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Information and Communication Technology and Electricity Consumption in Transitional Economies

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ABSTRACT

The study investigated the impact of information and communication technology (ICT) on electricity consumption in transitional economies using panel data analysis methods (dynamic generalized methods of moments [GMM], pooled ordinary least squares, fixed effects, random effects) with annual secondary data ranging from 1995 to 2014. Majority of prior studies on the subject matter had not focused on the impact of ICT on electricity consumption but on energy consumption, which is a broader area. They also did not focus exclusively on transitional economies and they ignored both the dynamic characteristics of electricity consumption data and endogeneity issues. The study revealed that electricity consumption is positively and significantly influenced by its own lag, in line with theoretical literature (Nayan et al., 2013). However, the impact of ICT on electricity consumption was found to be mixed. For example, the influence of ICT on electricity consumption was found to be negative and non-significant under the dynamic GMM and pooled OLS. Fixed and random effects observed that ICT had a significant positive impact on electricity consumption in emerging markets. It is against this backdrop that the current study urges transitional economies to develop and implement policies that ensures that ICT gadgets being used reduces the quantity of electricity consumption. In other words, transitional economies should focus on developing or importing energy efficient ICT gadgets in order to meet the required energy saving threshold levels. Future studies should investigate channels through which ICT influences electricity consumption, in line with Shahbaz et al. (2014) whose study noted that the relationship between ICT and electricity consumption is non-linear.

Keywords: Information and Communication Technology, Electricity Consumption, Panel Data, Transitional Economies
JEL Classifications: L17, Z32

1. INTRODUCTION

Several studies have attempted to investigate the impact of information and communication technology (ICT) on electricity consumption but they have so far produced divergent, mixed and unclear results. Four set of views emerged from the study on ICT-led electricity consumption hypothesis and these are: (1) ICT-led positive impact on electricity consumption, (2) ICT-led negative influence on electricity consumption, (3) the non-linear argument, (4) the neutrality hypothesis. The ICT-led positive impact on electricity consumption hypothesis argued that increased investment in ICT infrastructure leads to more electricity consumption in the economy, a view which was supported by Zhang and Liu (2015), Sadorsky (2012), Salahuddin and Alam (2016), Tunali (2016), Afzal and Gow (2016), Collard et al. (2005), Pothitou et al. (2017) and Choo et al. (2007), among others.

The ICT-led negative impact on electricity consumption view says that ICT has got a deleterious effect on electricity consumption. The view was supported by Lee and Brahmasrene (2014), Lu (2018), Han et al. (2016), Gelenbe and Caseau (2015), Wang and Han (2016), Horner et al. (2016), Schulte et al. (2016), Pano (2017), Choo et al. (2007) and Bernstein and Madlener (2010). The non-linear argument says that the impact of ICT on electricity consumption is non-linear in the sense that ICT influences electricity consumption through some channels and not in a direct manner. A study done by Shahbaz et al. (2014) produced findings which supports the non-linear argument. The neutrality hypothesis which was supported by Inani and Tripathi (2017) is of the view that there is no relationship at all between ICT and electricity consumption. Although the first two views are the most supported in the literature, the relationship between ICT and electricity consumption is still not clear and inclusive. It is against this backdrop that the current study performed further empirical tests to find out the impact of ICT on electricity consumption in transitional economies.

Majority of the empirical studies on the impact of ICT on electricity consumption shied away from focusing on transitional economies except two of them (Sadorsky, 2012; Afzal and Gow, 2016). The similarities between these prior studies and the current study is that they all used dynamic generalized methods of moments (GMM) which takes into account the dynamic nature of electricity consumption data and effectively deal with the endogeneity problem. The current study deviates from these two similar prior studies in the following ways: (1) The current study used other panel data analysis methods (fixed effects, random effects, pooled OLS) apart from the dynamic GMM for comparative analysis purposes, (2) the current study used more up to date dataset, (3) the current study used a different proxy of ICT (individuals using internet as a ratio of the population), which is a better measure of ICT investment and development in the country.

The rest of the paper is organised as follows: Section 2 is literature review, section 3 explains the other factors that influence electricity consumption whilst section 3 describes the methodology used in this study. Pre-estimation diagnostics is section 4, main data analysis, interpretation and discussion of results is done in section 5. Section 6 is the conclusion.

2. LITERATURE REVIEW

The ICT led electricity consumption view according to Zhang and Liu (2015) argues that ICT increases the amount of electricity consumption because more electrical gadgets are used which consumes a lot of energy. The optimistic view says that the use of ICT gadgets saves the overall energy consumption but not necessarily the quantity of electricity used (Lee and Brahmasrene, 2014). In line with Houghton's (2009) proposition, the relationship between ICT and electricity (energy consumption) consumption is quite unclear as it could be positive, negative or non-existent at all.

On the empirical front, quite a number studies investigated the relationship between ICT and electricity or energy consumption (Table 1).

Table 1 shows that the relationship between ICT and electricity consumption can be categorized into four: (1) ICT led positive impact on electricity consumption, (2) ICT led negative effect on electricity consumption, (3) there is no relationship between ICT and electricity consumption and (4) the impact of ICT on electricity consumption is non-linear. Clearly, both theoretical and empirical literature shows that the influence of ICT on electricity consumption is mixed and debate on the relationship between the two variables is inconclusive and still far from being over.

Other factors that influence electricity consumption are presented in Table 2.

Individuals using internet (% of population) is the proxy of ICT that was used in this study, consistent with Tsaurai and Chimbo (2019).

3. METHODOLOGY DESCRIPTION

3.1. Data

The study used annual panel data ranging from 1995 to 2014 for transitional economies (Argentina, Brazil, China, Colombia, Czech Republic, Greece, Hong Kong, Indonesia, India, Mexico, Malaysia, Peru, Philippines, Poland, Portugal, Republic of Korea, Russia, Thailand, Turkey, Singapore, South Africa). The sample of countries is in line with International Monetary Fund (2015) and data availability considerations. The data was obtained from World Development Indicators, African Development Indicators, International Financial Statistics and International Monetary Fund databases.

3.2. Empirical and Econometric Model Specification

In line with both theoretical and empirical literature, the general model specification of the electricity consumption function is shown in equation 1.

$$ELECTR = f(ICT, GDPPC, URBAN, ACCESS, RESOURCE, FDI, FIN, OPEN, HCD) \quad (1)$$

Where ELECTR, ICT, GDPPC, URBAN, ACCESS, RESOURCE, FDI, FIN, OPEN and HCD stands for electricity consumption, ICT, gross domestic product per capita, urban population, access to electricity, resource endowment, foreign direct investment, financial development, trade openness and human capital development.

Equation 1 is transformed into equation 2 when presented as an econometric estimation model.

$$ELECTR_{i,t}=\beta_0+\beta_1 ICT_{i,t}+\beta_2 GDPPC_{i,t}+\beta_3 URBAN_{i,t}+\beta_4 CCESS+\beta_5 RESOURCE_{i,t}+\beta_6 FDI_{i,t}+\beta_7 FIN_{i,}+\beta_8 OPEN_{i,t}+\beta_9 HCD_{i,t}+\mu+\varepsilon \quad (2)$$

ε is the error term. i and t stands respectively stands for country and time. μ_i is the time invariant and unobserved country specific effect, β_0 represents the intercept term, β_1 up to β_9 are the co-efficients of the respective variables used. Fixed effects, pooled OLS and the random effects were the three panel data analysis methods which were used to estimate equation 2.

Following Nayan et al. (2013) whose study argued that electricity consumption is affected by its own lag, the current study took into account the dynamic characteristics of the electricity consumption data (equation 3).

$$ELECTR_{i,t}=\beta_0+\beta_1 ELECTR_{i,t-1}+\beta_2 ICT_{i,t}+\beta_3 GDPPC_{i,t}+\beta_4 URBAN_{i,t}+\beta_5 ACCESS+\beta_6 RESOURCE_{i,t}+\beta_7 FDI_{i,t}+\beta_8 FIN_{i,t}+\beta_9 OPEN_{i,t}+\beta_{10} HCD_{i,t}+\mu+\varepsilon \quad (3)$$

Table 1: A summary of empirical studies on ICT-electricity consumption nexus

Author	Focal unit of analysis	Methodology	Research findings
Sadorsky (2012)	Emerging economies	Dynamic panel data analysis	When ICT is measured using mobile phones, number of computers and internet connections, ICT was found to have had a significant positive influence on electricity consumption
Salahuddin and Alam (2016)	OECD countries	Panel data analysis	A significant positive relationship running from ICT towards electricity consumption was detected both in the long and short run
Lu (2018)	Asian countries	Panel data analysis	ICT was found to have reduced (significant negative influence) carbon dioxide emissions in Asian countries
Han et al. (2016)	China	ARDL and ECM	ICT had a negative impact on energy consumption in the short run. In the long run, the influence of ICT on energy consumption was found to be U-shaped
Tunali (2016)	European union countries	ARDL	ICT led to an increase in electricity consumption in European Union countries in the long run
Yan et al. (2018)	50 economies	Panel data analysis	ICT had a significant positive effect on energy productivity
Gelenbe and Caseau (2015)	World-wide	Panel data analysis	ICT had a deleterious impact on energy consumption and carbon emissions
Afzal and Gow (2016)	Emerging economies	Dynamic panel data analysis and system GMM	ICT as measured by mobile phones, internet connections and import percentage of ICT goods of total imports was found to have had a significant positive effect on electricity consumption in emerging economies studied
Wang and Han (2016)	China	Panel ECM	ICT reduced energy intensity in the long run in China
Shahbaz et al. (2014)	United Arab Emirates	VECM	The non-linear relationship between ICT and electricity consumption was found to be an inverted U-shape
Inani and Tripathi (2017)	India	VECM and ARDL	The relationship between ICT and electricity consumption was found to be non-existent in India both in the short and long run
Solarin et al. (2019)	Malaysia	Toda-Yamamoto granger causality approach	A feedback effect between ICT and electricity consumption was observed
Collard et al. (2005)	France	VECM	The use of computers and software led to the increase in electricity consumption in France
Pothitou et al. (2017)	European Union	Descriptive statistics	ICT led to an increase in electricity consumption
Horner et al. (2016)	World-wide	Literature review	ICT was found to have had a negative impact on energy consumption
Schulte et al. (2016)	OECD countries	Difference-GMM	ICT was found to have a reduction effect on energy demand in the OECD countries
Pano (2017)	Albania	Descriptive statistics	The study found out that ICT reduced energy usage in Albania
Choo et al. (2007)	South Korea	Descriptive statistics	ICT investment in the manufacturing sector increased electricity consumption whilst ICT investment in the services sector was found to have had a deleterious impact on electricity consumption
Bernstein and Madlener (2010)	European union countries (UK, Sweden, Slovenia, Portugal, Italy, Germany, Finland, Denmark)	Panel econometric approach	ICT was found to have had an electricity consumption reduction effect in the sectors studied

Source: Author compilation. ICT: Information and communication technology, ECM: Error correction model, ARDL: Autoregressive distributed lag, VECM: Vector error correction model, GMM: Generalized methods of moments

Where $ELECTR_{it-1}$ is the lag of electricity consumption. Equation 3 was estimated using Arellano and Bond (1991)'s dynamic panel GMM approach.

4. PRE-ESTIMATION DIAGNOSTICS

This section includes correlation analysis and descriptive statistics. Table 3 shows that variables which were individually positively and significantly correlated with electricity consumption are ICT, economic growth (GDPPC), urban population (URBAN), foreign direct investment (FDI), financial development (FIN), trade openness (OPEN) and human capital development (HCD).

Access to electricity was found to have been negatively but non-significantly related with electricity consumption whilst a significant negative relationship between human capital development and electricity consumption was detected. The results are supports by the literature. The problem of multi-collinearity

Table 2: Variables, a priori expectation and theory intuition

Variable	Proxy used	Theory intuition	Expected sign
Lag of electricity consumption	Electric power consumption (kWh per capita)	Consistent with Nayan et al. (2013), the electricity consumption level follows a similar pattern of the previous electricity consumption period. In other words, the electricity consumption interdepends on each other across periods	+
Economic growth (GROWTH)	GDP per capita	Aye and Edoja (2017) noted that higher levels of economic growth increases the number of economic activities which uses a lot of electricity	+
Urbanization (URBAN)	Urban population (% of total)	The expansion of urban areas is associated with increased activities such as construction and the maintenance of roads and other related infrastructure, all of which leads to more electricity consumption (Zhao and Zhang, 2018; Sadorsky, 2014). On the contrary, Ye et al. (2013) revealed that urbanization is associated with high levels of technological advances which could lead to more energy use efficiency and lower electricity consumption	±
Access to electricity (ACCESS)	Access to electricity (% of population)	The author is of the view that more access to electricity reduces the cost per unit of electricity and consequently increases the overall quantity of electricity usage in the economy	±
Resource endowment (RESOURCE)	Total natural resources rents (% of GDP)	Consistent with Kwakwa et al. (2018), heavy machinery which requires the use of more electricity energy is employed in the process of extracting natural resources. However, a country uses other forms of energy apart from electricity if it is endowed with diverse type of natural resources	±
Foreign direct investment	Net FDI inflows (% of GDP)	FDI increases the number and level of manufacturing activities in the economy which require the use of more electricity (Blanco et al., 2013). However, Cheng and Yang (2016) observed that foreign investors bring the host country some advanced and smart technology which is energy use efficient	±
Financial development	Stock market capitalisation (% of GDP)	Sadorsky (2010) argued that financial sector development enables consumers and firms to borrow money in order to purchase more electricity consuming items such refrigerators, houses washing machines, among others. On the other hand, the author is of the view that higher levels of financial development allows domestic firms and individuals to borrow money and invest in state of the art and electricity saving gadgets	±
Trade openness (OPEN)	Total trade (% of GDP)	Consistent with Tsaurai (2019a), trade openness multiplies the number of energy use linked manufacturing activities in the economy. Grossman and Krueger (1991) however noted that trade openness allows companies to import new technology that is energy use efficient	±
Human capital development	Human capital development index	A study by Inglesi-Lotz and Morales (2017) noted that higher levels of education had a significant positive impact on energy consumption in developing countries	+

Source: Author compilation

Table 3: Correlation analysis

	ELECTR	ICT	GDPPC	URBAN	ACCESS	RESOURCE	FDI	FIN	OPEN	HCD
ELECTR	1.00									
ICT	0.61***	1.00								
GDPPC	0.78***	0.68***	1.00							
URBAN	0.49***	0.43***	0.61***	1.00						
ACCESS	−0.05	0.03	0.12**	0.36***	1.00					
RESOURCE	−0.17***	−0.07	−0.36***	−0.06	0.16***	1.00				
FDI	0.39***	0.35***	0.63***	0.50***	0.23***	−0.19***	1.00			
FIN	0.33***	0.32***	0.50***	0.36***	0.08*	−0.10**	0.79***	1.00		
OPEN	0.54***	0.40***	0.70***	0.46***	0.18***	−0.19***	0.81***	0.72***	1.00	
HCD	0.68***	0.46***	0.67***	0.61***	0.13***	−0.33***	0.36***	0.23***	0.44***	1.00

Source: Author's compilation from E-views. ***, **and *denote 1%, 5% and 10% levels of significance, respectively

does not exist, consistent with Tsaurai (2019b. p. 171) because the maximum absolute correlation value is 81% (between trade openness and FDI). This is understandable because both FDI and trade openness are measure of how open an economy is to the outside world.

The probabilities of the Jarque-Bera criterion equal to zero across all the variables studied, an indication that the data is not normally distributed (Odhiambo, 2008; Tsaurai and Ndou, 2019). Standard deviation values (>1000) show that electricity consumption and economic growth (GDPPC) data has abnormal values (Table 4).

Table 4: Descriptive statistics

Descriptive statistics	ELECTR	ICT	GDPPC	URBAN	ACCESS	RESOURCE	FDI	FIN	OPEN	HCD
Mean	3274.7	26.3	9796.6	66.2	89.4	3.64	4.12	88.4	94.4	0.77
Median	2702.6	18.1	6239.9	70.5	97.5	2.17	2.56	39.5	58.0	0.77
Maximum	10497	90.4	56284	100.0	100.0	21.7	39.9	1254	455.3	0.94
Minimum	263.6	0.00	381.5	26.6	2.98	0.0003	0.03	3.27	15.64	0.48
Std. Dev.	2361	25.07	9940.4	19.01	19.0	4.29	5.85	160.8	95.9	0.09
Skewness	0.71	0.72	1.82	−0.13	−2.68	1.62	3.56	4.93	2.28	−0.41
Kurtosis	2.77	2.28	6.87	2.48	10.3	5.51	17.0	30.6	7.36	2.78
Jarque-Bera	36.6	45.3	493.1	5.8	1447	294.8	4309.3	14998.7	695.6	12.5
Probability	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Observations	420	420	420	420	420	420	420	420	420	420

Source: Author’s compilation from E-views

Table 5: Panel stationarity tests –individual intercept

Variables	Level				First difference			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
LELECTR	−1.90**	2.19	38.82	103.31	−9.01***	−8.26***	150.41***	270.50***
LICT	−18.48***	−16.58***	412.15***	1622.71***	−12.43***	−6.02***	130.62***	122.80***
LGDPPC	1.13	4.80	10.27	16.71	−6.96***	−5.32***	98.90***	145.50***
LURBAN	−4.43***	1.43	40.42	74.18***	−3.14***	−5.95***	103.91***	473.57***
LACCESS	−4.29***	−1.00	38.77*	89.13***	−7.31***	−12.64***	193.47***	810.23***
LRESOURCE	−2.35***	−0.33	36.92	44.10	−12.67***	−10.63***	186.38***	290.29***
LFDI	−6.02***	−5.65***	105.42***	152.99***	−11.65***	−13.47***	236.69***	1565.71***
LFIN	−4.74***	−3.48***	87.67***	111.69***	−15.87***	−15.40***	273.93***	751.67***
LOPEN	−2.53***	0.30	36.69	39.49	−15.87***	−15.40***	273.93***	751.67***
LHCD	−10.40***	−7.25***	128.39***	180.02***	−17.77***	−15.71***	276.20***	2596.02***

Source: Author’s compilation from E-views. LLC, IPS, ADF and PP stands for Levin et al. (2002); Im et al. (2003); ADF fisher Chi-square and PP fisher Chi-square tests respectively.
*, **and *** denote 1%, 5% and 10% levels of significance, respectively

Abel and Le Roux (2016) transformed all the data sets into natural logarithms in order to effectively dealt with the issues of abnormal values and data that is not following a normal distribution. The current study used the same approach.

5. RESULTS AND DISCUSSION

Panel unit root tests (results presented in Table 5) show that the variables are integrated of order 1 (Odhiambo, 2008).

Table 6 shows that the null hypothesis which says that there is no long run relationship between and among the variables studied is rejected, thus paving way for main data analysis whose results are presented in Table 7.

The lag of electricity consumption had a significant positive impact on electricity consumption under the dynamic GMM approach, consistent with Nayan et al. (2013) whose study noted that electricity consumption level follows a similar pattern of the previous electricity consumption period. Under the dynamic GMM and pooled OLS, a non-significant negative relationship running from ICT towards electricity consumption was observed, in line with the optimistic view propagated by Lee and Brahmasrene (2014) which argues that the use of ICT gadgets reduces energy consumption. The finding also resonates with other related prior empirical studies (Han et al., 2016; Horner et al., 2016; Gelenbe and Caseau, 2015). On the other hand, ICT was found to have had a significant positive effect on electricity consumption under both the fixed and random effects methods,

Table 6: Kao residual co-integration test - individual intercept

Statistical description	T-statistic	Probability
Augmented Dickey-Fuller	−2.127601	0.0167

Source: Author’s compilation from E-views

a finding which supports Zhang and Liu’s (2015) view that ICT leads to increased electricity consumption because it triggers the use of more electrical gadgets.

Under the dynamic GMM approach, economic growth had a non-significant positive influence on electricity consumption whilst pooled OLS, fixed and random effects shows a significant positive relationship running from economic growth towards electricity consumption. The results resonate with Aye and Edoja (2017) whose study revealed that increased levels of economic growth boost the magnitude of economic activities which rely more on electricity consumption. Whilst urbanization had a significant negative impact on electrical consumption under the dynamic GMM, pooled OLS shows a non-significant negative relationship running from urbanization towards electricity consumption. The results support Ye et al. (2013) whose study argued that urbanization triggers the use of more technologically advanced equipment and machinery that is more energy efficient. In line with Sadorsky (2014) whose study argued that urbanization expands economic activities that uses a lot of electricity such as construction and infrastructure maintenance, the current study observed that urbanization had a significant positive effect on electricity consumption under both fixed and random effects.

Table 7: Panel data analysis results

Variables	Dynamic GMM	Pooled OLS	Fixed effects	Random effects
$ELECTR_{i,t-1}$	0.9822***	-	-	-
ICT	−0.0018	−0.0265	0.0313***	0.0314***
GDPPC	0.0079	0.6771***	0.1556***	0.1615***
URBAN	−0.0299***	−0.1150	1.3181***	1.2902***
ACCESS	−0.0158***	−0.1357**	0.2982***	0.2894***
RESOURCE	0.0018	0.0586***	0.0052	0.0002
FDI	0.0007	−0.0680**	−0.0068	−0.0073
FIN	0.0048*	0.0489	−0.0167*	−0.0167*
OPEN	−0.0007	0.1929***	0.0231	0.0374
HCD	0.0784***	1.3530***	0.2555***	0.2583***
Number of countries	21	21	21	21
Number of observations	420	420	420	420
Adjusted R-squared	0.8123	0.7420	0.6514	0.8684
F-statistic	J-static=409.00	134.92	1829.43	308.13
Prob (F-statistic)	Prob (J-statistic)=0.00	0.00	0.00	0.00

Source: Author's compilation from E-views. ***, **and * denote 1%, 5% and 10% levels of significance, respectively

Access to electricity was found to have had a significant negative impact on electricity consumption under the dynamic GMM and pooled OLS. On the other hand, a significant positive impact of access to electricity on electricity consumption was detected under the fixed and random effects methods. Resource endowment was found to have had a non-significant impact on electricity consumption under the dynamic GMM, fixed and random effects whilst pooled OLS shows a significant positive relationship running from resource endowment towards electricity consumption. The results generally resonate with Kwakwa et al. (2018) whose study argued that heavy machinery required to extract natural resources uses a lot of electricity energy.

The dynamic GMM shows that FDI had a non-significant positive effect on electricity consumption, in line with theoretical literature (Blanco et al., 2013). Pooled OLS shows a significant negative relationship running from FDI towards electricity consumption whilst fixed and random effects show that the impact of FDI on electricity consumption was negative but non-significant. The results imply that FDI reduced the levels of electricity consumption in line with Cheng and Yang's (2016) observation that foreign investors bring into the host country some advanced and smart technology which is energy efficient. A significant positive impact of financial development on electricity consumption was observed under the dynamic GMM yet pooled OLS shows that financial development had a non-significant positive effect on electricity consumption, findings which resonate with Sadorsky (2010) whose study noted that consumers and are able to purchase high electricity usage equipment through borrowing from financial markets if they are developed. On the contrary, fixed and random effects show that the impact of financial development on electricity consumption was negative and significant, in line with an argument that says developed financial markets enable firms and consumers to borrow money in order to purchase advanced technology which overall contributes to a reduction in energy consumption levels.

Under the dynamic GMM, trade openness had a non-significant negative effect on electricity consumption, in support of Grossman and Krueger's (1991) argument. Pooled OLS show a significant positive relationship running from trade openness towards electricity consumption yet trade openness was found to have had a non-significant positive impact on electricity consumption under the fixed and random effects, results which resonate with Tsaurai (2019a) whose study noted that the number of energy usage linked manufacturing activities multiplies if trade openness of a country is high. Last but not least, human capital development was found to have had a significant positive effect on electricity consumption across all the panel data analysis methods used, in support of Inglesi-Lotz and Morales's (2017) findings in the case of developing countries.

6. CONCLUSION

The study investigated the impact of ICT on electricity consumption in transitional economies using panel data analysis methods (dynamic GMM, pooled OLS, fixed effects, random effects) with annual secondary data ranging from 1995 to 2014. Majority of prior studies on the subject matter had not focused on the impact of ICT on electricity consumption but on energy consumption, which is a broader area. They also did not focus exclusively on transitional economies and they ignored both the dynamic characteristics of electricity consumption data and endogeneity issues.

The study revealed that electricity consumption is positively and significantly influenced by its own lag, in line with theoretical literature (Nayan et al., 2013). However, the impact of ICT on electricity consumption was found to be mixed. For example, the influence of ICT on electricity consumption was found to be negative and non-significant under the dynamic GMM and pooled OLS. Fixed and random effects observed that ICT had a significant positive impact on electricity consumption in emerging markets. It is against this backdrop that the current study urges transitional economies to develop and implement policies that ensures that ICT gadgets being used reduces the quantity of electricity consumption. In other words, transitional economies should focus on developing or importing energy efficient ICT gadgets in order to meet the required energy saving threshold levels. Future studies should investigate channels through which ICT influences electricity consumption, in line with Shahbaz et al. (2014) whose study noted that the relationship between ICT and electricity consumption is non-linear.

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