes from a variety of sources, including commercial and biomass sources. Commercial energy resources in Bangladesh include from hydroelectric power to natural gas to candles to petroleum goods to coal. Diesel, kerosene, furnace oil, and motor spirit are all petroleum products. Biomass materials include but are not limited to trees, bamboo, branch, wood shavings, sawdust, bark, roots, coconut shell and coir, rice husk and bran, straw, jute sticks, charcoal, and cow dung. Unfortunately, Bangladesh does not have many domestic renewable energy options and must rely heavily on fossil fuel imports.

In LDCs, rural energy consumption makes up most of overall national energy consumption. The social and economic implications of an inadequate domestic fuel supply are considerable and growing quickly. Studies conducted in 15 LDCs by the UNDP and the World Bank suggest that residential use accounts for 30-95% of total energy consumption [compared to 25-30% in industrialized nations (DCs)]. In the majority of developing nations, more than fifty percent of the energy utilized by families is for cooking. Hence, any reduction in energy usage during cooking may have a major influence on the overall energy needs of households in these nations. The quantity of carbon dioxide (CO₂) released into the atmosphere by animals, humans, wetlands, volcanoes, and other natural sources is almost equal to the amount removed from the atmosphere by photosynthesis in plants and the oceans. In contra, rising CO₂ emissions from fossil fuel usage are breaking this equilibrium (coal, gas, and petroleum products; and combustion via electricity generation, transportation, industry, and domestic use). Similarly, several forms of biomass fuel contribute to carbon dioxide emissions. Greenhouse consequences, including warming of the Earth, loss of polar ice caps and ice sheets, higher sea levels and subsequent coastal floods, and damage to agricultural and natural ecosystems are all assumed to result from such imbalances. Developing countries like Bangladesh, India, and Nepal are more vulnerable to the harmful effects of CO₂ emissions from human activity, and as a result, it is crucial to study this phenomenon in these places.

The study focuses on the contribution of electricity use in urban and rural areas of three Asian countries to the gross domestic product. This country was selected considering its contribution to the GDP of the economy. This study will help to understand the extent of the relationship between urban and rural electricity use and the gross domestic product.

The purpose of the study is to examine the contribution of rural electricity use and urban electricity use to the gross domestic product. There are several objectives of the study. First, to analyze the integration between rural and urban electricity use and gross domestic product, Second, to investigate the effects of whether positive or negative impact between rural electricity use, urban electricity use, and GDP, Finally, to analyze how differently rural electricity use and urban electricity use affect the gross domestic product in those nations.

CHAPTER 2

Literature review

Rural families in Bangladesh rely on biomass fuels, kerosene, electricity, candles, and LPG (liquefied petroleum gas) as their major energy sources (Asaduzzaman *et al.*, 2010; Miah *et al.*, 2010). Nonetheless, biomass fuels provide for over 60% of Bangladesh's main energy source (LGED & FAO, 2006; MoPEMR, 2008). The population density of the country is quite high. The average yearly growth rate is 1.54 percent, and there are around 990 people living in every square kilometer (BBS, 2010). As the world's population increased from 1990 to 2009, the amount of arable land available per person decreased from 0.07 ha to 0.05 ha (BBS, 2010). Nonetheless, the average annual energy consumption rose from 5.2 GJ in 1977 to 6.2 GJ in 2009. (Kennes *et al.*, 1984; IEA, 2009). The combination of rapid population growth, declining arable land, and rising energy consumption has placed excessive pressure on biomass supplies. Similarly, low levels of economic growth and per capita income are seen as the main challenges to transforming biomass energy into more efficient forms of energy in the near future (Bari *et al.* 1998). Hence, it is likely that the country's energy needs in the near future will be met mostly by biomass resources.

Between rural and urban locales, between lower and higher income groups within a nation, and between international levels, there is a wide range in electricity usage (Pachauri, 2004). Moreover, access to secure, dependable, and economical energy is essential for growth since practically all possible economic activity will need some type of energy service (UNDP, 2000). The larger a country's biomass usage, the poorer it is. Due to a shortage of readily available biomass in many areas, rural residents are forced to put forth extra time and effort to meet their basic fuel needs, further affecting their already shaky financial resources. It has also been shown that no causal connection can be established, such as in India (Omotor, 2008). These conclusions are unquestionably dependent on the time of analysis considered; when this period is extended, changes in data related to economic and political conditions become noticeable. Similar techniques have been used by other authors in a variety of fields (Cicea *et al.*, 2007). Rezitis and Ahammad (2017) evaluated the dynamic link between energy consumption and the three primary sectoral outputs (agriculture, manufacturing, and services) in thirteen South and Southeast Asian nations using a panel data framework from 1971 to 2012. The empirical findings demonstrated that the long-run equilibrium connection between energy consumption and the three sectoral outputs was positive and statistically significant, revealing the presence

of a long-term correlation between the variables.

All of these studies discussed the connection between gross domestic product and electricity use in rural and urban areas. Previous studies have shown that electricity use in rural and urban areas. Several studies have used a panel data technique to investigate these factors in the South Asian country. The present study assessed the relationship among gross domestic product and electricity use in rural and urban areas in the South Asian area. This study used a panel data methodology.

CHAPTER 3

Methodology of the study

3.1. Methodology

This study attempts to examine the correlation between the gross domestic product, urban electricity consumption, and rural electricity consumption in the three nations. First, panel unit root tests (Im et al; Levin et al; and Breitung) were used to determine the stationarity of the variables under evaluation. Pedroni (1999) employs panel co-integration tests to determine the existence of co-integration. Finally, the estimate of long run cointegration parameters is performed using Pedroni's research (1999). Note that the estimations were conducted using the econometric tool Eviews 10.

3.2. Panel unit root analysis

As employing the standard least squares estimator with non-stationary variables results in misleading regressions, panel unit root tests provide vital information about the order of integration of the variables under investigation, making them necessary for empirical evidence. In the last ten years, the panel unit root test has been the most prevalent analytical technique. It is an empirical study used to determine the stationarity of the variables under consideration. To identify the order of variable integration, the current study used four distinct panel unit root tests. The LLC test, established in 2000 by Levin et al., the IPS test, developed in 2003 by Im et al., and the Breitung test, developed in 2002 by Breitung (2000), are the three most common.

3.2.1. Levin-Lin-Chu Test

Different tests for the unit root have limited power. The power of a test is the chance of rejecting the null hypothesis when the null hypothesis is wrong, and unit root is the null hypothesis. Hence, there are too many unit roots. The following assumptions are supported by the results of the Levin-Lin-Chu Test (LLC):

H0: Every time series has a unit root

H1: Every period of time is stationary

Where the lag order p may differ across individuals.

3.2.2. Im, Pesaran and Shin test

The Im-Pesaran- Shin (IPS) test allows for homogeneous coefficients; hence it is less restrictive than the Levin-Lin-Chu test.

3.2.3. Breitung Test

Breitung proposes an alternative set of procedures to Levin-Lin-Chu that use unbiased estimators rather than bias-corrected ones.

3.3. Panel cointegration analysis

This analysis gives a summary of the cointegration tests enabled by EViews version 10. The Pedroni and Kao tests are based on the two-step (residue-based) cointegration tests developed by Engle and Granger (1987). The Fisher test is a Johansen test combined.

The Pedroni panel cointegration test is used to examine the presence of a long-run equilibrium connection between the variables under examination (GDP, urban electricity use, and rural electricity use). In particular, the testing procedure generates a null hypothesis indicating that the series are not cointegrated, i.e., that the residuals from a regression on the variables remain constant. It is the null hypothesis that the series are not cointegrated and do not share a cointegrating vector if the alternative is that they are cointegrated and have a common cointegrating vector. There are seven statistics that Pedroni uses to produce two sets of cointegration tests. Four of these seven statistics (panel cointegration statistics) are based on pooling along the inside dimension, while the other three are based on pooling along the between dimension (group mean panel cointegration statistics). Estimators that take into account the variance in how different units' coefficients are calculated form the basis of panel cointegration statistics. Whereas the unit root tests on the predicted residuals are based on estimators that pool the autoregressive coefficient across multiple units, panel cointegration statistics are based on the group mean. The first set of statistics consists of a parametric augmented Dickey-Fuller t-statistic (the panel ADF-statistic) and three nonparametric modifications (the panel v-statistic, the panel, and the panel PP-statistic) that are comparable to the work of Phillips and Perron. The second set of statistics consists of three different statistics: an updated Dickey-Fuller test statistic (group ADF statistic) and two nonparametric correction-based statistics (group and group PP statistics). Values of the panel v-statistic that are greater than the crucial value are conclusive evidence against the null hypothesis of no

cointegration, whereas values of the other test statistics that are greater than the critical value are conclusive evidence against the null hypothesis.

3.4. Data

The data for this study comes from a database of annual observations spanning from 1997 to 2020. World Bank Development Indicators (<http://data.worldbank.org/indicator>; accessed on January 23, 2023) provided the information for Bangladesh, India, and Nepal. The following countries (i.e., Sri Lanka, Pakistan, Bhutan, Afghanistan, and Maldives) were excluded because they lacked data for all variables (data from 1997 to 2020). The analysis of the variables taken into account ($\ln\text{GDP}$), ($\ln\text{EU}$), and ($\ln\text{ER}$) as natural logarithms.

CHAPTER 4

Analysis and interpretation

4.1. Results of Panel Unit Root

The findings of the panel unit root test are provided in Tables (1) and (2). The null hypothesis of a panel unit root for the variable levels is often not rejected by the results of the majority of panel unit root analyses. The majority of panel unit root findings, on the other hand, reject the null hypothesis of a panel unit root of the first-differences of the variables in favor of the alternative of stationary first differences of the variables. This is due to the fact that the majority of these findings favor the stationary first differences of the variables. Indicating the existence of a potential long-term cointegration interaction between factors such as lnGDP, lnelectricity use urban, and lnelectricity use rural, it may be determined from the panel unit root analysis that the variables are integrated in order one. Thus, the next phase of the empirical analysis is to determine if the variables under consideration are cointegrated.

Table 1: Test results of Panel Unit Root LLC and Breitung

Variables in levels	LLC test			Breitung test
	None	Constant and Trend	Constant	Constant and trend
lnGDP	4.59978 (1.00)	0.20667 (0.58)	0.09690 (0.53)	2.07579 (0.98)
lnUR	3.46351 (0.99)	-1.07920 (0.14)	-1.03323 (0.15)	-1.50756 (0.06)
lnRU	4.21468 (1.00)	-0.91164 (0.18)	-2.30104 (0.01)	1.16196 (0.12)
Variables in 1 st differences				
lnGDP	-2.18934 (0.01)	-2.73010 (0.00)	-2.31602 (0.01)	-0.67779 (0.24)
lnUR	-7.29029 (0.00)	-6.12422 (0.00)	-7.35343 (0.00)	-3.35677 (0.00)
lnRU	-5.97423 (0.00)	-6.71794 (0.00)	-6.23462 (0.00)	3.89673 (0.00)

Note: P- value numbers are in parentheses.

Table 2: Test results of the IPS and Panel Unit Root ADF

Variables in levels	ADF test			IPS test	
	None	Constant and trend	Constant	Constant and trend	Constant
ln GDP	0.01903 (1.00)	2.37635 (0.88)	1.49427 (0.95)	1.19053 (0.88)	2.20817 (0.98)
ln UR	0.06481 (1.00)	16.2923 (0.01)	2.45630 (0.87)	-1.33787 (0.09)	0.96023 (0.83)
ln RU	0.02558 (1.00)	11.8473 (0.06)	7.36718 (0.28)	-1.29501 (0.09)	0.06481 (1.00)
Variables in 1 st differences					
ln GDP	11.2191 (0.08)	10.0393 (0.12)	15.4489 (0.01)	-1.30827 (0.09)	-2.26707 (0.01)
ln UR	49.4976 (0.00)	45.7459 (0.00)	56.3847 (0.00)	-7.21349 (0.00)	-8.01270 (0.00)
ln RU	39.3412 (0.00)	50.2082 (0.00)	49.5096 (0.00)	7.92892 (0.00)	-7.16511 (0.00)

Note: P- value Numbers are in parentheses.

4.2. Panel cointegration result

The results of the panel cointegration test shown in Table (3) were determined by including the intercept. Prior to running the cointegration test, the addition of the intercept converts the original data series to deviations from time period means. The cointegration test results are consistent with the existence of a long-run cointegrating relation between GDP, electricity urban use, and electricity rural use, as eight of the eleven test statistics reject the null hypothesis that there is no cointegration between the three variables at the conventional level of significance. This suggests that the variables move together over the long term.

Table 3: Panel cointegration test

Intercept					Intercept and Trend			
	Statistic	P-Value	Weighted statistic	P-Value	Statistic	P-Value	Weighted statistic	P-Value
Panel v-Statistic	0.126347	0.44	0.247134	0.40	-0.896973	0.81	-0.840883	0.79
Panel rho-Statistic	-3.614291	0.00	-3.081271	0.00	-2.439358	0.00	-2.355879	0.00
Panel PP-Statistic	-4.673059	0.00	-5.227740	0.00	-5.420479	0.00	-7.511465	0.00
Panel ADF-Statistic	-1.203516	0.11	-2.203806	0.01	-2.048757	0.02	-3.785026	0.00
Group rho-Statistic	-2.262983	0.01			-1.604493	0.05		
Group pp-Statistic	-8.353389	0.00			-12.8735	0.00		
Group ADF-Statistic	-2.708902	0.00			-4.045651	0.00		

4.3. Kao Residual Cointegration Result

The Kao co-integration test is used to determine if there is a long-term relationship between non-stationary time series variables. It is calculated using the Augmented Dickey-Fuller (ADF) test, which checks if a time series is stationary or not. In this case, the ADF test statistic for $\ln GDP$, $\ln EU$ and $\ln ER$ is -1.65, with a corresponding probability value of 0.04 (Table 4). This suggests that there may be a long-term relationship among these variables.

Table 4: Kao Residual Cointegration Test

Variables	ADF	
	t-Statistic	P- value
	-1.653520	0.04

4.4. Johansen Fisher Cointegration Result

Lastly, the Johansen Fisher trace and maximum eigenvalue co-integration tests show that there is a long-term panel cointegration relationship between the GDP, urban electricity use, and rural electricity use, rejecting the null hypothesis that there is no cointegration among the variables (Table 5). This finding suggests that over time, electricity use may have an impact on GDP. One Cointegration relation seems to exist in practically all countries, according to individual cross-section analyses.

Table 5: Johansen Fisher Cointegration Test

Hypothesized No. of CE	Fisher Stat.	P-value	Fisher Stat.	P-value
None*	28.50	0.00	34.49	0.00
At most 1	2.506	0.86	2.357	0.88
At most 2	5.513	0.47	5.513	0.47

4.5. Fully Modified Ordinary Least Square and Dynamic Ordinary Least Square

The anticipated cointegration vector parameters for the whole panel, which includes all three south Asian nations, are shown in Table 6. Panel coefficient is statistically significant for FMOLS and DOLS, but DOLS lnER is insignificant. A 1% increase in urban electricity use is expected to raise GDP by FMOLS 6.70% and DOLS 6.78%, whereas a 1% increase in rural electricity use is estimated to increase GDP by FMOLS 0.48% and DOLS 0.48%. The model is validated by the test's coefficient statistics (FMOLS R-squared, Adjusted R-squared 0.98, 0.97, and DOLS R-squared, Adjusted R-squared 0.98, 0.97).

The anticipated cointegration vector parameters for the Bangladesh panel, which includes the south Asian nations, are shown in Table 6. The panel coefficient is statistically significant for FMOLS and DOLS. A 1% increase in urban electricity use is expected to raise GDP by FMOLS 5.83% and DOLS 4.57%, whereas a 1% increase in rural electricity use is estimated to increase GDP by FMOLS 0.32% and DOLS 0.60%. The model is validated by the test's coefficient statistics (FMOLS R-squared, Adjusted R-squared 0.93, 0.92, and DOLS R-squared, Adjusted R-squared 0.98, 0.97).

The anticipated cointegration vector parameters for the India panel, which includes the south Asian nations, are shown in Table 6. Each panel coefficient is statistically significant for FMOLS and DOLS. A 1% increase in urban electricity use is expected to raise GDP by FMOLS 32.34% and DOLS 32.34%, whereas a 1% increase in rural electricity use is estimated to decrease GDP by FMOLS -2.63% and DOLS -2.63%. The model is validated by the test's coefficient statistics (FMOLS R-squared, Adjusted R-squared 0.93, 0.92, and DOLS R-squared, Adjusted R-squared 0.98, 0.97).

The anticipated cointegration vector parameters for the India panel, which includes the south Asian nations, are shown in Table 6. Each panel coefficient is statistically significant for FMOLS and DOLS. A 1% increase in urban electricity use is expected to raise GDP by FMOLS 32.34% and DOLS 32.34%, whereas a 1% increase in rural electricity use is estimated to decrease GDP by FMOLS -2.63% and DOLS -2.63%. The model is validated by the test's coefficient statistics (FMOLS R-squared, Adjusted R-squared 0.93, 0.92, and DOLS R-squared, Adjusted R-squared 0.98, 0.97).

The anticipated cointegration vector parameters for the Nepal panel, which includes the south Asian nations, are shown in Table 6. Panel coefficient is statistically significant for FMOLS $\ln EU$ and DOLS $\ln EU$, but FMOLS $\ln ER$ and $\ln ER$ are not significant. A 1% increase in urban electricity use is expected to raise GDP by FMOLS 9.06% and DOLS 8.73%, whereas a 1% increase in rural electricity use is estimated to increase GDP by FMOLS 0.32% and DOLS 0.27%. The model is validated by the test's coefficient statistics (FMOLS R-squared, Adjusted R-squared 0.91, 0.91, and DOLS R-squared, Adjusted R-squared 0.97, 0.95).

Table 6: Panel cointegration coefficients of three South Asian contries

Country	Variables and value	Panel FMOLS		Panel DOLS	
		Coefficient	P- Value	Coefficient	P- Value
lnGDP (full panel)	lnEU	6.707499	0.00	6.787115	0.00
	lnER	0.485939	0.01	0.488473	0.13
	R-squared	0.991210		0.991210	
	Adjusted R-squared	0.986376		0.986376	
lnGDP (Bangladesh)	lnEU	5.835160	0.00	4.572699	0.00
	lnER	0.324832	0.09	0.609816	0.00
	R-squared	0.931870		0.987966	
	Adjusted R-squared	0.925057		0.979943	
lnGDP (India)	lnEU	32.34156	0.00	32.34156	0.00
	lnER	-2.630348	0.03	-2.630348	0.03
	R-squared	0.985713		0.985713	
	Adjusted R-squared	0.976189		0.976189	
lnGDP (Nepal)	lnEU	9.067824	0.00	8.732097	0.05
	lnER	0.323088	0.19	0.277742	0.43
	R-squared	0.919718		0.971029	
	Adjusted R-squared	0.911690		0.951714	

4.6. Panel Multivariate Impulse Response Functions (IRFs)

The real gross domestic product, electricity urban consumption, and electricity rural use are the three variables that are shocked to construct the panel impulse response functions (IRFs).

The top row of Figure 1 exhibits the rapid responses of elements to a shock of one unit in GDP. On the graph, study can observe that a country's urban power consumption increases as GDP rises, whereas rural electricity consumption decreases. This graph also shows that although urban areas have the highest GDP and power consumption, rural areas have the most growth in electricity consumption. Rural electricity consumption will need around four periods to restore to its long-term equilibrium level.

The second row of Figure 1 shows the variables' rapid responses to a one-unit shock in urban power consumption. A decrease in GDP may be seen when urban electricity usage increases by one unit, as seen in the graph. This is firstly positively upward and then negatively downward. The responses of electricity use urban and electricity use rural are positive relationship. Electricity use in urban is highly upward from one to three years and slightly downward from three to ten years positively, for all the countries. Electricity use rural is also positive relation but it is upward and downward continue.

Figure 1's third row represents the impulsive reactions of the components to a one-unit shock in rural electricity usage. This graph illustrates that a one-unit increase in rural electricity use has an upward effect on the GDP. Initially, there is a negative association between urban electricity use and its following upward trend. It takes around three periods for urban power consumption to restore to its long-term equilibrium level. The rural power usage response has a strong upward and a slight downward but positive effect.

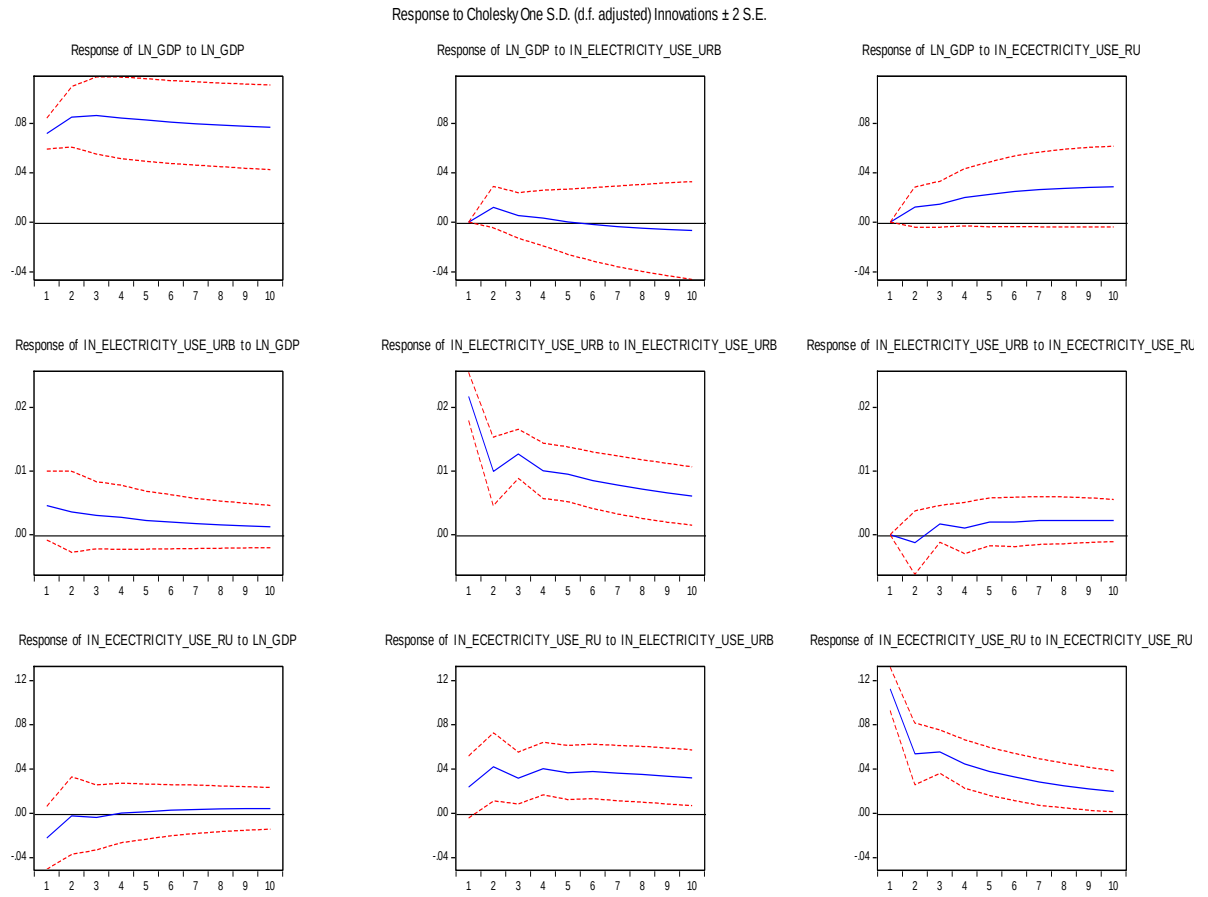


Figure 1: IRFs panel comparison of three south Asian nations

CHAPTER 5

Findings and Suggestions

5.1. Findings

Using the unit root test and showing that all the variables are integrated, the first difference suggests that all the variables are stationary. The panel cointegration study illustrates the long-term equilibrium association between GDP, urban, and rural electricity consumption. The Dynamic Ordinary Least Square (DOLS) and Fully Modified Ordinary Least Square (FMOLS) estimations of individual nations reveal that the impact of urban and rural electricity usage on GDP is positive and statistically significant in about three out of three nations. FMOLS and DOLS estimations of Bangladesh and Nepal reveal the impact of urban and rural electricity usage on GDP is positive. FMOLS and DOLS estimations of India reveal the impact of urban electricity usage on GDP is positive, but the impact of rural electricity usage on GDP is negative. A one-unit change in gross domestic product has a favorable effect on urban electricity consumption but a negative effect on rural electricity consumption. A one-unit change in urban power use has a negative outcome on the GDP. A one-unit increase in rural electricity consumption has an upward curve on the GDP. Urban and rural electricity consumption has an effect on a number of economic activities because it has an impact on the efforts that a nation makes to achieve sustainable economic growth and to enhance the overall quality of life.

5.2. Suggestions

While the existence of a long-term relationship among GDP and urban and rural electricity consumption is confirmed, it would be interesting to investigate the direction of causality among these variables. This can help policymakers identify the most effective policies for attracting and retaining GDP. Electricity production needs to be accelerated in order to achieve GDP growth in the future, and policymakers should be focused on attaining the goals. A one-unit shock to the GDP may have good effects on urban electricity consumption but negative effects on rural electricity use, suggesting that policies targeted at improving the gross domestic product may have unexpected implications for rural electricity usage. It is possible that a one-unit shock in urban electricity usage has a negative impact on the gross domestic product and that initiatives aimed at improving urban electricity use may have a beneficial effect on the GDP. The thesis paper should be extended by exploring the factor driven to higher electricity consumption (such as the number of electricity appliances, climatic conditions, and foreign direct investment, as suggested by other researchers) and the casual relationship between electricity and other macroeconomic variables.

CHAPTER 6

Conclusions, policy implications and future work

6.1. Conclusions

Using a panel data methodology, this study investigates the connection between gross domestic product and the two key sectoral outputs, urban electricity usage and rural electricity use, in three nations. The effect of shocks on GDP and the two discussed sectoral outputs is analyzed using panel cointegration analysis, and panel IRFs are used to assess the dynamic connection and the direction of short-run and long-run relationships. Evidence of long-term co-movement among the variables is provided by the panel cointegration analysis, which shows that there is a positive and statistically significant correlation between GDP and electricity consumption in rural areas and urban areas at long-run equilibrium.

The panel's long-run outcomes provide evidence that the causal relationship between the gross domestic product and the two sectoral electricity uses (urban and rural) is bidirectional, supporting the feedback hypothesis and indicating that the gross domestic product and electricity use in the rural sector are correlated and could very well serve as complements to one another. The Kao cointegration study suggests that the GDP might have a long-term effect on both electricity usage variables. Individual cross-section data indicate that a cointegration relationship exists in almost all nations, but with a constrained constant.

According to the panel's multivariate impulse response functions, (1) a one-unit shock to the GDP has a negative effect on urban electricity usage but a positive effect on rural electricity use. (2) A one-unit shock to urban electricity consumption has a positive impact on gross domestic product and rural electricity consumption. (3) A one-unit shock in rural electricity has a positive impact on urban electricity but a negative impact on the gross domestic product over the first eight periods.

6.2. Policy Implications

The empirical results from this study may help policymakers recognize the association between the gross domestic product, the two sectors, and the three nations. The dynamic interaction between the gross domestic product and two sector outputs in the existing study indicates that the GDP has a significant effect on the two sectoral outputs. This suggests that a constant increase in gross domestic product may contribute to a continuous increase in electricity use urban and electricity use rural sector outputs, while a continuous decrease in gross domestic product may hamper the growth of these outputs. Nevertheless, the high gross domestic product may have long-term environmental effects. In order to prevent a severe impact on the economic growth of the three nations, it is necessary to avoid negative shocks. The regulators may design good short- and long-term strategies to conserve GDP, taking sector-specific GDP interrelations and possible long-term environmental effects into mind.

6.3. Future work

This study covers only six months to collect data, analyze it, and prepare the report. But it is not enough to analyze the exact result or output of evaluating the affection of gross domestic product; electricity has urban and rural effects on the economy. More information and enough time may be needed to get a clear or exact result or condition. Anyone may choose the topic for further research. The panel VECM, ARDL, and GARCH models can be utilized to find the approach of short-run and long-run relationships, and panel IRFs can be utilized to examine the effect of shocks among variables (e.g., GDP, electricity uses in urban and rural areas). These models can better accommodate the influence of extraneous variables, such as a changing economy or other facts.

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