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Article

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International Journal of Energy Economics and Policy

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Usman, Muhammad/Rasheed, Kiran et. al. (2023). Impact of financial development and economic growth on energy consumption in developing countries of Asia. In: International Journal of Energy Economics and Policy 13 (3), S. 512 - 523. https://www.econjournals.com/index.php/ijeep/article/download/14233/7332/33322. doi:10.32479/ijeep.14233.

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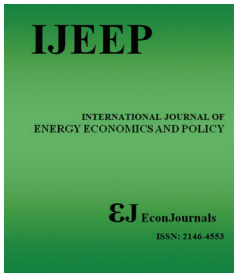

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2023, 13(3), 512-523.

Impact of Financial Development and Economic Growth on Energy Consumption in Developing Countries of Asia

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Received: 20 January 2023 **Accepted:** 05 May 2023 **DOI:** https://doi.org/10.32479/ijeep.14233

ABSTRACT

This study investigates the impact of financial development and economic growth on energy consumption by controlling variables such as urbanization and globalization in developing countries of Asia for the era of 1991-2019. Data related to financial development, economic growth, energy consumption and urbanization is collected from World Development Indicator and data related to globalization is collected from Konjunkturforschungsstelle (KOF) index of globalization. In this research Dynamic seemingly unrelated regression model is applied to test the hypothesis. According to the outcomes of Dynamic seemingly unrelated regression model (DSUR) the impact of financial development on energy consumption is positively substantial as increase of 1 unit in financial development brings 3.07% rise in energy consumption, the effect of GDP on energy consumption is positively influential as increase of 1 unit in GDP brings 0.29% increase in energy consumption and the influence of globalization is unfavorable but substantial as increase of 1 unit in globalization brings decrease of 15.57% in energy consumption. Moreover, the influence of urbanization on energy consumption is positive and considerable, as increase of 1 unit in urbanization brings 11.54% increase in energy consumption. Moreover, there is two way connections among GDP and financial development. Moreover, Asian countries should adopt energy conservation policies.

Keywords: Financial Development, Energy Consumption, Dynamic Seemingly Unrelated Regression Model, Gross Domestic Products
JEL Classifications: F43, Q40, R11, O47, O53

1. INTRODUCTION

Energy plays a significant role in growth as well as development of the economy. It is considered fuel for the growth and development of both industry and economy. For the business and social advancement of the country, energy is fundamentally same as other elements of manufacturing. In the past few years, there is rapid growth in Asia. From 1985-2009 there has been a growing trend in the GDP of South and East Asian countries (Perera and Lee, 2013). Energy consumption is reported higher in South and East Asia because energy resources are not utilized carefully. As described by the World Bank, GDP and energy consumption are increasing (Srivastava and Misra, 2007). There are many studies on the association of consumption of energy with different exogenous variables such as financial development and economic growth. Recently, a group of researchers document that the social and economic development of the country depends on energy (Sahir and Qureshi, 2007).

Financial development is described as the advancement in all the activities of the financial sectors such as an increase in activities of the banking sector, stock or bond market (Pradhan et al., 2018). Financial development enhances the growth in the economy by raising FDI and encouraging stock exchanges and banking activities (Kumar et al., 2016; Shahbaz et al., 2013). Similarly through development in financial sector, investment resources are available easily that promotes the industrial sector (Farhani and Solarin, 2017). Even in countries that have fewer financial resources, efficient financial system management brings efficient use of financial resources. It also increases economic development (Furuoka, 2015).

Financial sector enhancement increases energy utilization through different channels such as level and efficiency effects. According to the level effect, financial sectors enable unused resources from non-profitable investments to remunerative investments by appealing home and overseas investments. According to the efficiency effect, financial sectors provide financial capital for effective investments, thus the demand for energy increased due to an increase in effective investment (Sadorsky, 2010).

Similarly, economic growth is affecting the energy's consumption. Growth in the economy is the sign of the growth of the country. It means that the productive capacity of the country is increasing. In the past, numerous studies found out the economic growth's effect on energy consumption. Narayan and Smyth (2005) examined that because of growth in real GDP, electricity utilization is also increasing. With the advancement in Asian countries, industrial and commercial sectors are growing so electricity is used as a basic source of energy for the expansion of these sectors. So, growth in GDP is increasing the need for energy.

Likewise, energy consumption is affecting the economic growth. Numbers of studies have been performed to find out the cause and effect relationship among economic growth and energy consumption. (Akinlo, 2008; Zachariadis and Pashourtidou, 2007; Hondroyiannis et al., 2002; Halicioglu, 2007; Yoo and Kim, 2006; Ghosh, 2002; Ciarreta and Zarraga, 2010; Altinay and Karagol, 2005; Yoo, 2005).

Moreover, urbanization and globalization are used as control variables in this study. Concerning the urbanization stage, people are more likely to use electronic products which in turn positively affect energy consumption (Baloch, 2018). Urbanization has different essentials that are affecting energy consumption in different ways, such as; man-made environment, expansion in industrial and economic activities, infrastructural changes, and increased transportation activities (Poumanyvong et al., 2012; Madlener and Sunak, 2011). Promotion in the urban lifestyle is affecting energy consumption because people use more energy-intensive products due to enhancement in economic and social activities (Sadorsky, 2014).

Similarly, globalization is also influencing energy consumption. Globalization may have a direct and inverse impact on energy consumption. Because of removing barriers to trade between different countries and investment restrictions, economic growth is increased. By using advanced technology, overseas firms can establish a new business or develop the current business, and energy consumption can be reduced due to advanced technology. On the contrary, energy consumption may increase due to globalization because the goal of foreign firms is to maximize the profit not to conserve the energy.

This study will make some imperative contribution to literature by examining the impact of financial development and economic growth on energy consumption.

2. LITERATURE REVIEW

There are different researches on the FD and EC association. Komal and Abbas (2015) examine the favorable and substantial effect of development of financial sector by using channel of economic growth. Outcomes of this research show that increase of 1% in FD brings 0.024 % rise in EC. In Saudi Arabia Mahalik et al. (2017) exposed the association between financial sector advancement and energy consumption for the era 1971–2011. Their results show that there is one way causation between FD and EC. Similarly in Nigeria Odusanya et al. (2016) analyzed the relation between FD and EC for the era of (1971-2004). According to their results there is positive and significant association concerning these variables. In addition, Komal and Abbas (2015) found the association of FD and EC in Pakistan by using urbanization and energy price as control variables. According to their results development in financial sector has favorable and vital impact on consumption of energy.

Furthermore, when financial sector is developed then producers take loan at low cost and purchase advanced technology which consumes less energy (Shahbaz et al., 2017). Hence, Mielnik and Goldemberg (2002) established negative connection among FDI and energy's consumption. Imamoglu (2019) Suggests that there is direct and definitive impact of financial advancement, trading and economic growth on energy consumption, both in developed and emerging countries.

Shahbaz and Lean (2012) analyze the correlation concerning financial development and energy consumption in Tunisia. According to their findings there is direct association among financial sector's advancement and energy consumption because effect of development of stock market on energy consumption is positive.

Similarly, Granger cause and effect method was used by Dan and Lijun (2009) for testing the connection among energy consumption and development of financial sector in. Similarly, Ang (2009) expressed that DCP is an important indicator of financial development because private sector is able to use their funds in a good manner in comparison with public sector. To incorporate the overall credit expansion as the proxy of financial development, overall credit given by sector of banking as well as broad money supply was included. An increase in money supply increases financial depth (Gelb, 1989). They found the result that FD does not raise the consumption of energy.

Xu et al. (2012) examines the link among financial sector advancement and energy consumption throughout the period of 1999-2009 by using panel data set in Chinese provinces by applying generalized method of momentum. Results demonstrate that there is favorable and significant relationship between the variables. Financial development affects consumption of energy through economic growth (Bojanic, 2012; Calderón and Liu, 2003; Hassan et al., 2011).

FD reduces the EC by attaining effectiveness in its use. As financial development provides access to the financial capital by minimizing the risk of financing and reducing the cost of borrowing. Thus, financial development in many ways affects energy demand. For example, consumers get cheaper loan from the banks and purchase energy efficient products which minimize the use of energy. On

the other hand, if they buy high price items such as houses, air conditioners, automobiles and washing machines. Than high amount of energy is consumed by these items which can influence the overall energy demand of the country (Karanfil, 2009).

Another research was conducted on EU for examining the impact of FD on EC. According to the results there is strong and substantial effect of FD on EC for the old member countries which is consistent with financial development–energy literature (Çoban and Topcu, 2013).

There is cointegrating association between economic growth, energy consumption, revenues of oil and financial development in Iran by using Autoregressive–Distributed Lag bound test (Safaynikou and Shadmehri, 2014). There is long term connection between economic growth, energy consumption, trade and financial development in countries of South Asia such as Pakistan, Sri Lanka, Nepal and Bangladesh as well as there is no association among these variables in short period of time (Siddique and Majeed, 2015).

The literature leads to the development of following hypothesis:

H1: Financial development has significant impact on energy consumption.

Various researches have been done on the association of EG and EC. According to some researchers there are different elements that influence energy consumption such as economic progress and macro-variables. So many studies in past apply these variables to find the impact of EG on energy utilization. For example, method of granger causation was used to check out the effect of economic growth on energy consumption on the data of India. According to the results EG is the cause of EC (Chiou-Wei et al., 2008).

Similarly, Wolde-Rufael (2009) evaluates the correlation between economic growth and energy consumption. This study was conducted on seventeen African countries. According to the results economic progression is the reason of energy depletion which is in the support of growth leads to energy consumption hypothesis.

Ghali and El-Sakka (2004) examined the causative association among energy consumption and economic growth in Canada by using the model of VEC after applying multivariate cointegration among growth rate, labour, capital and energy consumption. The results suggest that there is reciprocal cause and effect connection among energy consumption and economic growth.

There is considerable connection among EG and EC (Erdal et al., 2008; Hossain and Saeki, 2011; Imran and Siddiqui, 2010; Zaman et al., 2011). Similarly, another research was conducted in Indonesia, Pakistan, India, Philippines, and Singapore for evaluating the association among EG and EC. According to the findings of the study there is cointegration among these variables in India, Pakistan and Indonesia, but there is no association takes place among these variables in Malaysia, Singapore and Philippines (Masih and Masih, 1996).

The similar research correspondingly established causal movement from EC to EG in India because the nation is depending on energy as well as causality running from EG to EC in Pakistan and Indonesia which is consistent with the growth leads to energy hypothesis. Moreover in India and Indonesia causation running from EC to income and reciprocal causation in Thailand and Philippines (Asafu-Adjaye, 2000). Two directional causation in Argentina, in Italy and Korea it is from EG to EC in Turkey, France, Germany and Japan the causation running from EC to EG (Soytas and Sari, 2003). As well as there is link among energy use and GDP in Turkey and one directional cause and effect relationship runs from GDP to energy consumption which indicates that country is less reliant on energy (Lise and Van Montfort, 2007). There is one directional causation from economic growth to energy consumption in six Gulf cooperation council countries (Al-Iriani, 2006). There is one directional cause and effect association running from EG to EC (Kraft and Kraft, 1978).

Similarly another research have been done in low paying, middle paying and high paying countries but findings suggest there is no cause and effect connection among EC and EG in low income countries but find out that economy's growth affects the energy's consumption in middle and high income (Huang et al., 2008). Results are consistent with neutrality hypothesis for low income countries.

Moreover, cause and effect association between GDP and energy consumption was observed by Mozumder and Marathe (2007) in Bangladesh. According to their findings, there is substantial effect of energy on growth of economy. Also causal connection among EG, EC and effluence of environment was examined by Chebbi and Boujelbene (2008) in Tunisia. According to empirical results, there is longitudinal relationship among energy consumption, performance of growth and contamination of environment for the period of 1971-2004. In addition, findings disclosed that there is short term mono directional cause and effect relationship among EC and EG in Tunisia.

For the era of 1971-2004, Loganathan and Subramaniam (2010) also examined the viable affiliation among energy consumption and economic growth in Malaysia. ARDL and ECM was used in this study. According to auto-regressive distributed lag, there is long run association among EC and EG. According to result of ECM there exists reciprocal causality between EG and EC.

In Eurasian and European countries, Tiwari (2011) observed the impact of EC on EG. Consumption of hydroelectricity was used as alternative of the sources of reusable energy as well as consumption of coal was used as a substitution of sources of non-renewable energy for the time period of 1965 to 2009. Panel Vector Autoregressive technique was used in analyzing the influence of energy consumption on economic growth. According to the result there is negative influence of the resources of non–renewable energy on gross domestic product, while there is positive impact of renewable resources of energy on gross domestic product.

Moreover, another study was conducted in Iran to check the granger cause and effect relationship among consumption of

energy such as electricity, gas and petroleum for the period of 1967-2003. This relationship was observed in manufacturing area. According to the results there is longitudinal mono directional cause and effect association from GDP to energy and there is two directional relationship of cause and effect among gross domestic product and gas as well as the relationship among economic growth and depletion of petrol for entire economy (Zamani, 2007). The findings show that in short-run there is no impact of energy consumption on economic growth but in long - run it will slow down the growth.

In Romania, Spain and European countries a study have been done for investigating the association of energy consumption, renewable energy, gas, oil and coal with growth of economy for the era of 1990-2010. According to the results, in Romania there is mono directional link from reusable energy consumption to economic growth and in Spain from consumption of gas to economic growth. But there is no cause and effect association among these variables in European countries (Pirlogea and Cicea, 2012).

Further, another study was conducted in South Africa for analyzing the association among disaggregates energy consumption and productivity of industry for the era of 1980-2005. According to the results there is two directional cause and effect relationship among consumption of oil and output of industry (Ziramba, 2009). The findings of this result are consistent with neutrality hypothesis.

Toda-Yamamoto long term cause and effect tests were used in US for examining the causative link between consumption of coal and real GDP for the period of 1949-2006. According to these tests there is cause and effect relationship among consumption of coal and real economic growth; mono directional cause and effect relationship from real economic growth to consumption of gas. This relationship is consistent with conservation hypothesis; and one directional cause and effect relationship from consumption of petrol to real economic growth is consistent with the growth hypothesis (Aperjis and Payne, 2011).

Growth hypothesis suggests, energy is imperative for growth of economy and proposes that EG is influenced by EC. Energy is essential same like other factors of production. Squalli (2007) examines the association between EG and EC. Findings show that there is unfavorable link related to EC and EG.

Moreover the research was conducted in Barbados for checking the longitudinal link among output growth and use of electricity and also the causal association between them. By using model of neo classical production they established the two directional causation among these variables in the long run but causation runs from energy consumption to output in short run (Lorde et al., 2010).

The literature thus leads to development of following hypothesis:
H2: There is significant effect of economic growth on energy consumption.
H3: There is significant effect of energy consumption on economic growth.

3. RESEARCH METHODOLOGY

We will use the annual data of the developing countries of Asia from 1991 to 2019 which are stated in the Table 1.

In this study we will use different variables to know the impact of FD and EG on EC, such as FD, EG, EC as well as we will include control variables which are urbanization and globalization (Table 2).

Financial development index includes different indices such as financial institutions and financial markets in terms of their access, depth and efficiency. Stock and bond markets are including in financial markets. Banks, insurance companies, pension funds and mutual funds are included in financial institutions. Combination of depth, access and efficiency is called financial development. Moreover, depth is defined as a liquidity of markets and size, access is defined as aptitude of corporations and customers to attain financial services and efficiency means to provide financial facilities at minimum cost and with maintainable profit.

Also we will use GDP per capita for the indication of EG, we will use GDP per capita for EC, energy use (kg of oil equivalent per capita), Urban population (% of total population) is used for urban population and KOF index of globalization is used as an indicator of globalization. Globalization with the economic, social and political dimensions are measured by KOF index.

Data of financial development will be collected from financial development index, Data of GDP (per capita), energy consumption, urbanization will be retrieved from World Development Indicator (WDI). As well as KOF Index of globalization will be used for data regarding globalization.

For empirical analysis DSUR model will be used for this study. Arnold Zellner in (1962) proposed the Dynamic seemingly

Table 1: List of developing countries (sample size)

Pakistan	Lebanon	Korea republic	Kyrgyzstan
India	UAE	Samoa	Mongolia
China	Cambodia	Kiribati	Malaysia
Armenia	Kazakhstan	Jordan	Saudi Arabia
Azerbaijan	Syrian Arab Republic	Myanmar	Tajikistan
Philippines	Sri Lanka	Nepal	Turkmenistan
Bangladesh	Indonesia	Thailand	Uzbekistan
Yemen	Vietnam		

Table 2: Variables measurement and data source

Variables	Symbol	Measurement	Source
Energy consumption	EC	kg of oil equivalent per capita	WDI
Financial development	FD	Financial development index	WDI
Economic growth	GDP	GDP per capita	WDI
Urbanization	URB	Percentage age of total population	WDI
Globalization	GLOB	Globalization index	KOF

EC: Energy consumption, FD: Financial development, GDP: Gross domestic product, URB: Urbanization, GLOB: Globalization, WDI: World development indicator, KOF: Konjunkturforschungsstelle

unrelated regressions (DSUR). DSUR is simplification of linear regression model. There are more than one regression equations. Each regression equation has its endogenous and exogeneous variables as every equation is separately predicted. Effect of FD and EG on EC will be examined through DSUR model.

3.1. Effect of Financial Development and Economic Growth on Energy Consumption

$$EC_{it} = \alpha_0 + \beta_1 FD_{it} + \beta_2 GDP_{it} + \beta_3 URB_{it} + \beta_4 GLOB_{it} + \varepsilon$$

Where,
FD = Financial development
EC = Energy consumption
GDP = Gross domestic product (per capita)
URB = Urbanization
GLOB = Globalization
ε = Error term.

3.1.1. Cross-sectional dependence test

CSD is an imperative diagnostic that should be examined by researchers before execution of a panel data analysis. This problem arises when we include the countries in our study which are interrelated. We will check the CSD of each variable included in this study.

3.1.2. Unit root test

Unit root tests are used for checking the stationarity of the data. ADF test is used in this study for checking the stationarity of panel data set.

3.1.3. Panel cointegration test

Cointegration tests are used to check the relationship among variables of given panel data set such as Engle-Granger, Johansen Test, Phillips-Ouliaris test. In this study we will use the Engle-Granger test of cointegration. The test which is used very extensively is Pedroni Engle-Granger cointegration test for panel data regression analysis, because it takes care of cross-sectional dependence, especially where the countries have the same outlook (either economical, socially, political etc) by allowing considerable heterogeneity.

3.1.4. DSUR (dynamic seemingly unrelated regression)

Arnold Zellner in (1962) proposed the seemingly unrelated regressions (DSUR). DSUR is simplification of linear regression model. There are more than one regression equations. Each regression equation has its endogenous and exogeneous variables as every equation is separately predicted.

3.1.5. Pairwise dumitrescu hurlin panel causality tests

Dumitrescu and Hurlin (2012) introduced the pairwise Dumitrescu Hurlin Panel Causality test. Among cross sections, this test permits the coefficients to be heterogeneous. Two statistics are used in this technique such as Wbar-statistic and Zbar-statictic. Average of test statistics is used in Wbar-statistic and Zbar-statictic demonstrates normal distribution.

3.1.6. Country wide dynamic ordinary least square model

For the valuation of longitudinal analysis of particular country, the dynamic ordinary least square is used in this study.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

In these results of Table 3, the mean value of dependent variable (energy consumption) is 1528.753. It means that on average countries consume 1528.753 energy (kg of oil equivalent per capita). The minimum energy that countries consume is 86.65042 (kg of oil equivalent per capita) as well as the maximum energy consumption is 12172.42 (kg of oil equivalent per capita). The value of skewness of energy consumption is 2.758885 which shows that distribution is skewed positively as well the probability value is 0.000 which is significant because the value of probability is 0.000 < 0.05. The mean value of financial development is 24%. It describes that on average financial development is 24%. The maximum financial development is 70% and minimum financial development is 0%. The value of skewness of financial development is 78% which means that distribution is skewed moderately as well the probability value is 0.000 which is significant because the value of probability is 0.000 < 0.05. The mean value of GDP is 3702.320 US.$. It shows that on average growth rate is 3702.320 US.$. The maximum growth rate in countries is 44498.93 US.$. and minimum growth rate is 137.1683 US.$. The value of skewness of GDP is 3.480199 which means that distribution is skewed positively as well the probability value is 0.000 which is significant because the value of probability is 0.000 < 0.05. The mean value of globalization is 50.81425. The maximum globalization is 80.77792 index and minimum globalization is 20.02393 index. The value of skewness of globalization is 0.043517 which means that distribution is almost symmetric as well the probability value is 0.000574 which is significant because the value of probability is 0.000574 < 0.05. On average the urban population is 45.32836%. The maximum urbanization rate is 90% and minimum urbanization rate is 9.18%. The value of skewness of urbanization is 0.485489 which means

Table 3: Descriptive statistics

Statistical measures	EC	FD_FD_IX	GDP	KOFGI	URB
Mean	1528.753	0.239	3702.32	50.81	45.32
Median	752.7963	0.210	1152.74	50.81	43.55
Maximum	12172.42	0.703	44,498.9	80.77	90.00
Minimum	86.65042	0.000	137.1	20.02	9.180
SD	2069.430	0.148	7029.0	13.21	21.28
Probability	0.000000	0.000	0.00	0.000574	0.000
Sum	1100702.	172.7486	2,665,670.0	36,586.26	326,364
Sum square deviation	3.08E+09	15.83	3.55E+10	125,639.5	325,664
Observation	720	720	720	720	720

EC: Energy consumption, FD: Financial development, GDP: Gross domestic product, URB: Urbanization, SD: Standard deviation, IX: Index, KOFGI: Konjunkturforschungsstelle Index

Table 4: Correlation analysis

Variables	EC	FD_FD_IX	GDP	KOFGI	URB
EC		0.29186	0.86544	0.325	0.613
FD_FD_IX	0.291	1	0.36362	0.7219	0.38931
GDP	0.86544	0.36341	1	0.481322	0.58220
KOFGI	0.325850	0.72196	0.48132	1	0.59466
URB	0.61347	0.3899	0.582203	0.59204	1

EC: Energy consumption, FD: Financial development, GDP: Gross domestic product, URB: Urbanization

that distribution is almost symmetric as well the probability value is 0.000574 which is significant because the value of probability is 0.000574 < 0.05.

4.2. Correlation Analysis

In these results of Table 4, Association between EC and FD is 0.29, which shows that there is positive but week association among these variables. Correlation between EC and EG is 0.86, which indicates the strong positive relationship among these variables. Correlation among energy consumption and globalization is 0.32, which specifies the positive but week relationship among these variables. Correlation between energy consumption and urbanization is 0.61, which shows that there is moderately positive link among these variables.

4.3. Cross-Section Dependence

4.3.1. Cross-sectional dependence (energy consumption)

According to findings of Table 5, the null hypothesis which is (there is no cross –section dependence) is refused because the probability value is 0.0000 <0.05 which is significant. So it means that there is CSD in given data set of energy consumption.

4.3.2. Cross-section dependence (financial development)

According to findings of Table 6, the null hypothesis which is (there is no cross - section dependence) is rejected because the probability value is 0.0000 <0.05 which is significant. So it means that there is CSD in given data set of financial development.

4.3.3. Cross-section dependence (economic growth)

According to findings of Table 7, the null hypothesis which is (there is no cross - section dependence) is rejected because the probability value is 0.0000 <0.05 which is significant. So it means that there is CSD in given data set of GDP.

4.3.4. Cross-sectional dependence (globalization)

According to findings of Table 8, the null hypothesis which is (there is no cross - section dependence) is refused because the probability value is 0.0000 <0.05 which is significant. So it means that there is CSD in given data set of globalization.

4.3.5. Cross-section dependence (urbanization)

According to findings of Table 9, the null hypothesis which is (there is no cross - section dependence) is rejected because the probability value is 0.0000 <0.05 which is significant. So it means that there is CSD in given data set of urbanization.

4.3.6. Unit root test

4.3.6.1. Unit root test (energy consumption)

Table 10 reports the result of ADF test. Results provide the evidence of refusal of null hypothesis because fisher Chi-square

Table 5: Cross-section dependence test of energy consumption

Series: EC Null hypothesis: No CSD (correlation)			
Test	**Statistic**	**df**	**Probability**
Breusch-Pagan LM	4197.659	435	0.0000
Pesaran scaled LM	126.5490		0.0000
Bias-corrected scaled LM	125.8968		0.0000
Pesaran CD	20.78967		0.0000

EC: Energy consumption, CSD: Cross-section dependence

Table 6: Cross-section dependence test of financial development

Null hypothesis: No CSD (correlation)			
Test	**Statistic**	**df**	**Probability**
Breusch-Pagan LM	2930.572	435	0.0000
Pesaran scaled LM	83.59073		0.0000
Bias-corrected scaled LM	82.93856		0.0000
Pesaran CD	42.92620		0.0000

CSD: Cross-section dependence

Table 7: Cross-section dependence test (Economic Growth)

Series: GDP Null hypothesis: No CSD (correlation)			
Test	**Statistic**	**df**	**Probability**
Breusch-Pagan LM	9157.995	435	0.0000
Pesaran scaled LM	294.7201		0.0000
Bias-corrected scaled LM	294.0680		0.0000
Pesaran CD	95.50204		0.0000

GDP: Gross domestic product, CSD: Cross-section dependence

Table 8: Cross-section dependence test (Globalization)

Series: KOFGI Null hypothesis: No CSD (correlation)			
Test	**Statistic**	**df**	**Probability**
Breusch-Pagan LM	9100.690	435	0.0000
Pesaran scaled LM	292.7773		0.0000
Bias-corrected scaled LM	292.1251		0.0000
Pesaran CD	95.27917		0.0000

CSD: Cross-section dependence

Table 9: Cross-section dependence test (Urbanization)

Series: URB Null hypothesis: No CSD (correlation)			
Test	**Statistic**	**df**	**Probability**
Breusch-Pagan LM	8139.085	435	0.0000
Pesaran scaled LM	260.1758		0.0000
Bias-correcte scaled LM	259.5237		0.0000
Pesaran CD	33.65673		0.0000

URB: Urbanization, CSD: Cross-section dependence

value is 0.0000 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

4.3.6.2. Unit root test (economic growth)

Table 11 reports the result of ADF. Results provide the evidence of refusal of null hypothesis because fisher Chi-square value is 0.0000 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

4.3.6.3. Unit root test (financial development)

Table 11 reports the result of ADF. Results provide the evidence of refusal of null hypothesis because Fisher Chi-square value is 0.0000 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

4.3.6.4. Unit root test (globalization)

Table 12 reports the result of ADF. Results provide the evidence of refusal of null hypothesis because fisher Chi-square value is 0.03 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

4.3.6.5. Unit root test (urbanization)

Table 14 reports the result of ADF test. Results provide the evidence of refusal of null hypothesis because fisher Chi-square value is 0.0000 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

Table 10: Null hypothesis: Unit root (individual unit root process) of Economic Growth

Method	Statistic	Probability**
Series: D (EC)		
ADF-Fisher's χ^2	220.991	0.0000
ADF-Choi Z-statistic	−9.09885	0.0000
Series: D (GDP)		
ADF	147.626	0.0000
ADF	−6.14250	0.0000

GDP: Gross domestic product, EC: Energy consumption

Table 11: Null hypothesis: Unit root (individual unit root process) of financial development

Series: D (FD_FD_IX)		
Method	**Statistic**	**Probability****
ADF	265.939	0.0000
ADF	−11.9546	0.0000

FD: Financial development

Table 12: Null hypothesis: Unit root (individual unit root process) Globalization

Series: KOFGI		
Method	**Statistic**	**Probability****
ADF	81.5279	0.0337
ADF	−0.95576	0.1696

Table 13: Null hypothesis: Unit root (individual unit root process) Urbanization

Series: URB		
Method	**Statistic**	**Probability****
ADF	495.095	0.0000
ADF	−12.3138	0.0000

URB: Urbanization

4.4. Pedroni residual cointegration test

According to the results of Table 14, null hypothesis is rejected which is (there is no cointegration) on the basis of four of seven tests because the probability value of panel pp-Statistic, panel ADF –Statistic, group PP-Statistic and group ADF-statistic is <0.05 except panel v-statistic, panel rho-statistic and group rho-statistic. So it is concluded that there is cointegration among variables of given panel data set.

4.5. Panel Data Long Run Estimates

4.5.1. Dynamic seemingly unrelated regression

According to the results of Table 15, the impact of FD on EC is positively significant as increase of 1 unit in FD brings 3.07% increase in EC, the impact of GDP on EC is negatively significant as increase of 1 unit in GDP brings 0.29% increase in EC. As well as the effect of globalization is negative but significant as increase of 1 unit in globalization brings decrease of 15.57% in EC. Moreover, the effect of urbanization on EC is positive and significant as increase of 1 unit in urbanization brings 11.54% increase in EC.

4.5.2. Pairwise Dumitrescu Hurlin panel causality test

According to the results of Table 16, there is bidirectional causality running from financial development to energy consumption. Likewise, there is bidirectional causality running from GDP to energy consumption. Moreover, there is bidirectional relationship among GDP and financial development.

4.5.3. Country wide long run estimates

For the estimation of long run analysis of single country the dynamic ordinary least square is used in this study. Results of Table 17 show that the impact of FD on EC is considerable and favourable in countries such as Bangladesh, China, Pakistan, India,

Table 14: Series: Energy_consumption financial development_financial development_IX gross domestic product KOFGI urbanization

Null hypothesis: No cointegration Alternative hypothesis: Common AR coefs. within-dimension) weighted				
Methods	**Statistic**	**Probability**	**Statistic**	**Probability**
Panel v-statistic	0.148182	0.4411	−2.035861	0.9791
Panel rho-statistic	0.496271	0.6901	0.637207	0.7380
Panel PP-statistic	−4.080452	0.0000	−6.222187	0.0000
Panel ADF-statistic	−3.348459	0.0004	−5.668781	0.0000
Alternative hypothesis: Individual AR coefficients (between-dimension)				
Methods	**Statistic**	**Probability**		
Group rho-statistic	3.063499	0.9989		
Group PP-statistic	−4.854447	0.0000		
Group Adf statistic	−3.441777	0.0003		

Table 15: Dynamic seemingly unrelated regression

Variables	Coefficient	SE	t-statistic	Probability
C (1) FD	3.071282	0.048666	63.10977	0.0000
C (2) GDP	0.288646	0.004836	59.69209	0.0000
C (3) Globalization	−15.57513	2.343548	−6.645963	0.0000
C (4) Urbanization	11.54356	1.572742	7.339762	0.0000
C (5) Constant	544.3358	104.0926	5.229341	0.0000
Equation: EC=C (1)*FD_FD_IX+C (2)*GDP+C (3) *KOFGI+C (4)*URB+C (5)				
Observations: 720				
R^2	0.757094	Mean dependent variable		1528.753
Adjusted R^2	0.755735	SD dependent variable		2069.430
SE of regression	1022.778	Sum squared resident		7.48E+08
Durbin-Watson statistic	0.198098			
Equation: GDP=C (1)*EC				
Observations: 720				
R^2	0.727506	Mean dependent variable		3702.320
Adjusted R^2	0.727506	SD dependent variable		7029.002
SE of regression	3669.206	Sum squared resident		9.68E+09
Durbin-Watson stat	0.212789			

SE: Standard error, SD: Standard deviation, FD: Financial development, GDP: Gross domestic product, EC: Energy consumption, URB: Urbanization

Table 16: Pairwise Dumitrescu Hurlin Panel Causality Test

Null hypothesis	W-statistic	Zbar-statistic	Probability
FD_FD_IX does not homogeneously cause EC	30.96	3.58	0.000
EC does not homogeneously cause FD_FD_IX	50.50	6.83	8.E-12
GDP does not homogeneously cause EC	3.95	3.56	0.000
EC does not homogeneously cause GDP	6.39	8.72	0.000
GDP does not homogeneously cause FD_FD_IX	5.42	6.68	2.E-11
FD_FD_IX does not homogeneously cause GDP	4.18	4.05	5.E-05

GDP: Gross domestic product, EC: Energy consumption, FD: Financial development

Azerbaijan, Kazakhstan, Thailand, Jordan, Cambodia, Sri Lanka, Mynammar, Malaysia, Philippines, Tajikistan, Turkmenistan, Kyrgyzstan, Yemen and Kiribati as well as the impact of FD on EC is significant but negative in countries such as UAE, Armenia, Indonesia, Lebanon, Nepal, Saudi Arabia, Syrian Arab Republic, Samoa and Korea Republic. The impact of GDP on EC is favourable and significant in countries such as UAE, Armenia, Bangladesh, Pakistan, India, Kazakhstan, Thailand, Sri Lanka, Myanmmar, Mongolia, Malaysia, Nepal, Tajikstan, Kyrgyzstan, Saudi Arabia, Syrian Arab Republic, Samoa, and Korea Rep. The impact of GDP on EC is significant but negavtive in countires such as China, Azerbaijan, Indoneshia, Jordan, Vietnam, Cambodia, Lebanan, Phillipines, Turkemenistan, Uzbekistan and Yemen.

The impact of globalization on EC is significant and favourable in countries such as Armenia, Bangladesh, Azerbaijan, Kazakhstan, Thailand, Jordan, Sri Lanka, Myanmmar, Malaysia, Nepal, Philipines, Yemen, Saudi Arabia, Syrian Arab Republic, Samoa, Korea Republic and Kiribati as well as the impact of globalization on EC is considerable but negative in countries such as UAE, China, Pakistan, India, Vietnam, Lebanon, Mongolia, Tajikstan, Turkemenistan, Uzbekistan and Kyrgyzstan. But the impact is negatively insignificant in Indoneshia. The impact of URB on EC is positive and significant in countries such as UAE, Armenia, Bangladesh, China, Pakistan, India, Azerbaijan, Indonesia, Jordan, Cambodia, Sri Lanka, Mongolia, Philippines, Tajikstan, Turkemenistan, Uzbekistan, Kyrgyzstan, Yemen, Syrian Arab Republic, Samoa as well as the impact of URB on EC is unfavourable and substantial in countries such as Thailand, Vietnam, Lebanan, Myanmmar, Nepal, Saudi Arabia, Korea Republic. There is positive but insignificant impact of urbanization in Kazakhstan and relationship is negatively significant in countries such as Malaysia and Kiribati.

5. DISCUSSION

This study examined the effect of financial development and economic growth on energy consumption in developing Asian economies for the period of 1991-2014. Different econometric techniques are used in this study. Before modeling, CSD test is applied to check the dependence within cross sections of the given variables. According to cross sectional dependence test there is CSD in given data set of all variables because the probability value is “0.000”. So the null hypothesis which is there is no cross sectional dependence is rejected. After checking cross sectional dependence, ADF is used to check whether the given variables have unit root or not. Results provide the evidence of refusal of null hypothesis because Fisher Chi-square value is 0.0000 <0.05. Null hypothesis in this test is (The data is non stationary) is rejected.

Dynamic seemingly unrelated regression model is used to find out the impact of FD and EG on EC. According to the results of dynamic seemingly unrelated regression the impact of FD on EC is positively significant as increase of 1 unit in FD brings 3.07% increase in EC. This result is consistent with direct effect, business effect and wealth effect. According to DE consumers get cheaper loan from the bank and buy big ticket items such as houses, air conditioners, automobiles and washing machines. So high amount of energy is consumed by these items which can influence the overall energy demand of the country (Ozturk and Acaravci, 2013).

Table 17: Results of Country Wide Long Run Estimates

Countries	Variables	FD	GDP	GLOB	URB
UAE	Coefficients	−0.24	0.85	−4.13	3.90
	Probability	0.000	0.000	0.000	0.000
Armenia	Coefficients	−0.029	0.280	0.904	0.152
	Probability	0.000	0.000	0.000	0.50
Bangladesh	Coefficients	3.978	0.067	53.679	0.734
	Probability	0.000	0.000	0.000	0.0016
China	Coefficients	−0.324	−0.201	−1.450	3.923
	Probability	0.000	0.000	0.000	0.000
Pakistan	Coefficients	0.423	0.281	−2.719	4.286
	Probability	0.000	0.000	0.000	0.000
India	Coefficients	0.038	0.204	−0.209	1.728
	Probability	0.000	0.000	0.000	0.000
Azerbaijan	Coefficients	0.840	−0.389	0.973	2.081
	Probability	0.000	0.000	0.000	0.000
Indonesia	Coefficients	0.204	−0.347	−3.039	5.492
	Probability	0.000	0.000	0.000	0.000
Kazakhstan	Coefficients	0.542	0. 195	1.266	0.623
	Probability	0.0000	0.0000	0.0003	0.5413
Thailand	Coefficients	0.378	0.255	2.523	−1.431
	Probability	0.009	0.025	0.026	0.000
Jordan	Coefficients	0.667	−0.348	0.323	1.982
	Probability	0.000	0.000	0.000	0.000
Vietnam	Coefficients	−11.819	0.057	9.204	−6.553
	Probability	0.000	0.000	0.000	0.000
Cambodia	Coefficients	0.380	−1.265	1.319	3.112
	Probability	0.000	0.000	0.000	0.000
Lebanon	Coefficients	−3.894	2.053	−2.755	−0.624
	Probability	0.000	0.000	0.000	0.000
Sri Lanka	Coefficients	0.217	0.061	0.985	0.641
	Probability	0.000	0.000	0.000	0.000
Myanmar	Coefficients	1.288	0.114	0.443	−0.076
	Probability	0.000	0.000	0.000	0.000
Mongolia	Coefficients	−6.133	11.442	−6.567	24.512
	Probability	0.000	0.000	0.000	0.000
Malaysia	Coefficients	1.045	0.184	5.268	−3.818
	Probability	0.000	0.000	0.000	0.070
Nepal	Coefficients	−0.940	0.185	0.908	−0.100
	Probability	0.000	0.000	0.000	0.002
Philippines	Coefficients	0.494	−0.156	0.083	1.945
	Probability	0.000	0.000	0.000	0.000
Tajikistan	Coefficients	−0.072	0.261	−1.484	2.894
	Probability	0.000	0.000	0.007	0.000
Turkmenistan	Coefficients	0.309	−0.025	−3.663	5.493
	Probability	0.000	0.000	0.000	0.000
Uzbekistan	Coefficients	−0.190	−0.145	−1.164	3.221
	Probability	0.000	0.000	0.000	0.000
Kyrgyzstan	Coefficients	0.041	0.426	−1.530	2.719
	Probability	0.000	0.000	0.000	0.000
Yemen	Coefficients	0.491	−0.197	0.223	1.781
	Probability	0.000	0.000	0.000	0.000
Saudi Arabia	Coefficients	−0.285	0.089	5.324	−4.144
	Probability	0.000	0.000	0.000	0.000
Syrian Arab	Coefficients	−0.228	0.288	−1.364	2.390
Republic	Probability	0.0081	0.000	0.000	0.000
Samoa	Coefficients	−0.146	0.119	0.901	0.165
	Probability	0.000	0.000	0.000	0.000
Korea	Coefficients	1.350	0.009	4.067	−2.453
Republic	Probability	0.000	0.000	0.000	0.000
Kiribati	Coefficients	0.010	0.326	1.723	−1.098
	Probability	0.000	0.000	0.000	0.22

GDP: Gross domestic product, FD: Financial development, URB: Urbanization, GLOB: Globalization

According to BE, businessmen enhance their business as well as producers purchase advance machinery and equipment through which energy demand increased (Sadorsky, 2011). Moreover, WE rises when developed stock market provides different channels of financing to the listed corporations and by minimizing the cost of financing. So these corporations invest in new projects which can ultimately increase demand for energy (Safaynikou, 2014).

This relationship is consistent with the findings of (Komal and Abbas, 2015; Odusanya et al., 2016; Shahbaz et al., 2016; Imamoglu, 2019; Sadorsky, 2011; Shahbaz and Lean, 2012; Islam et al., 2013; Bojanic, 2012; Calderón and Liu, 2002; Hassan et al., 2011; Kraft and Kraft, 1978; Karanfil, 2009).Their findings suggest that these countries are not taking the advantage of energy efficient technology in the production of goods and services. Thus it is suggested that these countries should assign more capital to energy efficient technology and new production procedures to use energy effectively.

As well as the impact of EG on EC is positively significant as increase of 1 unit in GDP brings 0.29% increase in energy consumption. This relationship is based on wealth effect. According to WE, stock market development is the sign of growth of economy. Due to this consumers and businesses get finance for investing in different projects that leads to economy growth and hence increase the energy demand. This relationship is consistent with the findings of (Chiou-Wei et al., 2008; Wolde-Rufael, 2009; Yavuz and Güriş, 2008; Suri and Chapman, 1998; Ghali and El-Sakka, 2004; Erdal et al., 2008; Hossain and Saeki, 2011; Imran and Siddiqui, 2010; Zaman et al., 2011; Masih and Masih, 1996; Asafu-Adjaye, 2000; Soytas and Sari, 2003; Lise and Van Montfort, 2007; Huang et al., 2008; Mozumder and Marathe, 2007; Chebbi and Boujelbene, 2008; Loganathan and Subramaniam, 2010). According to their findings, there is substantial effect of energy on growth of economy. And their findings suggest that energy is an important source for growth of economy.

Moreover, the impact of GLOB on EC is negative but significant as increase of 1 unit in globalization brings decrease of 15.57% in energy consumption. By using advanced technology, foreign firms can setup new business or expand existing business and energy consumption can be reduced due to advanced technology. This relationship is consistent with the study of Antweiler (2001). He observed the unfavorable relationship between globalization and energy depletion and found that due to importing cutting edge technology energy demand is reducing.

Likewise, the effect of URB on EC is positive and significant, as increase of 1 unit in urbanization brings 11.54% increase in energy consumption. In the urbanization stage, energy demand is increasing because of more electronic goods consumed by people (Danish and Baloch, 2018). Urbanization has different essentials that are affecting energy consumption in different ways. For example, man-made environment, expansion in industrial and economic activities, infrastructural changes and increasing transportation (Poumanyvong et al., 2012; Madlener and Sunak, 2011). Promotion in urban life style is effecting the energy consumption because people use more energy intensive products due to enhancement in economic and social activities (Sadorsky, 2014). Urbaniation has intricate connections with energy consumption because of the difficulty of the procedure.

Urbanization includes commercial procedures, societal procedures, spatial procedures and technical procedures. In terms of economic processes, urbanisation is a movement from a less amount of energy-consuming unindustrialized culture to high amount of energy-consuming urban society. Economic and manufacturing activities develop in cities, causing an rise in energy consumption (Jones, 1989, 1991).In actual, manufacturing production which needs more different and intricate collection of techniques and processes, depends on severe and huge energy consumption.

Furthermore, Pairwise Dumitrescu Hurlin panel causative association test was used in this study for checking the causative association among the variables. According to the result of PDHPCT there is reciprocal causative association running from FD to EC. Findings of this relationship are consistent with the findings of (Danish and Baloch, 2018). Their findings suggest that there is feedback effect among FD and EC. It is suggested that FD through the channel of EG increases the energy demand and energy plays vital role in the economic growth and thus economic activities create demand for financial facilities. So due to this energy consumption granger cause financial development.

As well as there is two way relationship among EG and EC. The findings are consistent with the study of (Loganathan and Subramaniam, 2010; Ghali and El-Sakka, 2004; Yavuz and Güriş 2008; Suri and Chapman, 1998; Wolde-Rufael, 2009; Noor and Siddique, 2010; Apergis and Payne, 2009). Feedback hypothesis supports the twoway relationship between EC and EG. According to feedback hypothesis, EC and EG are necessary to each other. As well as feedback hypothesis suggests that there is need of energy's expansionary policies for longitudinal economic growth.

Likewise, there is two directional connection among EG and FD. FD increases EG through different channels such as level and efficiency effects. According to level effect, financial sectors enable the idle resources from non profitable investments to profitable investments by appealing home and overseas investments due to which economic growth increases. According to efficiency effect financial sectors provide financial capital for effective investments, which increase the economic activities and develop the economy. Financial development granger cause economic growth because of increasing the efficacy of capital accretion and due to increase in investment level. It means that by increasing the investment level and efficacy of capital accretion financial development increases economic growth. Furthermore, it encourages the adoption of the cutting - edge technology. (Jalil and Ma, 2008; Greenwood and Jovanovic, 1990; Abu-Bader and Abu-Qarn, 2008; Ibrahim, 2007; Coccorese, 2008; Liang and Teng, 2006; Chukwu and Agu, 2009; Odhiambo, 2011; Al-Malkawi et al., 2012).

According to demand - following hypothesis EG granger cause FD. Demand following relationship specifies that economic activities create demand for financial facilities. (Fung, 2009; Jenkins and Katircioglu, 2010) exmine that EG has favourable impact on FD due to output increase.

For the estimation of long run analysis of single country, the dynamic ordinary least square is used in this study. According to the results of DOLS the impact of FD on EC is significant and favourable in some countries and negative in some countries.

6. CONCLUSION

This study observed the impact of financial development and economic growth on energy consumption in developing Asian economies for the period of 1991-2014. In addition, urbanization and globalization are used as control variables. Different econometric methods are used in this study. DSUR model is used to test the hypothesis. According to the results of DSUR the impact of FD on EC is positively significant. This result is consistent with direct effect, business effect and wealth effect. The impact of GDP on EC is negatively significant. This relationship is based on wealth effect. According to wealth effect, stock market development is the sign of growth of economy. Due to this consumers and businesses get finance for investing in different projects that leads to economy growth and hence increase the energy demand. As well as the effect of globalization is unfavorable but significant. By using advanced technology, foreign firms can setup new business or expand existing business and energy consumption can be reduced due to advanced technology. Moreover, the effect of urbanization on energy consumption is positive and significant. Urbanization has intricate connections with energy consumption because of the difficulty of the procedure. Urbanization includes commercial procedures, societal procedures, spatial procedures and technical procedures.

Furthermore, Pairwise Dumitrescu Hurlin Panel Causality test was used in this study to find out the causal relationship among the variables. According to the result of DHPCS, there is bidirectional causative relationship running from FD to EC. There is reciprocal effect among FD and EC. As well as there is bidirectional relationship among EG and EC. Feedback hypothesis supports the two directional relationship between EC and EG. Likewise, there is two directional relationship among EG and FD. FD increases EG through different channels such as level and efficiency effects. According to demand - following hypothesis EG granger cause FD. Demand following relationship specifies that economic activities create demand for financial facilities.

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