UNIVERSITY OF LEEDS

This is a repository copy of *Put on the light! Foreign direct investment, governance and access to electricity*.

White Rose Research Online URL for this paper:
https://eprints.whiterose.ac.uk/196542/

Version: Accepted Version

Article:
Aluko, OA orcid.org/0000-0001-5628-766X, Opoku, EEO, Ibrahim, M et al. (1 more author) (2023) Put on the light! Foreign direct investment, governance and access to electricity. Energy Economics, 119. 106563. ISSN 0140-9883

https://doi.org/10.1016/j.eneco.2023.106563

© 2023, Elsevier. This manuscript version is made available under the CC-BY-NC-ND 4.0 license http://creativecommons.org/licenses/by-nc-nd/4.0/.

Reuse
This article is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND) licence. This licence only allows you to download this work and share it with others as long as you credit the authors, but you can't change the article in any way or use it commercially. More information and the full terms of the licence here: https://creativecommons.org/licenses/

Takedown
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

White Rose university consortium
Universities of Leeds, Sheffield & York

eprints@whiterose.ac.uk
https://eprints.whiterose.ac.uk/

Put on the light! Foreign Direct Investment, Governance and Access to Electricity

[a,1] Olufemi Adewale Aluko, [b,2] Eric Evans Osei Opoku, [c,3] Muazu Ibrahim, [b,4] Nana Kwabena Kufuor

[a] Leeds University Business School, University of Leeds, Leeds, LS2 9JT, United Kingdom
[1] bnoaa@leeds.ac.uk

[b] Nottingham University Business School China, University of Nottingham Ningbo China, 199 Taikang East Road Ningbo, 315100, China
[2] eric-evans-osei.opoku@nottingham.edu.cn
[4] Nana.Kufuor@nottingham.edu.cn

[c] African Development Bank, Abidjan, Cote d'Ivoire
[3] m.u.ibrahim@afdb.org

Correspondence: bnoaa@leeds.ac.uk

Abstract

Despite efforts and commitments to achieve universal coverage of electricity, overall access in Africa is below expectation, making the attainment of the United Nations' Sustainable Energy for All Initiative almost a mirage for this region. The inability to mobilize adequate domestic financial resources and a seeming lack of political will (reflected in governance) have been highlighted as two of the major bottlenecks in the development of the electricity infrastructure in the African region. Regarding inadequate financial resources, we argue that inflows of foreign direct investment (FDI) and the influx of multinational enterprises can help a great deal. To this end, we investigate the impact of FDI on access to electricity and further examine whether this impact is contingent on the governance architecture. Using a sample of 36 African countries, and the IV-GMM method, our results suggest that, for the most part, the direct impacts of FDI and governance on access to electricity are positive. The role of governance on the FDI impact of electricity was established.

Keywords: FDI, Governance, Electricity Access, Africa
JEL Code: C33, O55, P18, Q40

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

1. Introduction

The inability to mobilize adequate domestic financial resources is a major setback in the development of the electricity infrastructure in Africa. Yet, the potential of foreign direct investment (FDI) in mitigating this set-back has been under-explored in the literature. Recent FDI literature in Africa has largely focused on the debate on how FDI influences economic growth (Aluko, Ibrahim & Vo, 2021; Acquah & Ibrahim, 2020), and environmental degradation (Opoku & Boachie, 2020; Bokpin, 2017). The dearth of attention on the importance of electricity access, including in the Sustainable Development Goals (SDGs) of the United Nations (UN), plus a persistent lack of it in Africa is what inspires this study. Thus, the present study seeks to examine the impact of FDI on access to electricity in Africa. We also consider it intriguing to further examine the role of governance in the impact of FDI on access to electricity. Lack of political will (reflected in weak governance environment) is identified as a major culprit in the slow pace and inefficacy of development initiatives in Africa (Bagoyoko and Gibert, 2009; Fosu, Bates & Hoffler, 2006). In the current context, good governance spurs better planning and efficiency, which potentially attracts investments from foreign investors and facilitates the efficacy of these investments in the sustainable development process of countries. Inefficient governance systems in developing countries limit their ability to plan, finance and develop the necessary infrastructure for power generation through to its distribution, resulting in inadequate access to electricity (Robbins & Perkins, 2012). The lack of clear electrification policies by many African countries due to poor governance could be potentially responsible for the low access to electricity in Africa. To the extent that access to electricity is largely seen as the responsibility of the state, issues surrounding governance and institutions have been gaining prominence regarding their implications for the extent of electricity coverage. Given the importance of access to electricity in reaching sustainable development in Africa, there is no better time to carry out this research than now. We contribute to the literature in two folds. First, we add evidence on how FDI inflows and governance explain cross-country differences in access to electricity in Africa. Second, given the nascent governance architecture on the back of Africa's FDI inflows, we present evidence on how governance plays a role in the effect of FDI on access to electricity in Africa. Thus, we show whether improved governance in Africa magnifies or dampens the effect of FDI on access to electricity.

Access to electricity has gained traction in recent policy discourse in Africa because the region ranks least among other regions of the world in terms of electricity access. The International Energy Agency (IEA) declared that about half (over 620 million) of the African population lack electricity, and approximately 730 million people in the region rely on traditional biomass energy (firewood, crop residue, dung and charcoal) (IEA, 2019). The usage of traditional biomass energy poses threat to human life and the environment (Adams, Klobodu & Opoku, 2016). The International Renewable Energy Agency (IRENA) has warned that 42% of Africa's population are at risk of living without electric power by 2030 if the energy consumption trajectory is not improved (IRENA, 2013). Improving the current energy needs of the continent would require additional generation capacity, building new energy sources (notably renewable energy), and

ensuring prudent energy demand management (Adom, Opoku & Yan, 2019). By recognizing the severity of energy poverty, the United Nations (UN) Secretary-General developed the Sustainable Energy for All Initiative in 2011, which has its first aim of achieving universal access to electricity by 2030.[1] While developing countries (including African countries) are committed to achieving the Sustainable Energy for All Initiative, the IEA estimates that achieving this goal would require an annual investment injection of $50 billion (IEA, 2014).[2] However, most African countries cannot meet this capital requirement and would need external financing. Due to this limitation, the involvement of foreign investors becomes imperative. Indeed, the involvement of foreign investors or multinational enterprises (MNEs) through FDI can help energy supply and could help light up the continent by providing electricity access to several communities.[3]

MNEs can contribute to increase in electricity generation and access along three main lines. Firstly, MNEs through corporate social responsibility (CSR) role can engage in the provision of infrastructure and services to host communities to either compensate for the negative externalities caused by their activities or as a way of gaining the acceptance of the host communities. MNEs can engage in these CSR activities as "nonmarket" competitive strategies –i.e., actions taken to portray MNEs in good light within their nonmarket environments to manage pressures, uncertainties and resource dependencies emanating from the influence and/or resistance of other nonmarket actors that can affect their economic performance– to complement their market strategies (Boddewyn & Doh, 2011). Secondly, MNEs can also be involved in electricity generation and access as a means of facilitating their own activities. They need stable power supply to carry out their essential production activities and increase business opportunities (D'Amelio, Garrone & Piscitello, 2016). Lastly, MNEs venture into power generation business as their main market strategies or profit ventures. The more MNEs venture into power generation, the better they supplement the inadequate supply by government utility firms, and hence the greater access to electricity by the public.

For many years, most African governments have consistently introduced policy incentives or attractive packages to attract FDI. Following the economic recovery programmes in the 1980s, the inflow of FDI into the African region has increased tremendously. For instance, Africa's FDI inflow increased from $1.94 billion between 1981 and 1985 to $2.96 billion in the 1986-1990 period and $4.91 billion between 1991 and 1995. The increase witnessed in the 2000s has been more impressive; for example, from $19.98 billion between 2001 and 2005, FDI to Africa increased to about $49.38 billion between 2006 and 2010 and to $52.90 billion between 2011 and 2015.[4] Figure 1 summarizes the trajectory of these inflows. The United Nations Conference on

[1] https://www.seforall.org/who-we-are/history
[2] The estimated $50 billion required investment in the energy sector amounted to about 13% of total capital investment (proxied with gross fixed capital formation, with a total of about $392 billion) in Sub-Saharan Africa (SSA) in 2014 (World Development Indicators Online).
[3] Unless otherwise indicated FDI and MNEs are used interchangeably.
[4] These statistics were obtained from UNCTADStats <https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx>

Trade and Development (UNCTAD) notes that since the early 2000s, the motive of MNEs to invest in Africa has gradually shifted from mainly the natural resource-based sectors, and services industries such as electricity, water and telecommunications are gaining prominence (UNCTAD, 2004). Streatfeild (2018) indicates that the total annual greenfield FDI announcements for new electricity generation projects in SSA averaged almost $10 billion between 2008 and 2018. Adams and Opoku (2017) note that the increase in FDI from the BRIC (Brazil, Russia, India, China) countries in recent years has contributed to about 35% increase in electricity supply in Africa. About 24% of Africa's FDI inflows went to the energy sector in 2015, making it the top FDI recipient sector in 2015, and electricity witnessed a 49% and 91% increase in capital investment and project numbers respectively (FDI Intelligence, 2016).

The rest of this the paper is as follows. The next section presents the literature review while Section 3 explains the methodology. In Section 4, we discuss the empirical findings, with Section 5 concluding the paper.

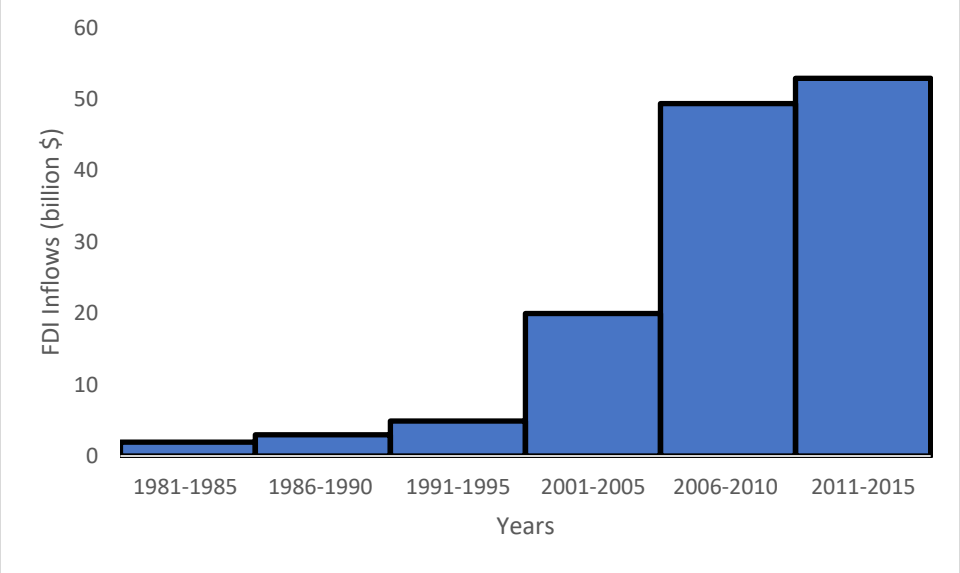

Figure 1: FDI Inflows to Africa
Source: Constructed by Authors with data from UNCTADStats

2. Literature review

2.1 Review of empirical studies

Prominently espoused in the FDI-growth theoretical expositions on the back of endogenous growth models is the notion that MNEs bring newer and better technologies, as well as capital expansion, into host countries through FDI, which resultantly spur economic growth. Host countries' long-run growth rate is expected to rise always if there is a predominance of FDI-related technology

transfers, capital inflow and productivity spillovers to local firms (De Mello, 1997). Opoku, Ibrahim and Sare (2019) highlight that the total factor productivity of developing countries is boosted due to valuable capital and technologies transferred into their economies through FDI, which facilitates production efficiency. In the current context, the advanced technologies introduced by MNEs due to their extensive R&D activities can lead to the improvements in existing ways as well as introduction of new ways to generate electricity. Furthermore, FDI may be associated with the expansion of electricity infrastructure in host regions. In that case, it would be reasonable to argue that FDI is capable of increasing access to electricity in host countries. FDI is seen as a good contributor to access to electricity (Panos, Densing & Volkart, 2016). It is worth mentioning here that, in developing countries, greater access to electricity increases socio-economic development (Kanagawa and Nakata, 2008) and labour productivity (Alam, Miah, Hammoudeh & Tiwari, 2018). By the same token, access to electricity alleviates poverty, facilitates economic productivity, and promotes human development (Sarkodie and Adams, 2020a).

Due to the dearth of a well-established theoretical model of FDI-electricity access nexus, *ad hoc* models have been developed on the empirical front to determine factors that matter for electricity access (Zhang, Shi, Zhang & Xiao, 2019). It can be intuitively inferred that MNEs can increase access to electricity due to the ability of FDI to facilitate infrastructural development.[5] Zhang et al. (2019) argue that infrastructural development is important for electricity access. Due to the importance of electricity for business activities, multinationals can develop electricity infrastructure to meet their needs which may raise access to electricity (D'Amelio et al. 2016). Indeed, there has been quite an extensive literature on how FDI is related to economic growth, poverty, financial development, environmental quality, and energy consumption among others over the past decades. In recent years, interest has emerged on the FDI-electricity access relationship in the empirical literature. Unfortunately, this relationship is still a very much underexplored area. Thus, evidence on the FDI- electricity access nexus is dearth although a few studies are notable.

D'Amelio et al. (2016) rely on bilateral FDI flows from 83 home countries into 15 host countries in sub-Saharan Africa (SSA) to evaluate the role of FDI in access to electricity over the period 2005-2011. Using the system GMM, the authors establish that FDI promotes access to electricity. However, Garrone, Piscitello and D'Amelio (2019), using a similar approach but with bilateral FDI from 73 home countries, demonstrate that FDI decreases electricity access. More recently, Nguea, Kaguendo and Noumba (2022) demonstrate that rural and urban areas in Africa experience increased access to electricity due to FDI. Tang (2009) estimates an ARDL model in the Malaysian context over the period 1970-2005 to show that FDI increases electricity consumption in the short and long run. Also, Tang (2009) conducts an error correction model-based Granger causality test to show that there is a long run bidirectional causal relationship between FDI and electricity

[5] See Rehman et al. (2020) for recent evidence on the effect of FDI on infrastructural development.

consumption. On the other hand, Bekhet and Othman (2011) employ the VECM and find that electricity consumption is not caused by FDI inflows in Malaysia for the 1971-2009 period. However, the authors observe that electricity consumption may boost the FDI receipts. Applying the VECM model, Alam (2013) compares India and Pakistan for the period 1975-2008 and reveals long run unidirectional causality from electricity consumption to FDI in India. In the case of Pakistan, the author discovers a long run unidirectional causality from FDI to electricity consumption.

D'Amelio et al. (2016) and Garrone et al. (2019) consider weak governance (institutional void) to be an impediment to improved access to electricity. Weak governance is considered as one of the reasons for poor rural electrification in many developing countries (Haanyika, 2006). Onyeji, Bazillian and Nussbaumer (2012) use the OLS estimation method and averaged data over the period 2000-2009 to show that countries with higher government effectiveness record greater access to electricity. An interesting argument by the authors is that government effectiveness is more important for SSA countries than non-SSA countries.

Trotter (2016) discovers that democratic governance spurs rural electrification and diminishes inequalities in rural/urban electrification. This discovery is based on pooled OLS estimations and data from 46 SSA countries spanning 1990-2010. Using a dataset consisting of 46 SSA countries for the period 1990-2017, Sarkodie and Adams (2020a) apply the Driscoll-Kraay non-parametric covariance estimator to pooled OLS model and demonstrate that the political environment promotes electricity access. The authors also find that the promoting role of the political environment in electricity access is conditioned by human development. Subsequently, Sarkodie and Adams (2020b) adopt the Bayesian estimation approach to show that increase in corruption reduces access to electricity in South Africa, using data between 1990 and 2017. With this, they indicate that corruption seems to impede the roadmap towards achieving energy for all.

To contribute to the debate, we investigate how governance and its various sub-components (control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability) independently play a role on FDI impact on access to electricity using a sample of 36 African countries over the period 2000-2017. Unlike D'Amelio et al. (2016) and Garrone et al. (2019), we focus on aggregate rather than bilateral FDI inflows. Our approach enables us to ascertain the implications of the investments undertaken by MNEs (FDI inflows) in Africa for access to electricity in the region and how the governance architecture of host African countries plays a role in the impact of these investments on access to electricity. In addition, we control for low/high FDI recipient countries and weak/strong governance countries in our sample to make a case for the electricity access trajectory in these different country groups.

2.2 An Overview of Access to Electricity in Africa

Table 1 reports the profile of electricity access for our sample of 36 African countries over the 2000-2017 period. The statistic for the year 2000 indicates that only 32.2% of the population in the sample had access to electricity. This is an indication that, by the turn of the present

millennium, majority of people living in Africa lacked access to electricity. However, over a decade later, more people have gained access to electricity. In the year 2012, 44.55% of the population was estimated to have access to electricity. Further improvement was witnessed in the year 2016 as the percentage of population with access to electricity in the study's sample has risen to 50.98% and this slightly rose to 51.82% in the following year. The statistics recorded for years 2016 and 2017 indicates that, on average, more than half of the population in the sample has gained access to electricity. Summarily, it can be inferred from Table 1 that access to electricity in Africa has witnessed upward trajectory although sluggishly. We observe a wide disparity between the countries with the most access (99.0%) (Mauritius) and with the least access (2.8%) (Chad).

Figure 2 shows the number of countries in our sample that had less than or equal to 50% electricity access rate over the years. The figure shows that in the year 2000, 29 countries had a maximum of 50% of its population with access to electricity. This number reduced over the years: 27 countries in the year 2004, 25 countries in the year 2008, 22 countries in the year 2012, and 19 countries in both years 2016 and 2017. This shows a steady improvement over the years. Despite these improvements, the average access rate in the sampled countries lags massively behind the world average. Though the improvements in access to electricity extend to rural areas in the region, rural areas remain most underserved with some countries having less than 5% rural electrification (Eberhard, Gratwick, Morella & Antmann, 2016; Eberhard, Rosnes, Shkaratan & Vennemo, 2011). On average, rural electricity access rate in Africa is about 25% (Blimpo & Cosgrove-Davies, 2019).

Table 1: Percentage of Population with Electricity Access in Africa

Year	2000	2004	2008	2012	2016	2017
Africa	32.18	36.37	39.83	44.55	50.98	51.82
Top Country	99.00	99.00	99.80	99.70	100.00	100.00
Least Country	2.84	3.50	4.80	6.50	9.30	9.30
World Average	78.30	80.01	82.24	84.83	87.94	88.83

NB: Africa refers to the average for all the countries in our sample for the respective years. Top and least countries refer to countries with the highest and least access to electricity in our sample for the respective years, respectively.
Source: Computed with data from the World Development Indicators of the World Bank

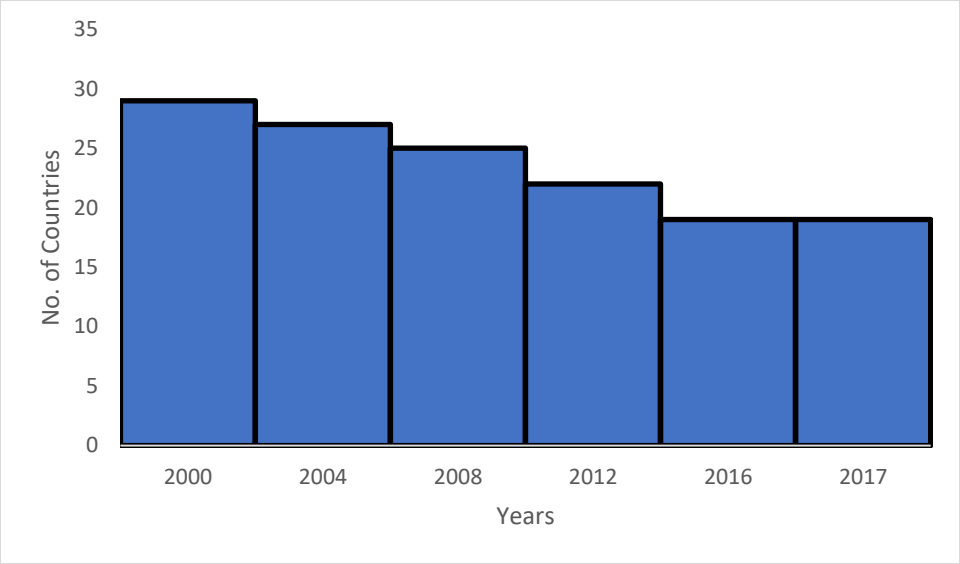

Figure 2: Number of Countries with Less or Equal to 50% of their Population with Access to Electricity
Source: Constructed with data from the World Development Indicators of the World Bank

2.3 MNEs' Participation in Promoting Access to Electricity in African countries: A Brief Insight

Some MNEs have engaged in the electrification of their host communities in African countries. For instance, in Guinea, electrification of mining towns and nearby towns have almost completely been undertaken by foreign mining corporations (Bolay & Knierzinger, 2021). Since the 1960s, South Africa's Anglogold Ashanti and Russia's Rusal have been very instrumental in providing electricity to mining towns (such as Siguiri, Kamsar and Mambia) in Guinea. The MNEs were able to increase access to electricity in these towns which generally lacked access to electricity before the intervention of MNEs. Also, Canada-based Giyani Metals had by January 2021 finished its study and plan of building a solar plant for its manganese-mining site in Botswana. It is considering different scenarios of constructing the solar facility ranging between 14 to 60 Megawatts (MW) and selling the surplus to the national grid of Botswana.[6]

Some MNEs have also entered into independent power projects (IPPs) agreements with various governments across Africa. The IPPs which account for about 13% of SSA's total installed generation capacity is the main medium of private investment in the power sector in Africa (Eberhard et al., 2016). For example, Electricite´de France Group, a major player in the global power sector has lots of power supply engagements in countries like Botswana, Mali, South Africa, and Senegal. In Ghana, the Sunon Asogli Thermal Power Station, a partnership with the majority (60%) of its shareholding by an MNE (the Shenzhen Energy Group Ltd of China) is a 560MW power station. Also, the Electricity Corporation of Ghana is in partnership with General Electric (GE) and other global power producers under a power purchase agreement to supply 400MW under the Bridge Power Project. According to GE, the project aims to provide electricity of nearly

[6] https://finance.yahoo.com/news/giyani-metals-corp-completion-solar-142300787.html

17% of Ghana's capacity.[7] Denham International Power, a US-based company, has been investing in the power sector in Africa since 2018, and together with its partners are developing about 3,000MW of projects across the African region.[8] They currently have ongoing projects in Burkina Faso, Egypt, Ghana, South Africa, and Zambia. Following the preceding statements, we argue that MNEs can promote electricity access in the African countries where they invest and operate. It follows then that FDI inflows can affect electricity supply/generation in Africa.

2.4 FDI, Governance, and Access to Electricity in Africa

Despite the gradual growth of IPPs and influx of MNEs that participate in the power sector in Africa, issues bordering electricity generation and distribution traditionally rest on the governments. Considering the high cost of electricity infrastructure and final consumption, the government comes in handy to assist with welfare packages mostly in the form of subsidy. In many African countries, the increase in access to electricity and subsidization of electricity cost for the final consumer are some of the major topics of political campaigns and debates. For example, the 2016 presidential election in Ghana hinged mainly on access, availability, and cost of electricity. It was a period that the country was in dire energy crisis. The incumbent government lost the election, and many political analysts attributed the loss partly to their inability to increase electricity access, reduce or stop power outages and rationing, and to reduce the cost of electricity amid the electricity crisis.[9] To many, poor governance was the cause of the electricity crisis of the country.

The IEA notes that achieving high governance standards in Africa is one of the main actions needed to unlock greater levels of energy sector investment to increase access to electricity in the region (IEA, 2014). The IEA further recounts that reforms in the energy sector, if accompanied by general governance reforms, could boost Africa's economy by about 30% by 2040 (IEA, 2014). The weak governance affecting development in the power sector of many African countries is well highlighted and as the IEA (2014) notes, they include corruption, inadequate regulatory and legal frameworks, weak institutions, poor transparency, and accountability. These factors can affect electricity supply and coverage in many ways; within a well-functioning institutional framework with minimal or lack of corruption, money collected from the purchase of electricity by consumers would not end up with government officials to promote selfish gains. All financial resources would be channelled to the electricity corporations, and this would make them relatively more financially resourced to raise funds to embark on expansion and extension projects. Dealing with corruption could also eliminate or reduce illegal electricity connections that badly affect power distributions and the finances of electricity corporations. Proper regulatory and legal frameworks would also ensure that electricity consumers do not delay in bill payment nor engage in power theft.

---

[7] https://www.ge.com/news/press-releases/ge-supply-power-generation-technology-ghanas-400-mw-bridge-power-project

[8] https://www.denhamcapital.com/news-article/denham-capital-highlights-its-three-african-power-portfolio-companies

[9] https://www.nytimes.com/2016/12/26/opinion/the-end-for-ghanas-power-cut-president.html
https://www.voanews.com/africa/ghanas-ndc-ponders-reasons-election-loss

Transparency and accountability would also ensure that governments are accountable to their citizens, making sure that basic amenities (like electricity) are accessed by everyone. Transparency and accountability are also important to ensure that governments pay their debts to electricity corporations. For instance, in Ghana, the government is the major debtor of the Electricity Corporation of Ghana (Kumi, 2017). In 2015, the government of Ghana announced that it owed the Electricity Corporation of Ghana about $249 million whereas the private sector owed $160 million. The outstanding debt is noted to have resulted in under-investment in electricity distribution infrastructure, worsening the challenge of total system losses of about 25% of electricity output.[10]

The foregoing indicates that improvements in governance can affect electricity supply and access. Issues of governance and activities of governments on electricity access also become so important due to the influence of government on the cost of electricity. van Beers and Strand (2013) note that political factors are crucial in determining energy prices. This is particularly critical in Africa, where energy policy is not just about efficiency but net political benefits as well (Adams et al., 2016). Inadequate access to electricity in the African region is somehow considered as a lack of political will, in the sense that many believe access would improve if governments invest more in the power sector, prioritize access to electricity considering its many benefits, and then improve governance by way of reducing corruption and becoming more transparent and accountable to their citizens.

In addition to the possible direct adverse effect on the energy sector in Africa, poor governance is often cited as one of the major bottlenecks to doing business in the region (IEA, 2014). This is very imperative to the energy sector as poor governance may deter the involvement of foreign investors in injecting capital into the energy sector to boost the provision of electricity. Foreign investment comes through FDI, and FDI inflows in Africa are largely believed to strive on good governance (UNCTAD, 2005). Following the dark ages of political instability and not so good governance post-independence (in the 1960s), the region was not considered a favourable investment destination (UNCTAD, 2005; Ernst & Young, 2020). Lucas (1990), for example, noted that developing countries did not see much capital inflows as the returns to investment could not match up the actual and perceived risks of ineffective governance, political risks, bribery, and corruption. However, with major political and governance adjustments since the 1980s through 1990s in many African countries, attention has been drawn to the region (Ernst & Young, 2020). The Economist Intelligence Unit (2012), for example, notes that among the major factors attracting much FDI into the African region in recent decades is improvement in governance reflected in increasing political stability in many countries. UNCTAD (2005, pp.21) emphasizes that "… better governance, understood to include increased openness, diminished public-sector control and more transparent and participatory policy procedures, should lower perceptions of risk and strengthen the hand of reformers in implementing adjustment programmes, thereby establishing a more

[10] https://m.peacefmonline.com/pages/local/news/201608/289588.php?storyid=100&

appropriate and predictable incentive structure for attracting foreign investors". In highlighting the importance of governance to FDI, a report by Ernst &Young (2020) notes that, due to Ghana's set-up in its governance structure, it has emerged as a major destination for the building of power plants by foreign companies like DeAngelis and Denham.

Good governance would not only lead to increase in FDI inflows but can ensure that the benefits and efficacy of FDI are optimum. Government institutions have the duty of keeping MNEs to task, to ensure that they stick to their core mandate and contribute to the building of host communities through CSR activities. For example, government institutions must ensure that MNEs registered to supply electricity do so, and that their activities contribute to sustainable development, and in that case do not pollute the environment or deplete resources. Good governance would also ensure that governments play their part in helping MNEs thrive by fostering competitive output markets, efficient allocation of goods and resources, provision of necessary infrastructure, increase in the scope for profitable business activities, protection and security of investments and investors among others (Adams & Opoku, 2015; Cole, Elliott & Zhang, 2009; Kayalvizhi & Thenmozhi, 2018; Kucera & Principi, 2017). The interplay of the elements of good governance would make these come to fruition. For instance, absence of or minimized corruption can ensure competitive biddings and tendering; government effectiveness would ensure independence of MNEs from political pressures; political stability would enhance the protection and long term commitments of MNEs; regulatory quality would ensure that government bring up policies that promote private sector development; rule of law, and voice and accountability would ensure that property rights are upheld, courts and the legal systems are fair, crime and violence are on the low, and people have freedom of expression (Kaufmann, Kraay & Mastruzzi, 2004).[11] These would contribute to the optimal operations of MNEs. Hence, in the case where activities of MNEs include the provision of electricity, governance indirectly affect the outcome (electricity supply and access) through increased FDI.

Notwithstanding the interplay between governance and FDI posited, another school of thought argues that FDI may flourish on the back of poor governance and autocracy (see Asiedu & Lien, 2011; Jensen, 2003; Li & Resnick, 2003). That is, some MNEs may prefer to cash on poor governance whereby government officials are not transparent and accountable to its citizens, limit freedom of speech, and engage in corrupt practices. These enable MNEs to exploit the system by conniving with some corrupt government officials. Besides, considering that there is a limit to electricity access (which is 100% access), it is intuitive to expect that there may be less role for FDI in the provision of electricity when the level of governance is high. This is because, as explained above, good governance facilitates the provision of electricity infrastructure and access. Thus, where there is good governance, the impact of FDI on electricity access may be low. This may be the reason why FDI has insignificant effect on electricity access in Malaysia and India with relatively high levels of governance (and electricity infrastructure for that matter), but positive

[11] Detail of these elements of governance is given under Section 3.1.

impact in Pakistan with a lower level of governance and electricity infrastructure (Bekhet and Othman, 2011; Alam, 2013).

3. Methodology

3.1 Model Specification

To examine the extent to which governance affects the impact of FDI on access to electricity in Africa, we follow existing empirical studies (Sarkodie & Adams, 2020a; Magnani & Vaona, 2016) and consider a dynamic baseline specification as below.

$$Access_{i,t} = \alpha + \emptyset FDI_{i,t} + \theta Gov_{i,t} + \psi(FDI * Gov_{i,t}) + \zeta Controls_{i,t} + \varepsilon_{it} \quad (1)$$

In equation 1, $Access_{i,t}$ denotes access to electricity of country i in period/year t, FDI denotes foreign direct investment, GOV represents a vector of governance variables, $FDI * Gov$ represents interaction terms of FDI and governance (or its sub-components). $Controls$ is a vector of other explanatory variables, which include indicators of gross domestic product, urbanization, trade openness, financial development, industry/industrialization and government budget/expenditure. ε is the error term and α is the intercept. $\emptyset$ captures the impact of FDI on access to electricity when governance and other variables are set to zero, θ captures the effect of governance when FDI and other variables are equal to zero, ψ captures the interaction effects of FDI and governance on the dependent variable ceteris paribus, and ζ measures the impact of other explanatory variables on the dependent variable, ceteris paribus.

In what follows we describe the variables in detail. The dependent variable, $Access$, is measured as the percentage of population with access to electricity, following Opoku, Kufuor and Manu (2021), Garrone et al. (2019), and D'Amelio (2016). This measure captures both infrastructural and non-infrastructural solutions to electricity access and accounts for the supply side of electricity access, including accessibility across the population rather than per capita expenditure (Garrone et al., 2019). Most of the studies on energy-FDI or energy-growth nexus captured energy as either fossil fuel energy consumption or energy use (Adom et al. 2019; Adams et al. 2016; Amri, 2016; Salim, Yao, Chen & Zhang, 2017). These measures of total energy usage do not reflect accessibility across the population and, for that matter, how much work there is to be done with regards to the spread of electricity infrastructure. Considering that Africa is the region with the least access to electricity in the world, we deem the use of our electricity access variable more important as it concerns all, rich or poverty-stricken communities. Electricity is important for all in many aspects, including lightening homes and offices, powering equipment and cooking, which may reduce stress and time wastage, as well as make education and health provisions more effective (Adams et al. 2016; Kanagawa & Nakata, 2007, 2008; Wandji, 2013). FDI is measured as foreign direct investment (net inflows) as a percentage of GDP. It is expected that the coefficient of FDI would be positive considering that inflows of FDI can increase access to electricity. The World Bank (2018) observes that several MNEs moving into areas without electricity or with unstable electricity may invest in energy to get their businesses thriving.

Gov is a vector of the six governance indicators from the World Governance Indicators (WGI) dataset. The WGI dataset is popular among researchers because it is more informative and provides better global coverage than alternative datasets on governance. It includes data on control of corruption (*Corruption*), government effectiveness (*GovtEffect*), political stability and absence of violence and terrorism (*PolStab*), regulatory quality (*RegQual*), rule of law (*RuleLaw*) and voice and accountability (*Voice*). *Corruption* measures the extent to which public power is exercised for private gain as well as ‘‘capture” of the state by elites and private interests; *GovtEffect* measures the quality of public and civil services and the extent of their independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies; *PolStab* measures the likelihood of political instability and/or politically-motivated violence, including terrorism; *RegQual* measures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development; *RuleLaw* measures the extent to which people have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence; *Voice* measures the extent to which a country’s citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The governance variables are originally measured on a scale of -2.5 (worst) to 2.5 (best).

From these six governance indicators, we create a composite governance variable ‘*Governance*’ using the principal component analysis (PCA). We use both the composite measure and the sub-components of governance in our analyses. For ease of comparison and analysis, we normalized the composite *Governance* and all the sub-component variables to range between 0 and 1, with higher values indicating better governance. Considering the above exposition, $FDI * Gov$ in equation 1 is therefore a vector of seven interaction terms; these are the interaction terms of FDI with control of corruption (FDIxCorruption), government effectiveness (FDIxGovtEffect), political stability (FDIxPolStab), regulatory quality (FDIxRegQual), rule of law (FDIxRulelaw), voice and accountability (FDIxVoice) and the composite governance variable (FDIxGovernance). We posit FDIxGovernance as our main interaction term whilst we also examine the six governance indicators for a robust understanding of our findings. It is worthy to note that in to capture the role of governance in the impact of FDI on electricity access, it is necessary to compute the marginal effects. We obtain the marginal effects of FDI on access to electricity using equation 2. Following this, we evaluate the effect of FDI at the mean and various percentile values of the governance variables.

$$\frac{\partial Access_{i,t}}{\partial FDI_{i,t}} = \emptyset + \psi * Gov_{i,t} \qquad (2)$$

Guided by existing studies (Garrone et al., 2019; Asumadu-Sarkodie & Yadav, 2019; D’Amelio et al., 2016), we include the following control variables: GDP measured as the log of real GDP, urbanization measured as the log of urban population, trade openness measured as total trade

(exports plus imports) as percentage of GDP, financial development measured as credit to the private sector as percentage of GDP, industry measured as industry value added as a percentage of GDP, and government budget measured as final government consumption expenditure as percentage of GDP.

3.2 Data

Apart from the governance variables, which are obtained from the World Governance Indicators (WGI) database of the World Bank, all other variables are obtained from the World Development Indicators (WDI) database of the World Bank. The sample size of the study is 36 countries over the period 2000-2017 (see Table A1 in the Appendix for the list of countries included). The choice of the countries and the sample period are based on data availability and the quest to have many countries as possible. Table A2 (in the Appendix) presents a summary of the description of variables while Table 2 reports their summary statistics.

Table 2: Summary Statistics of Variables

Variable	Obs	Mean	Std. dev.	Min	Max
Access	648	41.1	30.1	2.8	100.0
FDI	648	3.7	5.0	-4.9	57.8
GDP	648	23.3	1.4	20.4	26.9
Trade	630	68.5	32.1	19.1	225.0
Fin Dev	636	25.0	27.9	2.2	160.1
Urbanization	648	37.9	16.5	8.2	89.0
Industry	635	23.4	8.9	2.1	61.7
Govt Budget	585	14.9	6.4	1.0	43.5
Governance	648	0.4	0.2	0.0	1.0
Corruption	648	0.4	0.2	0.0	1.0
GovEffect	648	0.4	0.2	0.0	1.0
PolStab	648	0.6	0.2	0.0	1.0
RegQual	648	0.5	0.2	0.0	1.0
RuleLaw	648	0.5	0.2	0.0	1.0
Voice	648	0.5	0.2	0.0	1.0

As shown in Table 2, the mean of electricity access rate is about 41%. The minimum electricity access rate is about 2.85% and this is observed for Chad in 2000. The maximum electricity access rate in the sample is 100%, which is observed for North African countries, namely Egypt, Morocco, and Tunisia. Regarding the FDI variable, the mean value is about 3.67%. The mean value of the composite governance variable is about 0.45, indicating that on the average, governance level in our sampled countries is relatively low. All the individual governance indicators except one (regulatory quality) have mean values below 0.5, buttressing the low governance as portrayed by the composite indicator.

3.3 Estimation method

In this study, we employ the instrumental variable generalized method of moments (IV-GMM) technique by Baum et al. (2003). A major advantage of this estimation method is that it accommodates potential issues of endogeneity, which bedevils many empirical analyses in economics. The IV-GMM estimator permits consistent estimations in the presence of autocorrelation (AR(1)) within panels and heteroscedasticity (Baum et al., 2003). In the IV-GMM implementation, we employ the Driscoll-Kraay standard errors robust to cross-sectional dependence (CSD). A potential econometric problem in panel data model estimation is cross-sectional dependence (CSD) and its presence may cause estimates to be biased. Panel data is most likely to show CSD in the errors, which may be due to the presence of common shocks, unobserved components of the error term and spatial dependence (De Hoyos & Sarafidis, 2006). In cross-country panel data model estimations (as in this paper), the tendency for CSD to be present is high because the countries share a common region and are economically integrated with each other; hence, shocks from one country are likely to affect other countries in the region. Hoechle (2007, p.281) argues that "Driscoll-Kraay standard errors are well-calibrated when cross-sectional dependence is present". These standard errors are also robust to heteroskedasticity and autocorrelation.

The application of an instrumental variable (IV) estimator is straightforward; if the error distribution is considered not independent of the regressors' distribution, suitable set of instruments are employed (Baum et al., 2003). However, in applied research several hard choices come to play. The major challenge has been the difficulty in identifying valid instrumental variables. Many of the instrumental variables adopted in empirical studies are considered either invalid, weak or both (see Bazzi & Clemens, 2013). Durlauf, Johnson and Temple (2005) decry the use of valid instrumental variables and state that the belief that it is easy to find valid instrumental variables is awfully mistaken. The use of external instruments is fraught with many inaccuracies due to the qualitative and non-objective judgment in their selection (Durlauf et al., 2005). Considering the difficulty in finding external instruments and justifying their validity, in this study, we rely on the use of the lags of the variables considered as endogenous as instruments in the IV-GMM estimation.[12] The Hansen J-statistics is used to test the reliability of the IV-GMM estimates. The estimates of the IV-GMM are reliable when the Hansen J-statistics rejects the null hypothesis that the instruments are over-identified.

4. Results and Discussion

Table 3 reports the empirical results of the paper. The Table presents 4 models; model 1 includes only FDI as the main explanatory variable, model 2 includes only the composite governance variable as the main explanatory variable, model 3 includes both FDI and composite governance variables, and model 4 includes the variables in model 3 in addition to the interaction terms of FDI

[12] We considered the main explanatory variables in the estimations and GDP as endogenous variables. We used the first and second lags as instruments.

and the composite governance variables. In model 1, the coefficient of the FDI variable is positive but statistically insignificant. In model 2, where only governance is the main explanatory variable, the results show governance to have a positive and statistically significant (at 5% level) coefficient. In model 3, where FDI and governance are put in the same model, they both have positive and statistically significant coefficients (at 5% level for FDI and 10% for governance). In model 4, which happens to be the main estimation of interest, the coefficient of both FDI and governance variable remain positive and statistically significant. The variable representing the interaction between FDI, and governance registers a negative coefficient and only slightly significant statistically (10% level).

Table 3: Access to Electricity, FDI and Governance (Composite Governance Variable)

	Model 1	Model 2	Model 3	Model 4
FDI	0.074		0.075**	0.306**
	(0.045)		(0.038)	(0.130)
Governance		4.843**	4.459*	4.724**
		(1.882)	(2.299)	(2.228)
Control Variables:				
GDP	9.480***	9.697***	9.767***	11.208***
	(2.217)	(2.073)	(1.794)	(1.342)
Trade	-0.042***	-0.029***	-0.042***	-0.021
	(0.015)	(0.009)	(0.014)	(0.016)
Fin Dev	0.050*	0.038	0.040	0.032
	(0.027)	(0.030)	(0.028)	(0.026)
Urbanization	1.294***	1.329***	1.322***	1.196***
	(0.079)	(0.064)	(0.055)	(0.076)
Industry	-0.037*	-0.038*	-0.040**	-0.059***
	(0.020)	(0.021)	(0.019)	(0.018)
Govt Budget	0.076**	0.098**	0.081**	0.079**
	(0.037)	(0.039)	(0.037)	(0.033)
FDIxGovernance				-0.790*
				(0.434)
Observations	505	505	505	505
Countries	36	36	36	36
Hansen J	0.527	0.200	0.349	0.421
Hansen J p-value	0.7682	0.9050	0.9506	0.9807
R^2	0.659	0.660	0.660	0.649
Adjusted R^2	0.629	0.630	0.630	0.616

NB: The dependent variable in all the models is *Access* (percentage of population with access to electricity). The

governance variable used is the composite measure. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Specifically, the results generally indicate that holding other variables constant, FDI is directly associated with higher access to electricity in our sampled African countries. Focusing on only the FDI variable, the results indicate that a 1% increase in FDI relates to about 0.306% increase in access to electricity, all other things being equal (model 4, Table 3). The results are therefore suggestive that FDI inflows to our sampled countries could contribute to expansion of access to electricity. Indeed, a key reason for the electricity access-enhancing effect of FDI might be that MNEs largely need reliable electricity to be able to effectively conduct their business and productive activities. It is therefore plausible to expect that higher influx of MNEs into countries increases access to electricity through the development of local electricity infrastructure which are near-necessities for their day-to-day activities. FDI can hence be used as a viable strategy for lightening up countries as it has the potency of increasing peoples' access to electricity. In addition, African governments' initiative of welcoming IPPs has seen several FDI flowing into the energy sector in recent years (Eberhard et al., 2016). Also, some MNEs as agents of development (Banks et al., 2016), provide infrastructure (including electricity infrastructure) as their CSR. Examples of MNEs that have been involved in electricity generation in Africa include Electricité de France Group, Sunon Asogli Thermal Power Station, and Denham International Power. The results of FDI corroborate those of Tang (2009), D'Amelio et al. (2016), Garrone, Piscitello and D'Amelio (2019).

Regarding the governance variable, the results indicate that generally governance does have an independent (direct) effect on access to electricity as the coefficient of governance is found to be statistically significant and positive in models 2-4 (Table 3). This is quite intuitive, as one would expect that good governance would translate into improvement in the wellbeing of the populace, considering that governance quality is a prerequisite for the provision of public goods, including electricity (Ahlborg et al, 2015). It has largely been argued that the success of economic activities is strongly tied to good governance (institutions) (Acemoglu, Johnson & Robinson, 2001; Acemoglu & Robinson, 2010). Acemoglu et al. (2001) show that institutions remain the main underlying factor accounting for differences in development, resulting in different per capita income among countries. They explain that countries with stronger and better institutions improve the living standards of their citizens by way of generating greater income levels. The results of the direct impact of governance are generally in line with those of Trotter (2016), Sarkodie and Adams (2020a), and Sarkodie and Adams (2020b), who generally indicate that improvements in the political environment, institutional and governance framework and reduction in corruption enhance access to electricity in developing countries.

Turning to the effect of the interaction term between FDI and governance, we find the coefficient to be negative and statistically significant (at 10% level). Thus, while FDI enhances access to electricity, the impact is less when there is good governance perhaps because other financial resources might have already been utilized effectively to facilitate access to electricity. In other words, there is more reliance on FDI for access to electricity when governance is not strong. To

better gauge the role of governance on the impact of FDI on electricity access, it is necessary to compute the marginal effects. Specifically, we evaluate the marginal effect of FDI on access to electricity at the mean and various percentiles of governance, using equation 2. Estimates of the marginal effects as well as their levels of significance (for model 4 in Table 3) are reported in Table 3.1. The computed coefficients show that the marginal effect of FDI on access to electricity evaluated at the mean value of governance is statistically insignificant. This indicates that, FDI does not play a role in improving electricity access in countries with average levels of governance. Positive and statistically significant marginal effects of FDI on electricity access are found for levels of governance up to the 25th percentile, whereas the upper percentiles of governance show insignificant marginal effects (Table 3.1). Our interpretation is that at lower levels of governance, governments are unlikely to mobilize enough financial resources to improve access to electricity, leaving a larger lacuna for FDI to fill. Conversely, there might be less role for FDI in facilitating access to electricity when governance levels are high. Thus, the role of FDI in improving electricity access is more relevant in low-income countries with low levels of governance.

Table 3.1: Marginal Effects (Composite Governance Variable)

Marginal Effects	Coefficient	Std. Err.	P-value
Mean	-0.046	0.078	0.551
Percentiles			
1%	0.291**	0.311	0.030
5%	0.240**	0.095	0.012
10%	0.201***	0.076	0.008
25%	0.088**	0.036	0.018
50%	-0.054	0.081	0.509
75%	-0.142	0.127	0.262
90%	-0.290	0.206	0.159
95%	-0.410	0.271	0.130
99%	-0.461	0.299	0.123

** $p < 0.05$, *** $p < 0.01$

Having discussed the results for the composite governance variable and getting an idea of the general effect of governance, we turn to focus on the individual subcomponents of governance. Table 4 reports results using the individual subcomponents of the governance variable. Respectively, models 1-6 contain results using control of corruption (*Corruption*), government effectiveness (*GovtEffect*), political stability and absence of violence and terrorism (*PolStab*), regulatory quality (*RegQual*), rule of law (*RuleLaw*) and voice and accountability (*Voice*). Like the previous results (in model 4, Table 3), the FDI variable consistently shows positive coefficients in all the estimated models (see Table 4), however the coefficients are statistically significant in three models (models 3, 4, 6). This gives a general indication that improvement in FDI can enhances access to electricity. Similar to the effect of governance as found in Table 3, the coefficients of all the subcomponents of governance are positive and statistically significant, except in the case of voice and accountability (*Voice*) in column 6 (Table 5), where the coefficient

is negative. The coefficient of *Voice* is counter-intuitive and may be because the quality of the variable in capturing governance is low. Generally, the results imply direct and statistically significant effect of governance on access to electricity: all things being equal, improvement in corruption, government effectiveness, political stability and absence of violence and terrorism, regulatory quality and rule of law are found to be associated with enhanced access to electricity.

Table 4: Access to Electricity, FDI and Governance (Individual Governance Variables)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
FDI	0.246	0.795	0.319***	0.362**	0.235	0.136*
	(0.225)	(0.557)	(0.124)	(0.161)	(0.149)	(0.071)
Corruption	6.787**					
	(3.095)					
FDIxCorruption	-0.832					
	(1.372)					
GovtEffect		14.462***				
		(4.969)				
FDIxGovtEffect		-2.343				
		(1.687)				
PolStab			1.569*			
			(0.882)			
FDIxPolStab			-0.589*			
			(0.338)			
RegQual				5.479**		
				(2.520)		
FDIxRegQual				-0.639*		
				(0.347)		
RuleLaw					6.320**	
					(2.844)	
FDIxRulelaw					-0.592	
					(0.534)	
Voice						-4.255***
						(1.037)
FDIxVoice						-0.216
						(0.207)
Control Variables:						
GDP	11.255***	13.226***	11.216***	9.406***	10.246***	9.181***
	(2.475)	(2.452)	(1.990)	(2.012)	(1.559)	(1.947)
Trade	-0.017	0.028	-0.023	-0.036***	-0.025	-0.032**
	(0.051)	(0.040)	(0.021)	(0.014)	(0.016)	(0.015)
Fin Dev	0.026	-0.011	0.032	0.045	0.034*	0.060**
	(0.029)	(0.031)	(0.026)	(0.027)	(0.020)	(0.023)
Urbanization	1.222***	1.124***	1.222***	1.269***	1.255***	1.284***
	(0.210)	(0.154)	(0.095)	(0.078)	(0.122)	(0.092)
Industry	-0.065**	-0.105**	-0.066***	-0.043***	-0.051***	-0.039**
	(0.032)	(0.044)	(0.020)	(0.015)	(0.017)	(0.018)
Govt Budget	0.095***	0.104***	0.103***	0.052	0.074**	0.087***
	(0.037)	(0.032)	(0.034)	(0.035)	(0.037)	(0.027)

Observations	505	505	505	505	505	505
Countries	36	36	36	36	36	36
Hansen J	0.257	3.765	1.209	1.056	0.815	1.608
Hansen J p-value	0.992	0.439	0.877	0.901	0.937	0.807
R^2	0.647	0.519	0.654	0.658	0.657	0.660
Adjusted R^2	0.614	0.474	0.622	0.626	0.625	0.628

NB: The dependent variable in all the models is *Access* (percentage of population with access to electricity). The columns, 1-6, respectively represent using corruption, governance effectiveness (GovtEffect), political stability (PolStab), regulatory quality (RegQual), rule of law (RuleLaw) and Voice (voice and accountability) as the measures of governance. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.1: Marginal Effects (Individual Governance Variables)

Marginal Effects	Coefficient	Std. Err.	P-value	Marginal Effects	Coefficient	Std. Err.	P-value
Corruption				**RegQual**			
Mean	-0.057	0.278	0.837	Mean	0.031	0.045	0.497
Percentiles				Percentiles			
1%	0.227	0.194	0241	1%	0.312**	0.135	0.021
5%	0.192	0.136	0.158	5%	0.194**	0.076	0.011
10%	0.147**	0.065	0.022	10%	0.160***	0.061	0.009
25%	0.078	0.059	0.187	25%	0.095**	0.041	0.020
50%	-0.030	0.232	0.899	50%	0.026	0.047	0.571
75%	-0.171	0.465	0.713	75%	-0.026	0.066	0.698
90%	-0.317	0.704	0.653	90%	-0.087	0.095	0.361
95%	-0.381	0.811	0.638	95%	-0.162	0.134	0.22
99%	-0.512	1.027	0.618	99%	-0.232	0.170	0.172
GovtEffect				**RuleLaw**			
Mean	-0.246	0.196	0.209	Mean	-0.033	0.098	0.741
Percentiles				Percentiles			
1%	0.575	0.400	0.150	1%	0.223	0.139	0.107
5%	0.470	0.324	0.147	5%	0.165*	0.0870.087	0.059
10%	0.352	0.240	0.143	10%	0.138**	0.066	0.034
25%	0.044	0.038	0.246	25%	0.057*	0.030	0.063
50%	-0.200	0.163	0.221	50%	-0.040	0.105	0.704
75%	-0.519	0.391	0.184	75%	-0.111	0.168	0.507
90%	-0.975	0.718	0.175	90%	-0.168	0.218	0.442
95%	-1.120	0823	0.174	95%	-0.257	0.298	0.389
99%	-1.400	1.025	0.172	99%	-0.338	0.371	0.362
PolStab				**Voice**			
Mean	-0.006	0.082	0.939	Mean	0.033	0.059	0.575
Percentiles				Percentiles			
1%	0.275***	0.100	0.006	1%	0.130**	0.066	0.049
5%	0.218***	0.072	0.003	5%	0.108**	0.052	0.036

10%	0.187***	0.059	0.001	10%	0.097**	0.046	0.035
25%	0.102**	0.044	0.020	25%	0.077*	0.042	0.066
50%	-0.032	0.096	0.735	50%	0.032	0.060	0.600
75%	-0.098	0.130	0.452	75%	-0.005	0.089	0.953
90%	-0.178	0.175	0.307	90%	-0.038	0.118	0.749
95%	-0.218	0.197	0.268	95%	-0.053	0.132	0.686
99%	-0.241	0.210	0.250	99%	-0.072	0.149	0.630

* p < 0.10, ** p < 0.05, *** p < 0.01

Regarding the interaction terms, except for the interaction terms of FDI with political stability and regulatory quality (i.e., FDIxPolStab, FDIxRegQual respectively) that show slightly statistically significant (10% level) negative coefficients, all other interaction terms (i.e., FDIxCorruption, FDIxGovtEffect, FDIxRulelaw and FDIxVoice) are statistically insignificant. The interpretation is that the impact of FDI on electricity access is less when there is good political stability and regulatory quality. Thus, access to electricity is less dependent on FDI when there is improved political stability and regulatory quality. These two variables (political stability and regulatory quality) may be driving the negative coefficient found for the interaction term of FDI and the composite governance variable (FDIxGovernance) reported in Table 3 (model 4). However, corruption, government effectiveness, rule of law, and voice and accountability seem not to influence the effect of FDI in enhancing access to electricity. As before, we evaluate the marginal effect of FDI on access to electricity at the means and various percentiles of the individual subcomponents of governance, using equation 2. The results are reported in Table 4.1. At the mean levels of all the individual subcomponents of governance, the results show statistically insignificant coefficients. This generally indicates that FDI does not play a role in improving electricity access in countries with average levels of the subcomponents of governance. In considering the percentile values, the results only show that it is only at the lower percentile values of the subcomponents of governance (up to 25%) that improvement in FDI enhances access to electricity.

In the next set of analyses, we split the sample into various groups to ascertain changes, if any, in the results. In Table 5, we report results focusing on the composite governance variable for various subsamples; strong governance group (model 1), weak governance group (model 2), high FDI group (model 3), low FDI group (model 4) and SSA group (model 5).[13] These analyses enable us to ascertain whether there exists differences in access to electricity conditional on whether or not a country receives high FDI, has strong governance or is in the SSA sub-region. The results show that, except for the low FDI sample, increase in FDI is found to be associated with increase in

[13] The governance variable is extracted by principal component analysis (PCA) from the six governance variables: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. We rescaled the PCA governance variable to range between 0 and 1, with 0 indicating weakest governance and 1 best governance. The data on FDI, access to electricity and governance are averaged across the sampled period. To the derive weak and strong governance countries, following a similar grouping in Asiedu and Lien (2011), the weak governance group is made up of countries with governance scores less than 0.5, and those with scores equal or greater than 0.5 form the strong governance group. To get the SSA sample, we exclude North African countries of Egypt, Morocco, and Tunisia. The North African countries relative to SSA countries have higher access to electricity.

access to electricity. Specifically, we find that in strong governance, weak governance, high FDI and SSA countries' samples, the direct effect of FDI is positive and statistically significant. However, the effect of FDI in countries receiving low FDI is statistically insignificant. Understandably, FDI may not be significant determinant of energy infrastructure in countries receiving low amounts of FDI, hence access to electricity is not significantly improved. It is only in the weak governance and high FDI samples (models 2 and 3, Table 5), that governance is found to have direct effect (positive and statistically significant). This implies that, all other things being equal, improvement in governance is expected to enhance access to electricity in countries that have weak governance and receive high FDI. For the other samples, governance is found not to have direct effect on access to electricity. Regarding the interaction term (FDIxGovernance), the coefficient is negative and statistically significant in all the samples except the low FDI countries' sample (which though registers negative coefficient is statistically insignificant). Consistent with the previous results, the reliance on FDI for electricity access is less when the level of governance is high. In Table 5.1, we also report the marginal effects. At the mean levels of governance, the results show statistically insignificant coefficients for all the subsamples. This generally indicate that FDI does not play a significant role in improving electricity access where there are average levels of governance (Table 5.1). In considering the various percentiles of the governance variable, the results show that for the low FDI countries' sample, the coefficients are all statistically insignificant. For the other samples, such as strong and weak governance countries' samples, positive and statistically significant coefficients are found for margins of governance at lower percentiles, and for higher percentiles, the coefficients are found to be negative. Thus, in these samples also, FDI enhances electricity access significantly where there are lower levels of governance, but the effect is insignificant where the levels of governance are high.

Table 5: Access to Electricity, FDI and Governance (Sub-Samples)

	Strong Gov	Weak Gov	High FDI	Low FDI	SSA
FDI	4.195**	0.249***	0.920**	-0.736	0.406***
	(1.707)	(0.095)	(0.401)	(1.109)	(0.148)
Governance	-1.692	6.362***	21.817***	4.061	1.588
	(9.755)	(2.063)	(4.636)	(7.582)	(2.055)
FDIxGovernance	-6.306**	-0.752**	-3.639**	0.920	-1.071*
	(2.733)	(0.322)	(1.570)	(2.314)	(0.584)
Control Variables:					
GDP	16.075***	9.337***	19.037***	9.071***	13.640***
	(5.744)	(1.667)	(2.966)	(2.644)	(2.025)
Trade	-0.051	0.007	0.208**	-0.027*	-0.019
	(0.048)	(0.017)	(0.099)	(0.014)	(0.028)
Fin Dev	0.011	0.148***	-0.188**	0.032	-0.020
	(0.031)	(0.020)	(0.087)	(0.031)	(0.031)
Urbanization	0.694	1.328***	0.906***	1.435***	1.059***
	(0.451)	(0.118)	(0.126)	(0.371)	(0.112)

Industry	0.123**	-0.162***	-0.004	-0.197***	-0.059***
	(0.057)	(0.031)	(0.113)	(0.050)	(0.020)
Govt Budget	0.038	0.044	0.234***	-0.114	0.082***
	(0.114)	(0.056)	(0.075)	(0.115)	(0.030)
Observations	185	320	196	309	457
Countries	12	22	13	21	31
Hansen J	4.035	0.366	1.227	3.935	0.612
Hansen J p-value	0.401	0.985	0.874	0.415	0.961
R^2	0.720	0.616	-0.386	0.628	0.642
Adjusted R^2	0.684	0.575	-0.561	0.588	0.608

NB: The dependent variable in all the models is *Access* (percentage of population with access to electricity). The governance variable used is the composite measure. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.1: Marginal Effects (Individual Governance Variables)

Marginal Effects	Coeff.	Std. Err.	P-value	Marginal Effects	Coeff.	Std. Err.	P-value
Strong Governance				**Weak Governance**			
Mean	-0.087	0.417	0.835	Mean	0.001	0.036	0.983
Percentiles				Percentiles			
1%	4.071**	1.655	0.014	1%	0.234***	0.089	0.008
5%	3.670**	1.485	0.014	5%	0.186***	0.070	0.008
10%	3.353**	1.353	0.013	10%	0.148***	0.056	0.008
25%	2.428**	0.974	0.013	25%	0.038	0.032	0.232
50%	1.323**	0.561	0.019	50%	-0.093	0.066	0.153
75%	0.617	0.389	0.113	75%	-0.178*	0.099	0.071
90%	-0.561	0.542	0.301	90%	-0.318**	0.156	0.042
95%	-1.522*	0.893	0.088	95%	-0.433**	0.205	0.035
99%	-1.931*	1.056	0.068	99%	-0.482**	0.226	0.033
High FDI				**Low FDI**			
Mean	-0.725**	0.320	0.023	Mean	-0.328	0.248	0.185
Percentiles				Percentiles			
1%	0.848**	0.370	0.022	1%	-0.718	1.065	0.500
5%	0.616**	0.272	0.024	5%	-0.659	0.922	0.475
10%	0.434**	0.197	0.027	10%	-0.613	0.810	0.449
25%	-0.100	0.076	0.191	25%	-0.478	0.499	0.336
50%	-0.738**	0.325	0.023	50%	-0.317	0.243	0.192
75%	-1.145**	0.498	0.022	75%	-0.214	0.333	0.521
90%	-1.825**	0.790	0.021	90%	-0.042	0.705	0.952
95%	-2.379**	1.029	0.021	95%	0.098	1.043	0.925
99%	-2.616**	1.131	0.021	99%	0.158	1.190	0.895
SSA							
Mean	-0.065	0.126	0.609				

Percentiles			
1%	0.385***	0.137	0.005
5%	0.317***	0.103	0.002
10%	0.263***	0.078	0.001
25%	0.106**	0.053	0.047
50%	-0.082	0.135	0.545
75%	-0.202	0.197	0.307
90%	-0.402	0.304	0.187
95%	-0.565	0.392	0.150
99%	-0.635	0.430	0.140

* p < 0.10, ** p < 0.05, *** p < 0.01

Regarding the control variables, we observe that increase in GDP is associated with statistically significant increase in access to electricity in all the estimated models (Tables 3-5). This finding is expected as higher GDP translates to higher incomes. In this endeavour, a representative household switches to modern energy source (electricity) as income increases. Furthermore, as countries' level of economic growth improves, there is a higher likelihood of governments to extend electricity to areas hitherto not connected. This relies on the assumption that a country's fuel choice and electricity connectivity in particular is also dependent on the overall level of GDP and as such, improved GDP is associated with higher electricity connectivity. This outcome is similar to that found in Sarkodie and Adams (2020a).

The urbanization variable is also found to be positive and statistically significant in almost all the estimated models, indicating that increase in urbanization is associated with increase in access to electricity. The government budget/expenditure variable is found to generally register positive and statistically significant coefficients, indicating that increase in government spending, especially if it is on infrastructure, might increase access to electricity. Electricity generation and supply require huge infrastructural investment mainly from the side of the government. As the IEA (2019) notes investment in energy in Africa is just about 4% of the global energy investment and to achieve electricity for all would require an annual investment of about $50 billion. Trade openness and industry variables generally register negative coefficients (Tables 3-5), indicating that increased openness of the economy to trade and increase in industrialization exert negative influence on access to electricity. Considering that our measure of access to electricity reflects the proportion of the population that have access, it could be that increase in industrialization and output for trade compete with the scarce available electricity available to households, hence reducing the number of people with access. The financial development variable generally shows positive but statistically insignificant coefficients (with just pockets of negative coefficients). The generally statistically insignificant effect of financial development on access to electricity may be explained by the sample in question. Generally, improvement in financial development would empower households to get access to cheaper credit and other financial facilities to enhance access and usage of electricity. However, in many African countries the provision of energy infrastructure and expansion of access to electricity are mainly tasks of governments. Hence, individuals obtaining facilities from the financial sector may channel these facilities to other aspects of their lives - such

as children's education and businesses – rather than accessing electricity.

5. Conclusion

As part of efforts to increase global access to electricity, the Sustainable Energy for All Initiative was launched in 2011 with the aim of ensuring universal access to modern energy services by 2030. In a similar vein, the UN in the 2015 Sustainable Development Goals (SDGs) recognizes, as its seventh goal (SDG 7), the need for countries to promote access to affordable and clean energy to achieve sustainable development by 2030. In this pursuit of energy-for-all objective, African countries appear to lag due to constraints that include lack of adequate domestic financial resources and good governance. Considering that sophisticated technologies and financial resources often transferred into countries through FDI may provide affordable, clean and modern energy, we examine the impact of FDI on access to electricity in Africa. We acknowledge the importance of the governance architecture for FDI inflows and access to electricity. Accordingly, we investigate how FDI, governance and their interactions combine to influence access to electricity relying on a sample of 36 African countries over the period 2000-2017. Using the IV-GMM estimation method, our results suggest that, for the most part, FDI inflows are associated with increase in access to electricity in Africa. The robustness of the estimates implies that, FDI could contribute to lightening up African countries. In this case, governments should pursue policies that tend to attract the much-needed FDI since the influx of MNEs heighten electricity access which is exceedingly relevant for attaining the Sustainable Energy for All Initiative and SDG 7. The results also suggest improvement in governance and its component variables to generally exert direct positive effect on access to electricity. Considering how governance plays a role in the impact of FDI on access to electricity, we document two interesting findings. First, the coefficients of the interaction terms are generally negative, on the face value indicating that while higher FDI enhances electricity access, the effect of is small in countries with higher levels of governance. Intuitively, this may be because electricity access nears its capacity in countries with high levels of governance, leaving less role for FDI to play with regards to electricity access. Second, computing the marginal effects of the impact of FDI on access to electricity, given the mean and percentile values of the governance variables, the results suggest that generally the positive effect of FDI on access to electricity is significant for countries at the lower percentiles of governance (up to the 25th percentile), but insignificant thereafter.

Undoubtedly, the findings on the interactions of the governance with FDI raise important questions. Specifically, they tend to be inconsistent with the common idea that good governance and strong institutions should facilitate foreign investment to improve on electricity access. Understandably, this is mainly true for countries with low levels of governance but not those with high levels of governance. However, the findings of the interaction of FDI with governance should be taken with some caution as some of them are conditioned on the model specification and choice of the governance indicators. It is imperative to note that, the measures of governance as used in this study only ranks countries based on institutional lapses and do not highlight the processes through which they interact with FDI inflows in influencing provision of general social amenities, in particular electricity. For this reason, we propose the following avenues for future research

efforts. First, more nuanced micro- and firm-level empirical studies would be needed in unearthing the different dynamics through which the inter-relationship between governance and FDI plays-out. Second, it would be interesting to see how the various forms of FDI and the inflows of FDI into the different sectors influence access to electricity in the presence of countries' institutional and governance architecture.

Appendix

Table A1: List of Countries

Benin	Ethiopia	Mali	Seychelles
Botswana	Gabon	Mauritius	South Africa
Burkina Faso	Gambia, The	Morocco	Sudan
Burundi	Ghana	Mozambique	Tanzania
Cameroon	Guinea	Namibia	Togo
Central African Republic	Kenya	Niger	Tunisia
Chad	Lesotho	Nigeria	Uganda
Cote d'Ivoire	Madagascar	Rwanda	Zambia
Egypt, Arab Rep.	Malawi	Senegal	Zimbabwe

Table A2: Summary Description of Variables

Variables	Description	Source
Access	The percentage of population with access to electricity	WDI
FDI	Foreign direct investment, net inflows (% of GDP)	WDI
Corruption	The extent to which public power is exercised for private gain	WGI
RegQual	The ability of the government to formulate and implement sound policies	WGI
GovtEffect	The quality of public and civil services and the extent of independence	WGI
Voice	It is the degree to which citizens can elect government as well as the freedom of expression, freedom of association, and a free media	WGI
Rule of law	The extent to which agents have confidence in and abide by the rules of society	WGI
PolStab	The perception of the likelihood that there would be political instability and/or terrorism	WGI
Governance	A composite (PCA) index of the six governance variables	WGI
GDP	Log of real GDP	WDI
Urbanization	Log of urban population	WDI
Trade	Trade openness as a percentage of GDP	WDI
Govt Budget	Final government consumption expenditure as a percentage of GDP	WDI
Industry	Industry value added as a percentage of GDP	WDI
Fin Dev	Credit to the private sector as a percentage of GDP	WDI

Note: WDI and WGI represent World Development Indicators and Worldwide Governance Indicators of the World Bank, respectively.

References

Acquah, A. M., & Ibrahim, M. (2020). Foreign direct investment, economic growth and financial sector development in Africa. *Journal of Sustainable Finance & Investment*, *10*(4), 315-334.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, *91*(5), 1369-1401.

Acemoglu, D., & Robinson, J. A. (2010). Why is Africa poor? *Economic History of Developing Regions*, *25*(1), 21-50.

Adams, S., & Opoku, E. E. O. (2015). Foreign direct investment, regulations and growth in sub-Saharan Africa. *Economic Analysis and Policy*, *47*, 48-56.

Adams, S., & Opoku, E. E. O. (2016). Population Growth and Urbanization in Africa: Implications for the Environment. In *Population Growth and Rapid Urbanization in the Developing World* (pp. 282-297). IGI Global.

Adams, S., & Opoku, E. E. O. (2017). BRIC versus OECD foreign direct investment impact on development in Africa. In *Foreign capital flows and economic development in Africa* (pp. 147-161). Palgrave Macmillan, New York.

Adams, S., Klobodu, E. K. M., & Opoku, E. E. O. (2016). Energy consumption, political regime and economic growth in sub-Saharan Africa. *Energy Policy*, *96*, 36-44.

Adom, P. K., Opoku, E. E. O., & Yan, I. K. M. (2019). Energy demand–FDI nexus in Africa: do FDIs induce dichotomous paths? *Energy Economics*, *81*, 928-941.

Ahlborg, H., Boräng, F., Jagers, S. C., & Söderholm, P. (2015). Provision of electricity to African households: The importance of democracy and institutional quality. *Energy Policy*, *87*, 125-135.

Alam, A. (2013). Electric power consumption, foreign direct investment and economic growth. *World Journal of Science, Technology and Sustainable Development*, *10*(1), 55-65.

Alam, M. S., Miah, M. D., Hammoudeh, S., and Tiwari, A. K. (2018). The nexus between access to electricity and labour productivity in developing countries. *Energy Policy*, *122*, 715-726.

Aluko, O. A., Ibrahim, M., & Vo, X. V. (2021). On the foreign direct investment–economic growth relationship in Africa: does economic freedom mediate this relationship? *International Journal of Emerging Markets*. https://doi.org/10.1108/IJOEM-04-2021-0568

Amri, F. (2016). The relationship amongst energy consumption, foreign direct investment and output in developed and developing countries. *Renewable and Sustainable Energy Reviews, 64,* 694-702.

Asiedu, E., & Lien, D. (2011). Democracy, foreign direct investment and natural resources. Journal of International Economics, 84(1), 99-111.

Asumadu-Sarkodie, S., & Yadav, P. (2019). Achieving a cleaner environment via the environmental Kuznets curve hypothesis: determinants of electricity access and pollution in India. *Clean Technologies and Environmental Policy*, *21*(9), 1883-1889.

Bagoyoko, N. & Gibert, M.V. (2009). The linkage between security, governance and development: the European Union in Africa. *The Journal of Development Studies*, *45*(5), 789-814.

Banks, G., Scheyvens, R., McLennan, S., & Bebbington, A. (2016). Conceptualising corporate community development. *Third World Quarterly*, *37*(2), 245-263.

Baum, C. F., Schaffer, M. E., & Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. The Stata Journal, 3(1), 1-31.

Bazzi, S., & Clemens, M. A. (2013). Blunt instruments: Avoiding common pitfalls in identifying the causes of economic growth. American Economic Journal: Macroeconomics, 5(2), 152–186.
Bekhet, H. A. & Othman, N. S. (2011). Causality analysis among electricity consumption, consumer expenditure, gross domestic product (GDP) and foreign direct investment (FDI): Case study of Malaysia. *Journal of Economics and International Finance*, *3*(4), 228-235.

Blimpo, M.P. and Cosgrove-Davies, M. (2019). Electricity access in Sub-Saharan Africa: Uptake, reliability, and complementary factors for economic impact. The World Bank, Washington DC.

Bokpin, G. A. (2017). Foreign direct investment and environmental sustainability in Africa: The role of institutions and governance. *Research in International Business and Finance*, *39*, 239-247.

Bolay, M., & Knierzinger, J. (2021). Corporate gift or political sacrifice? State-sponsored CSR and electricity provision in Guinean extractive enclaves. *Political Geography*, *84*, 102300.

Boddewyn, J., & Doh, J. (2011). Global strategy and the collaboration of MNEs, NGOs, and governments for the provisioning of collective goods in emerging markets. *Global Strategy Journal*, *1*(3-4), 345-361.

Cole, M. A., Elliott, R. J., & Zhang, J. (2009). Corruption, governance and FDI location in China: A province-level analysis. *The Journal of Development Studies*, *45*(9), 1494-1512.

D'Amelio, M., Garrone, P., & Piscitello, L. (2016). Can multinational enterprises light up developing countries?: Evidences from the access to electricity in sub-Saharan Africa. *World Development*, *88*, 12-32.

De Hoyos, R. E., & Sarafidis, V. (2006). Testing for cross-sectional dependence in panel-data models. *The Stata Journal*, *6*(4), 482-496.

De Mello, L. R. (1997). Foreign direct investment in developing countries and growth: A selective survey. *The Journal of Development Studies*, *34*(1), 1-34.

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, *80*(4), 549-560.

Durlauf, S. N., Johnson, P., & Temple, J. (2005). Growth Econometrics, 1, Part A, 555–677, Elsevier, Netherlands.

Eberhard, A., Rosnes, O., Shkaratan, M., & Vennemo, H. (2011). Africa's Power Infrastructure Investment, Integration, Efficiency. The World Bank, Washington DC.

Eberhard, A., Gratwick, K., Morella, E. & Antmann, P. (2016). Independent Power Projects in Sub-Saharan Africa. Lessons from Five Key Countries. World Bank, Washington DC.

Economist Intelligence Unit (2012). Into Africa: Institutional investor intentions to 2016 Abu Dhabi.

Ernst & Young (2020**).** Why Africa is becoming a bigger player in the global economy. https://www.ey.com/en_gl/tax/why-africa-is-becoming-a-bigger-player-in-the-global-economy

FDI Intelligence (2016). The Africa Investment Report 2016 (The Financial Times).

Fosu, A., Bates, R. & Hoeffler, A. (2006). Institutions, governance and economic development in Africa: An overview. *Journal of African Economies*, *15*(1), 1-9.

Garrone, P., Piscitello, L., & D'Amelio, M. (2019). Multinational enterprises and the provision of collective goods in developing countries under formal and informal institutional voids. The Case of electricity in sub-Saharan Africa. *Journal of International Management*, *25*(2), 100650.

Haanyika, C. M. (2006). Rural electrification policy and institutional linkages. *Energy Policy, 34*(1), 2977-2993.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*(3), 281-312.

IEA (2014). Africa Energy Outlook: A Focus on Energy Prospects in Sub-Saharan Africa. International Energy Agency, Paris.

IEA. (2019). *World Energy Outlook. Africa Energy Outlook 2019*. International Energy Agency, Paris, France.

IRENA (2013). Africa's Renewable Future: The Path to Sustainable Growth. International Renewable Energy Agency, Abu Dhabi.

Jensen, N. M. (2003). Democratic governance and multinational corporations: Political regimes and inflows of foreign direct investment. *International Organization*, 587-616.

Kanagawa, M. & Nakata, T. (2007). Analysis of the energy access improvement and its socio-economic impacts in rural areas of developing countries. *Ecological Economics, 62*(2), 319-329.

Kanagawa, M., & Nakata, T. (2008). Assessment of access to electricity and the socio-economic impacts in rural areas of developing countries. *Energy Policy*, *36*(6), 2016-2029.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2004). Governance matters III: Governance indicators for 1996, 1998, 2000, and 2002. The World Bank Economic Review, 18(2), 253-287.

Kayalvizhi, P. N., & Thenmozhi, M. (2018). Does quality of innovation, culture and governance drive FDI? Evidence from emerging markets. *Emerging Markets Review*, *34*, 175-191.

Kucera, D., & Principi, M. (2017). Rights, governance, and foreign direct investment: an industry-level assessment. *International Review of Applied Economics*, *31*(4), 468-494.

Kumi, E.N. (2017). The electricity situation in Ghana: Challenges and opportunities. CGD Policy Paper. Washington, DC: Center for Global Development. https://www.cgdev.org/ publication/electricity-situation-ghana-challenges-and-opportunities.

Li, Q., & Resnick, A. (2003). Reversal of fortunes: Democratic institutions and foreign direct investment inflows to developing countries. *International Organization*, *57*(1), 175-212.

Lucas, R. E. (1990). Why doesn't capital flow from rich to poor countries? *The American Economic Review*, *80*(2), 92-96.

Magnani, N., & Vaona, A. (2016). Access to electricity and socio-economic characteristics: Panel data evidence at the country level. *Energy, 103,* 447-455.

Nguea, S. M., Kaguendo, U. V. E., & Noumba, I. (2022). Are growth effects of foreign capital significant for increasing access to electricity in Africa? *Energy Policy*, *168*, 113129.

Onyeji, I., Bazillian, M., & Nussbaumer, P. (2012). Contextualizing electricity access in sub-Saharan Africa. *Energy for Sustainable Development, 16*, 520-527.

Opoku, E. E. O., & Boachie, M. K. (2020). The environmental impact of industrialization and foreign direct investment. Energy Policy, 137, 111178.

Opoku, E. E. O., Ibrahim, M., and Sare, Y. A. (2019). Foreign direct investment, sectoral effects and economic growth in Africa. *International Economic Journal*, *33*(3), 473-492.

Opoku, E.E.O., Kufuor, N.K. and Manu, S.A. (2021). Gender, electricity access, renewable energy consumption and energy efficiency. *Technological Forecasting and Social Change*, *173*, 121121.

Panos, E., Densing, M., and Volkart, K. (2016). Access to electricity in the World Energy Council's global energy scenarios: An outlook for developing regions until 2030. *Energy Strategy Reviews*, *9*, 28-49.

Robbins, G., & Perkins, D. (2012). Mining FDI and infrastructure development on Africa's East Coast: Examining the recent experience of Tanzania and Mozambique. *Journal of International Development, 24*(2), 220–236.

Salim, R., Yao, Y., Chen, G. & Zhang, L. (2017). Can foreign direct investment harness energy consumption in China? A time series investigation. *Energy Economics, 66,* 43-53.

Sarkodie, S. A. & Adams, S. (2020a). Electricity access, human development index, governance and income inequality in sub-Saharan Africa. *Energy Reports, 6,* 455-466.

Sarkodie, S. A. & Adams, S. (2020b). Electricity access and income inequality in South Africa: Evidence from Bayesian and NARDL analyses. *Energy Strategy Reviews*, *29*, 100480.

Streatfeild, J. E. (2018). Electricity Investment in Sub-Saharan Africa: A Historical Overview and a Way Forward. *Journal of International Commerce and Economics*, June 2018, 1-16.

Tang, C. F. (2009). Electricity consumption, income, foreign direct investment, and population in Malaysia: New evidence from multivariate framework analysis. *Journal of Economic Studies*, *36*(4), 371-382.

Trotter, P. A. (2016). Rural electrification, electrification inequality and democratic institutions in sub-Saharan Africa. *Energy for Sustainable Development, 34*, 111-129.

UNCTAD (2004). World Investment Report 2004. The Shift Towards Services. Unites Nations, New York and Geneva.

UNCTAD (2005). Economic development in Africa: Rethinking the role of rethinking the role of rethinking the role of foreign direct investment.
https://unctad.org/system/files/official-document/gdsafrica20051_en.pdf

van Beers, C. & Strand, J. (2013). Political determinants of fossil fuel pricing. The World Bank.

Wandji, Y. D. F. (2013). Energy consumption and economic growth: Evidence from Cameroon. *Energy Policy, 61,* 1295-1304.

World Bank (2018). Global Investment Competitiveness Report 2017/2018. Foreign Investor Perspectives and Policy Implications. The World Bank, Washington DC.
Zhang, T., Shi, X., Zhang, D., and Xiao, J. (2019). Socio-economic development and electricity access in developing economies: A long-run model averaging approach. *Energy Policy*, *132*, 223-231.