CAN MULTINATIONAL ENTERPRISES LIGHT UP DEVELOPING COUNTRIES?

Evidence from the access to electricity in sub-Saharan Africa

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This is a post-print version of ***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.*** https://doi.org/10.1016/j.worlddev.2016.06.018

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Highlights

- Multinational enterprises (MNEs) and foreign direct investment (FDI) can contribute to the electrification of developing countries
- MNEs' involvement in electrification may be driven by operational needs or legitimacy search
- Positive impacts are more likely if local institutions are weaker
- MNEs' effectiveness also depends on the institutional quality of home country

Abstract

This paper examines the role that multinational enterprises (MNEs) and foreign direct investments (FDI) can have in enhancing the access to electricity for local communities in developing countries based on the quality of home and host institutions. Access to electricity is a marker for development but it is far from being universal in developing countries. The shortage of electricity is mainly the consequence of the inability of governments in planning, financing and developing necessary electricity infrastructure. In this context, investments from other actors can be essential. Particularly, in this paper we focus on the role of FDI and MNEs. We claim that when MNEs invest in developing countries, they are incentivized to solve the lack of electricity infrastructure mainly for two reasons: to guarantee their business activities and to gain legitimacy with their local stakeholders. In addition, we argue that MNEs and FDI from institutionally underdeveloped countries will be more prone to develop infrastructure for the provision of electricity to local population, as generally they suffer from a negative stereotype. For this study, we rely on 1547 observations composed of pairs of 83 home countries and 15 host countries in sub-Saharan Africa, observed from 2005 to 2011. Due to the nature of the database, we adopt panel data techniques, i.e., system-GMM and corrected Least Square Dummy Variable estimators. We find that FDI promotes access to electricity in developing countries with weak institutions and that this is more likely true when FDI comes from institutionally underdeveloped countries. These results are far from obvious, as they controvert the common idea among institutional scholars that a regulatory authority is essential in the provision of infrastructure.

In conclusion, with this paper we partially rehabilitate the image of MNEs investing in developing countries, by demonstrating that - under certain conditions - they could contribute to the energy poverty alleviation of local population.

Keywords: FDI; MNE; electricity infrastructure; institutions; Africa

I. Introduction

In the last years, the world is facing profound and escalating challenges, such as climate changes, poverty and inequality, and the rise of economic and financial crises. For decades, the most obvious candidates for solving these global problems were governments and global institutions, such as the World Bank or the International Monetary Fund. These institutions do in fact play a role; nevertheless, the Rio+20 summit emphasized the need for a much wider partnership. Among the partners that could act jointly to address these widespread challenges, multinational enterprises (MNEs) play a key role, as since the seventies they have been growing in size and capabilities (Gratton, 2014). For instance, Lodge and Wilson (2006) use value added (defined as the sum of salaries and pre-tax profits), as a measure the economic size and estimate that, in 2005, 29 of the world's largest economies were not countries, but multinationals. The necessity of MNEs' involvement has also been emphasized in the 2014 World Investment Report (WIR), released by the United Nations Conference on Trade and Development (UNCTAD). The WIR focuses on the contribution that the private sector could make to the 2030 Agenda for Sustainable Development and the related Sustainable Development Goals (SDGs), aimed at ending poverty, fighting inequality and injustice, and tackling climate change by 2030[i].

When talking about sustainable development, it is necessary to consider one of its fundamental and inescapable drivers, i.e., energy (Dinkelman, 2011). Access to modern energy services, particularly electricity, together with other commodities, functions and services, such as drinkable water, education, transportation, communication and health, is a collective good[ii], and its provision is necessary both to enhance standards of living and to run business activities (eg., Kebede et al., 2010; Khavul and Bruton, 2013). However, in 2013, the International Energy Agency (IEA) estimates that 1.2 billion people (almost one fifth of the world population) do not have access to electricity. More than half is located in sub-Saharan Africa, a fifth in developing Asia (without China and India), 20 percent in India, and the rest in Latin America and Caribbean Sea, and North Africa and Middle East[iii]. For this reason, in 2011, the United Nations General Secretary launched the Sustainable Energy for All Initiative (SE4All) with one of its objectives being the universal access to electricity by 2030[iv]. However, to meet the goal the IEA evaluates that $50 billion of investments per year would be required (IEA, 2014).

The reasons of this shortage of electricity in developing countries could be imputed mainly to the rapid population growth and to the failure of local governments in defining sound electrification policies[v]. In fact, developing countries are generally affected by institutional voids, i.e., they lack those institutions that minimize the three main sources of market failure. Specifically, accordingly with Khanna and Palepu (1997) these sources are: (1) the lack of reliable market information; (2) the inefficiency of the judicial systems and; (3) the misguided regulations, i.e., when regulators place political goals over economic efficiency. This ineffective system of governance, together with other factors such as low rates of domestic savings and poor tax revenues, could actually undermine developing countries' ability in planning, financing and developing necessary infrastructure for power production, transmission and distribution, leading to the scarcity of access to electricity for local communities (Robbins and Perkins, 2011).

The inability of local governments to provide electricity makes essential the involvement of different actors, such as development banks, no-profit organizations and the private sector, to guarantee the running of social and business activities (Boddewyn and Doh, 2011; Buckley and Boddewyn, 2015). In these circumstances, MNEs, which in the past twenty years have increasingly invested in developing countries, could possibly play a role. Based on the UNCTAD estimates, in 2013, foreign direct investment (FDI) flows to developing countries reaching a new high of $778 billion, which accounts for 54 percent of the global inflows. Developing Asia is the region with the highest FDI inflows, with a total amount of $426 billion, followed by Latin America and the Caribbean region, which experiences a growth of six percent, reaching a peak of $292 billion. Finally, Africa shows a growth rate of four percent and FDI inflows amount to $57 billion, whilst developing Oceania is the only region that remains stable at $3 billion.

While criticisms of the negative impact of MNEs continues to be vivid (for an overview see Oetzel and Doh, 2009), policy attention has been recently addressed to their potential added value in alleviating poverty. Accordingly, we argue that in countries where governments are too weak to provide infrastructure for the supply, distribution and transmission of electricity, MNEs can have a positive impact on the society. Indeed, MNEs and FDI can contribute to the expansion and modernization of electricity infrastructure, alone or with other players, as they need them to not only gain access to essential production inputs, reduce costs, and increase business opportunities, but also to stimulate the development of local communities and achieve legitimacy required to operate therein (North, 1990; Kostova and Zaheer, 1999). We also argue that the positive impact of MNEs and FDI is stronger when they come from institutionally weak home countries. Indeed, despite less sophisticated-resources and business practices, those MNEs are more likely to possess the managerial expertise needed to operate in contexts that are similar to their home country (Cuervo-Cazurra and Genc, 2008; Zeng and Eastin, 2012). These arguments are far from obvious, as it is common knowledge that a regulatory authority is necessary in the infrastructure sector to restrain the tendency of private firms of exerting monopoly power. In fact, highly specific investments (i.e., sunk costs), large economies of scale and scope, as well as widespread consumption imply that customers of infrastructure services have limited bargaining power, and suppliers tend to adopt opportunistic behavior if regulation is absent (Williamson, 1976; Levy and Spiller, 1994; Sawant, 2010). For this reason, the delivery options for electricity have historically been either direct provision through state-owned enterprises or indirect provision through regulation of private business (Bergara et al., 1998).

In this paper, we focus on sub-Saharan Africa (SSA). The region has experienced an unprecedented presence of MNEs and FDI in the last ten year (UNCTAD, 2014); at the same time, in 2013, more than

30 percent of the population still has no access to electricity (for details see section III) (IEA, 2014). Our sample is composed by FDI into 15 sub-Saharan host countries from 83 home countries, observed throughout the 2005-2011 period. Given the nature of the data, the econometric analysis relies on dynamic panel techniques. Our findings confirm that MNEs and FDI could stimulate the access to electricity in developing countries affected by institutional voids, and this effect appears to be stronger when these companies come from institutionally weak environments.

With the present work we aim to contribute to the debate on the potentials and opportunities of MNEs in relation to poverty alleviation in general (Kolk and Van Tulder, 2006) and to the provision of electricity to the population in particular (Sesan et al., 2013). So far, this debate has received significant attention from a wide spectrum of scholars, without reaching, nevertheless, a univocal consensus. Our scope is to disentangle the concept of poverty and the contribution of MNEs in this regard. For this reason, we focus on a specific form of poverty, i.e., lack of access to electricity, and on a specific type of MNE's presence, i.e., FDI. We argue that this impact could be affected by the institutional framework of both the destination country and the target country of the investment. For this purpose, we rely on several streams of literature. Specifically, institutional voids and MNE behavior (Khanna and Palepu, 1997; Boddewyn and Doh, 2011), institutional arrangement for the provision of infrastructure for public purposes (Levy and Spiller, 1994; Henisz, 2002), as well as the MNEs' legitimation mechanisms (Kostova and Zaheer, 1999; Zeng and Eastin, 2012).

The paper is organized as follows: section II describes the conceptual framework, section III presents the data and methodology, while sections IV and V illustrate the results and robustness checks, respectively. Finally, section VI reports the discussion and conclusion.

II. Conceptual framework

A. Infrastructure development in weak institutional environments: the role of MNEs and FDI

Reasons behind the shortage of access to electricity in developing countries are complex and vary across economies. However, one of the main cause can be imputed to the lack of adequate infrastructure for the production, distribution and transmission of electricity[vi]. In SSA, the inadequacy of electricity system is mainly due to the reduction of investments in construction and maintenance of infrastructure, caused by the decline in state revenues and political stability, which involved most of the countries in the region since the seventies (Robbins and Perkins, 2012). This decrease of investments raises the area's dependence on infrastructure stocks heritage of colonial period, resulting in a qualitative and quantitative mismatching between supply and demand of infrastructure (Escribano et al., 2010).

More generally, the electric infrastructure system of a country is expression of its institutional environment and governments have always been involved in its provision or regulation (Williamson, 1976; Laffont and Tirole, 1991; Ostrom et al., 1993; Sawant, 2010). Namely, three features make electricity infrastructure a complex form of economic transaction, particularly sensitive to the country's institutional environment: (i) the high level of physical specificity of the investment (i.e., a high component of sunk investment); (ii) the widespread domestic consumption and; (iii) economies of scale and scope (Levy and Spiller, 1994). Following the framework provided by Bergara et al. (1998), four complementary institutional mechanisms could be identified that determine the profitability and feasibility of the investments. (i) Political stability, which enhances the potential for opportunistic behavior by governments. (ii) Administrative capabilities of the country, which represent the potential sophistication of the regulatory system and have a direct impact on the investment performances, due to the complexity of the infrastructure industry. (iii) Judicial independence and professionalism, which guarantees a more confident framework for enforcing formal constraints, offering credible commitment against arbitrary changes in the rule of the game and; (iv) credibility of regulatory system. Indeed, in countries where consultations and agreements between independent entities are needed for changing the status quo policies, the credibility of a regulatory policy is stronger because the rules proclaimed by a government cannot be changed unilaterally by the next one.

In the past forty years, the lack of strong and stable formal institutions has undermined the ability of developing country governments to provide or regulate electricity infrastructure for public purposes, deeply threatening their development opportunities (Robbins and Perkins, 2012). This has motivated other actors (e.g., the private - either profit or nonprofit – sector or interest group coalitions) to intervene to try to fill this institutional void, by supporting public agencies or substituting them (Boddewyn and Doh, 2011; Buckley and Boddewyn, 2015). In these circumstances, we claim that MNEs can be crucial in enhancing the provision of electricity in developing countries.

Since Caves (1974), empirical studies on the impact of MNEs on host countries have proliferated. On the one hand, scholars argue that MNEs are important sources of employment and marketable channels of technology, skills and knowledge transfer for the host country (Aitken and Harrison, 1999). From the achievement of economic development objectives, local governments expect positive impact on society (e.g., in term of quality of education or health system), and the reinforcement of local institutions (Weingast, 2002; North, 2005). In addition, some studies suggest that MNEs contribute also to social development of developing countries. Indeed, multinationals may raise the environmental, labor and safety standards and develop corporate social responsibility activities targeted to the local population (Kolk and Van Tulder, 2006).

On the other hand, studies have shown negative economic and social impacts stemming from MNEs presence in developing countries (Gunther, 2002). Some studies find that multinationals crowd out local firms and that technology, knowledge and skills transfers do not occur over the long-term (Aitken and Harrison, 1999). In addition, MNEs pollute the environment, exploit child labor, adopt inadequate safety standards and are not effective in alleviating poverty with their social initiatives (Oetzel and Doh, 2009).

In this paper, we follow the first school of thought, and we argue that, under certain conditions, MNEs can have a positive and significant impact on the access to electricity for local population, by developing electricity infrastructure in developing countries where they invest and operate.

Although access to electricity could overall be assured through on-grid-systems, distributed mini-grid systems and, distributed off-grid systems (IEA, 2014)[vii], we argue that MNEs can raise access to electricity only by providing the former two solutions. Thus, accordingly to Levy and Spiller (1994), only on-grid and mini-grid systems can be fully considered electricity infrastructure (see Table A.1 in Appendix). Our idea is corroborated by the findings of Sesan et al. (2013), where they show that an MNE that tries to introduce an off-grid system into the Nigerian market was not able to reach the target households. In addition, the engagement of MNEs in the development of electricity infrastructure can pass through four channels: planning, financing, construction (i.e., greenfield or repowering) and, operation and maintenance (Ostrom et al., 1993). It is important to specify that, based on the definition provided by Ostrom et al. (1993), by *planning* we refer to the decision process related to the definition of: (i) the type, quantity and quality of infrastructure that have to be provided; (ii) the degree to which private activities related to this infrastructure have to be regulated; (iii) how and where the construction of this infrastructure have to be arranged; (iv) how to finance it, and; (v) how to monitor its performance. In sum, planning is a key phase of electricity infrastructure development and the participation in it, through formal and informal relations with governments, can also be a viable option of engagement for MNEs. Table A.1 (Appendix) summarizes the characteristics of electricity provision, focusing on the SSA case.

Finally, the provision of electricity infrastructure by means of MNEs, may be related to the enterprise's market or non-market strategies[viii] (Doh et al., 2012). In the case of a market strategy, MNEs develop electricity infrastructure as part of their core product/service or as part of the chain of activities responsible for delivering that product/service. A good example is the Electricité de France Group (EDF), a global leader in the power sector, which signed several agreements with national governments and other MNEs to cooperate in the improvement of the electrification rate in several sub-Saharan countries, such as Botwana, Mali, South Africa and Senegal. This has been done through the development of on-grid and mini-grid systems[ix]. On the contrary, in other industrial sectors, MNEs need to supplement governmental activities in the provision of electricity infrastructure as part of their non-market strategies that, in these contexts, are essential to gain legitimacy that is necessary to countervail their liabilities of being a foreign as well as a profit-driven company. A good example is AngloGold Ashanti, a South African multinational mining company operating in Guinea that, as results of villagers' protests in 2012, built an electric power line from one of its mining plant to the nearby town, to gain legitimacy with villagers and guarantee their business activities[x].

Accordingly, our first hypothesis states as follows.

H1: MNEs are more likely to promote the access to electricity in countries that suffer from institutional voids than in countries with well-established institutions.

B. MNEs, legitimacy and liability of origin

Firms' organizational structures, policies, and practices tend to reflect the institutional environment in which they have been established (Zaheer, 1995). Accordingly, MNEs and FDI from institutionally developed countries (especially from Western economies) have been traditionally considered as generating spillovers in developing countries and creating the conditions for their long-term development (Hitt, Li, and Worthington, 2005). However, in the latest fifteen years, studies have shown that MNEs and FDI from institutionally weak countries can sometimes have higher positive effect than those from institutionally advanced economies (e.g., Javorcik and Spatareanu, 2011) revitalizing the debate over the factors that could moderate MNEs impact on host country development.

One of the main arguments adopted to justify this ambiguity in results is that what matters are both the country institutional framework and the differences in institutional environments between host and home country. Institutional differences are multifaceted and refer to regulatory, cognitive, and normative institutions (Scott, 1995). They include differences in laws and regulations surrounding the acquisition of property; in licensing of new businesses; in domestic or international contracting for the acquisition of needed factors of production or for downstream sales; in protection of intellectual property; in payment of taxes, acquisition of government licenses and payment of fees; in prevalence of corruption and; in means and feasibility of market exit (Henisz, 2004). The greater the institutional differences between home and host environment, the more difficult is for the MNE to understand and correctly interpret local institutional requirements, as well as the extent of necessary adjustments (Kostova and Zaheer, 1999; Cuervo-Cazurra and Genc, 2008). This is more likely to be true when MNEs invest in countries affected by institutional voids, as the lack of strong institutions can challenge their conformity process (Ahlstrom et al., 2014; Young et al., 2014).

Under these conditions, MNEs that invest in countries affected by institutional voids can be advantaged if they come from an institutionally weak country, as managers already acquired at home the capabilities to survive and be successful under difficult institutional conditions (Eriksson et al., 1997; Cuervo-Cazurra, 2006). This ability could represent a competitive advantage for those MNEs, and can be strategically exploited in order to overcome the severe lack of legitimation, whereby these firms generally suffer with their stakeholders, e.g., local consumers, shareholders, current and future business partners and consumers in developed export markets (Ramachandran and Pant, 2010). Legitimacy is defined as the acceptance of the organization by its environment and it is essential to operate and succeed in a foreign context. All MNEs have to engage in activities to gain and maintain legitimacy in the widespread institutional settings in which they operate (Kostova and Zaheer, 2009). However, legitimation strategies are particularly important for MNEs from institutionally weak countries, as these firms generally bear their country of origin institutional environment, i.e., liability of origin effect (Ramachandran and Pant, 2010). This liability of origin comes from a negative stereotype that associates home country with weak institutions, weak firm governance that "does not provide to stakeholders adequate information for evaluating these firms" (Cuervo-Cazurra and Ramamurti, 2014 pp. 209-211). In order to overcome this issue, MNEs from institutionally weak countries need to engage in alternative legitimation mechanisms and develop strategic responses instead of adapting passively (Kostova et al., 2008; Doh et al., 2012). For instance, Berliner and Prakash (2013) demonstrate that firms from corrupted countries adopt voluntary stringent environmental practices that go beyond the minimum requirements of the home or the host country laws, as they face discrimination from non-governmental organizations (NGOs), investors and potential business partners.

Under this perspective, we argue that, by leveraging on internal managerial expertise to countervail the fragility of governments, the development of electricity infrastructure can be employed by MNEs from institutionally weak countries as a legitimation strategy to alleviate local stakeholders' negative perception. Of course, some critical reflections are needed, as MNEs research of legitimacy could target only few powerful stakeholders, e.g., politicians or governmental officials (Hillman et al., 2004; Mellhai et al., 2015). This perspective goes beyond the paper aims, namely the analysis of the relationship between MNEs presence and access to electricity growth. Nevertheless, we acknowledge that one should refrain from an over-optimistic view of legitimation strategies, because attempts to gain recognition from and influence over a restricted set of local actors may come to alter local dynamics in the long term[xi].

Finally, good evidences of our argument are provided by the Brazilian mining companies Vale and the Indian car manufacturing company Tata Corporation. These two companies are developing strong electrification programs in countries like Mozambique and Guinea, by leveraging on their familiarity with development challenges. The scope of these initiatives is to guarantee their business activities and to gain legitimacy at the international and national level. Thus, legitimacy could be essential for them to better penetrate in a region rich of natural resources and with a growing middle-class willing to spend money on consumer goods (Forstater et al., 2010).

Accordingly, our second hypothesis states as follows.

H2: In countries that suffer from institutional voids, MNEs from institutionally weak countries are more effective in promoting the access to electricity, compared to MNEs from well-established institutional environments.

III. Methods

A. Sample

For our study, an econometric analysis using a panel dataset has been performed. The sample is composed of pairs of 83 home countries and 15 host countries from sub-Saharan Africa, which are observed from 2005 to 2011. Table 1 reports the list of sample host countries and host-home country pairs, while Graph 1 is the network diagram of FDI stock per capita by home-host country pair. More details about FDI distribution between host and home country are presented in the rest of this section.

[Insert Table 1 about Here]

[Insert Graph 1 about Here]

Missing data proved to be an issue, but the problem has been faced by adopting statistical techniques (see the description of the single variables for more details) and this leads to a final sample size of 1,547 observations.

B. Dependent variable

Access to electricity. The dependent variable is the percentage of households with access to a minimum level of electricity consumption per year (Source: IEA). According to the definition provided by IEA, access to electricity involves more than the simple household connection to the grid; it also comprises consumption of a specified minimum level of electricity. The consumption threshold is computed by assuming five people per household and is set equal to 250 kilowatt-hours (kWh) per year for rural households and to 500 kWh per year for urban households (IEA, 2014). We are well aware that this proxy could overestimate the phenomenon, because it also includes non-infrastructure solutions for the provision of electricity, i.e., off-grid systems (see Table A.1), and could mainly refer to the supply side of electricity access. However, we believe that these two limitations could be overcome by including appropriate control variables, which capture factors that determine the electricity demand (e.g., variables that indicate the economic structure of a country and/or its income level) and the obstacles to the development of electricity infrastructure (e.g., rural population and population density).

Table 2 shows how access to electricity rate evolved in our sample host countries from 2005 to 2011. Overall the SSA region's access to electricity increased by 13 percent in 7 years. In our sample, Namibia (+26 percent), Angola and Ghana (+23 percent), and Congo Republic (+18 percent) exhibit the highest growth rates, while the diffusion rate is observed in Congo Democratic Republic and Uganda (less than 15 percent). Further, in order to better qualify the SSA region's electricity sector, Table 2 reports the time trends of household electricity consumption and net electricity production for the sample host countries. Overall, both electricity produced and consumed by households increased from 2005 to 2011[xii].

[Insert Table 2 about Here]

Graph 2 shows the overall growth in electricity consumption and its distribution across sectors, i.e., commercial and public services, households, manufacturing, construction and non-fuel industry, mining and quarrying, transports, and agriculture forestry and fishing, in 2005 and 2011. Overall, electricity consumption increased in the observed period, with the largest increase occurring in commercial and public services (30 percent) and households (25 percent). Increases in electricity consumption are likely to be related to an expansion of domestic production, as the correlation statistics of Table A.2 confirm (Appendix).

[Insert Graph 2 about Here]

The distribution of electricity consumption between different sectors does not appear to be coherent with a scenario where MNE effects in the electricity sector, if any, are concentrated in productive uses, and do not involve households. Commercial and public services, and households have been the only sectors that increased their weight by 1.3 and 1.2 percent, respectively, in the 2005-2011 period; while the share of electricity consumed by manufacturing and transports decreased by 1.3 and 0.9 percent, respectively. At last, household access to electricity rate is adopted as the dependent variable, instead of household electricity consumption, a variable that is moderately correlated to household access (0.454 and p<0.01, Table A.2). In fact, as households' access to electricity include a minimum consumption threshold for each connection to the distribution network, it is likely to capture poverty alleviation more thoroughly than country-level aggregate measures of electricity consumption[xiii].

Finally, to fill missing data (accounting for about the 30 percent of data), we adopt an approach that has been largely shown to present good statistical properties, i.e. multiple imputation (Allison, 2001). With multiple imputation, missing values are drawn from a distribution of observed variables, including the variables at stake, and can lead to consistent, asymptotically efficient, and asymptotically normal estimates (Allison, 2001). As the proportion of missing data is high and their pattern is arbitrary, we adopt the chained equations option (MICE), which uses a Gibbs-like algorithm to impute multiple variables sequentially using univariate fully conditional specifications (Raghunathan et al., 2001)[xiv]. In addition, in order to guarantee the consistency of imputed data, all the paired countries with less than three observations per variable, over the seven years, have been removed[xv].

C. Explanatory variables

FDI per capita. The presence of MNEs in SSA countries is proxied by inward FDI stocks disaggregated according to home and host country, i.e., country-pair FDI (Source: UNCTAD). Since inward FDI stocks constitute an extensive variable, which varies on the basis of the country's size, and our dependent variable is expressed as a percentage of population, country-pair FDI per capita are employed (unit of measure: US dollars per capita). This variable is also affected by missing data (about 26 percent); thus, the treatment has been replicated by means of multiple imputation.

Table 3 illustrates the distribution of inward stock FDI in our sample, by home region, during the period considered.

[Insert Table 3 about Here]

From 2005 to 2011, MNEs from European Union have been the major investors in SSA (28 percent of total FDI), followed by North American ones (19 percent), South East Asian (15 percent) and sub-Saharan ones (11 percent). Chinese MNEs rank only sixth in terms of size of the investment, with a total amount of $19k per capita, which represent around seven percent of the total investments in our sample. It is worth noticing that in 2005, 80 percent of investment came from only two regions, i.e., European Union (54 percent) and SSA (25 percent), while in 2011, the FDI origin was much more diversified. In particular, a greater presence in SSA is observed for North America (25 percent), South East Asia (22 percent), Latin America and Caribbean Sea (11 percent) and China (9 percent), while investments from European Union and other SSA countries represented only the 17 percent and 6 percent of total inward FDI stock, respectively [xvi].

Institutional quality of host and home countries. The institutional quality of a country has been measured through the six World Bank's Worldwide Governance Indicators (WGIs): regulatory quality, control of corruption, voice and accountability, rule of law, governance effectiveness and, political stability and the absence of violence and terrorism. The WGIs have been used extensively in academic research. Winters and Martinez (2015), for instance, find that 8 out of 19 studies that examine governance as a determinant of foreign aid use WGIs. All the six indicators are used, because choosing only a few of the WGIs to model the institutional quality would be highly discretionary. In addition, as shown in Table 4, a conceptual link has been identified between each WGIs and the institutional dimensions that are relevant for the provision of electricity infrastructure (for further details, see section II). However, the correspondence is not univocal[xvii].

[Insert Table 4 about Here]

The high correlation between these variables (more than 95 percent in some cases), their correspondence to multiple theoretical constructs, and in line with previous literature (e.g., Farla et al., 2014), a factorial analysis is performed in order to obtain a unique indicator. Thus, a factor has been built for host countries and another for home countries over the 2005-2011 period, by means of the principal-component analysis method (Hotelling, 1936). Table A.3 in Appendix shows the factor analysis results. There is only one single dominant factor that summarizes the WGIs, and it can explains more than 84 percent (for home countries) and 86 percent (for host countries) of the six institutional dimensions. Table A.3 also shows that each of the components loads very high into their respective factor and has a low value of uniqueness, meaning that the two factors explain well the WGIs for home and host countries.

Finally, Table 5 illustrates how the institutional quality changed in each host country and in the home countries aggregated by regions, from 2005 to 2011. The institutional quality of host countries (*institutional quality host*) undergoes a slight deterioration in the SSA region as a whole (- 0.04). Countries with the weakest formal institutions are Congo Democratic Republic, Eritrea and Angola, while Botswana and Mauritius, which are respectively 1.06 and 1.16 points over the regional average, host the strongest institutions. On the other side, the institutional quality of home countries (*institutional quality home*) decreased (-0.12). As expected, European Union, North America and Oceania lie at the opposite side of SSA (-1.12) and India (-1.04), while China could be considered a lower-middle country as for institutional quality (0.82 points under the worldwide average). Home regions that experienced the strongest reduction in the institutional quality have been North Africa and Middle East (-0.30) and South East Asia (-0.17).

[Insert Table 5 about Here]

D. Control variables

In order to reduce the risk of spurious correlations, we control for the following host-country specific characteristics.

Population. This variable allows controlling for the host country size and it is expressed in millions of people. (Source: World Bank).

Rural population. Only 37 percent of the sub-Saharan population lives in urban areas[xviii]. This raises barriers to the access to electricity, as the deployment of electricity infrastructure is more difficult and costly outside cities and their outskirts (IEA, 2014). For this reason, we control for the share of rural population in the host country, expressed as a percentage of the total population (Source: World Bank).

Population density. Like the rural population, the low population density, i.e., people per square kilometer per land area (Source: World Bank), is also a barrier to the diffusion of electricity access, especially through national or regional grids (Crousillat et al., 2010).

Income level. Two dummies, i.e., low-income (LIC) and lower middle-income (LMIC) countries, are used to model the income group to which the host country belongs, as defined by the World Bank. Host countries that are neither LIC nor LMIC are upper middle-income (UMIC) and represent our baseline. We prefer to use income-class binary variables instead of using a full-scale income measure, e.g. gross domestic product (GDP) per capita, to show any dependence of FDI effects on the country income in a more self-explanatory way. However, as a robustness check we run our model by replacing income dummies with GDP per capita (see section V).

Industry and services value added. These two variables aim to control the host country's economic structure (Source: World Bank). Industry value added, expressed as a percentage of GDP, covers mining, manufacturing, construction, electricity, water and gas. Services value added, also expressed as a percentage of GDP, comprises wholesale and retail trade (including hotels and restaurants), transport, government, financial, professional and personal services, such as education, health care, and real estate services. The two variables obviously take on a low value if the country is specialized in agriculture, husbandry, forestry and fishing.

Time and country-pair dummies. These dummies are included in the model to capture unobservable factors that may drive changes in the access to electricity rate and country-pair FDI. On one side, country-pair fixed effects control for unobservable mutual linkages that can affect the degree of involvement of MNEs into the development of electricity infrastructure in host countries (e.g., bilateral agreements or political alliances). On the other side, time fixed effects control global or regional shocks that may change the ability of all the host countries to attract FDI and to diffuse the access to electricity (e.g., price crisis for metal commodities or global recessions).

E. Model

For our study, we adopt a growth model often used by institutional scholars (e.g., Henisz and Zelner, 2001), which has the following form:

$$(1) \quad \Delta y_{i,t} = \alpha_0 + (\alpha - 1) y_{i.t-1} + x'_{i,t}\,\beta + \chi_i + \varphi_t + \varepsilon_{i,t} \qquad for\ i = 1, \dots, N\ and\ t = 2, \dots, T$$

We operationalize this model as specified in Equation (2).

$$(2) \quad \Delta Access\ to\ Electricity_{\,i,t} = \alpha_0 + \alpha_1\, Access\ to\ Electricity_{\,i,t-1} +$$

$$+ \beta_1\, FDI\ per\ capita_{\,i,j,t-1} + \beta_2\, Institutional\ quality\ host_{\,i,t-1} +$$

$$+ \beta_3\, Institutional\ quality\ home_{\,j,t-1} +$$

$$+ \gamma\, Z'_{\,i,t-1} + \delta\, D'_{i,t} + \varphi_t + \chi_{ji} + \varepsilon_{i,j,t}$$

Finally, the model is extended by introducing two interaction terms as showed in Equation (3).

$$(3) \quad \Delta Access\ to\ Electricity_{\,i,t} = \alpha_0 + \alpha_1\, Access\ to\ Electricity_{\,i,t-1} +$$

$$+ \beta_1\, FDI\ per\ capita_{\,i,j,t-1} + \beta_2\, Institutional\ quality\ host_{\,i,t-1} +$$

$$+ \beta_3\, Institutional\ quality\ home_{\,j,t-1} +$$

$$+ \beta_4\, FDI\ per\ capita_{\,i,j,t-1} * Institutional\ quality\ host_{\,i,t-1}$$

$$+ \beta_5\, FDI\ per\ capita_{\,i,j,t-1} * Institutional\ quality\ home_{\,j,t-1} +$$

$$+ \gamma\, Z'_{\,i,t-1} + \delta\, D'_{i,t} + \varphi_t + \chi_{ji} + \varepsilon_{ij,t}$$

Where i is the host country, j is the home country, t is the year, φ_t and χ_{ji} are the unobservable year and country-pairs fixed effects, respectively; $\varepsilon_{ij,t}$ is the i.i.d. disturbance term. $Z'_{i,t-1}$ is vector of controls, i.e., population, rural population, population density, industry and services value added, while $D'_{i,t-1}$ is the vector of LIC and LMIC dummies.

Δ*Access to electricity*$_{i,t}$ is the yearly increase in the percentage of households with access to electricity between time t-1 and t (i.e., *access to electricity*$_{i,t}$ - *access to electricity*$_{i,t-1}$). *Access to electricity* $_{i,t-1}$ is the lagged dependent variable in level, which allows to control for the dynamics of the process. Finally, in order to alleviate potential reverse causality problems, we lag the explanatory variables and controls by one period. We adopt a one-lag model specification as it is typical of growth models (Henisz and Zelner, 2001) and because we want to preserve the maximum possible number of degrees of freedom available for the estimates. However, the inclusion of only one lag among regressors does not constrain the process dynamics to a short transient, as recalled in the following paragraphs.

The introduction of the interaction terms requires the evaluation marginal effects by means of Equations (4) and (5). The former simulates the effects of FDI in an institutionally weak host country, given the quality of home institutions at the mean level. The latter simulates how, setting the quality of host institutions at the minimum value, the effect of FDI varies when the quality of the home institutions decreases from a minimum to a maximum level.

(4) $\left.\frac{\partial(\Delta \text{Access to electricity}_{\text{i,t}})}{\partial(\text{FDI per capita}_{\text{i,j,t}-1})}\right|_{\substack{(Inst.\ quality\ host_{i,t-1})_{min} \\ (Inst.\ quality\ home_{j,t-1})_{mean}}} =$

$$\beta_1 + \beta_4(Inst.quality\ host_{\ i,t-1})_{min} + \beta_5(Inst.quality\ home_{\ j,t-1})_{mean}$$

(5) $\left.\frac{\partial(\Delta \text{Access to electricity}_{\text{i,t}})}{\partial(\text{FDI per capita}_{\text{i,j,t}-1})}\right|_{\substack{(Inst.\ quality\ host_{i,t-1})_{min} \\ (Inst.\ quality\ home_{J,t-1})_{min}}} -$

$\left.\frac{\partial(\Delta \text{Access to electricity}_{\text{i,t}})}{\partial(\text{FDI per capita}_{\text{i,j,t}-1})}\right|_{\substack{(Inst.\ quality\ host_{i,t-1})_{min} \\ (Inst.quality\ home_{J,t-1})_{max}}} =$

$$+\beta_5\left[(Inst.quality\ home_{\ j,t-1})_{min} - (Inst.quality\ home_{\ j,t-1})_{max}\right]$$

However, these are only the short-term effects; whenever $\alpha_1 < 1$, also the long-term effect of FDI on the access to electricity growth can be estimated. For the sake of exposition, formulas on the long-term calculation are given for the model presented by Equation (4); generalization to the model presented by Equation (5) are straightforward. Since the effect after T periods is given by

$\lambda^T = \left[\beta_1 + \beta_4(Inst.quality\ host_{\ i,t-1})_{min} + \beta_5(Inst.quality\ home_{\ j,t-1})_{mean}\right] * \sum_{l=0}^{T}(\alpha_1 + 1)^l$, the long-term effect is given by the following expression:

$\lambda = \lim_{T\to\infty}\lambda^T = -\frac{\left[\beta_1 + \beta_4(Inst.quality\ host_{\ i,t-1})_{min} + \beta_5(Inst.quality\ home_{\ j,t-1})_{mean}\right]}{\alpha_1}$ (see also Garrone and Grilli, 2010).

According to the literature on dynamic panel data, the system Generalized Method of Moments, i.e., system GMM (Arellano and Bover, 1995; Blundell and Bond, 1998), and the corrected Least Square Dummy Variables, i.e., corrected LSDV (Kiviet, 1995; Bruno, 2005), estimators are used.

The System-GMM allows dealing with the endogeneity problems due to the lagged-dependent variable, and the potential correlation of the explanatory variables with the error term. This estimator instruments the lagged-dependent variable and any other similarly endogenous variables with variables that are uncorrelated to the fixed effects, thus dramatically improving efficiency of the estimates (Roodman, 2009)[xix]. The two-step method results in more asymptotically efficient estimates than the one-step (Baltagi, 2005), and the bias in the standard errors is fixed by means of Windmeijer's (2005) correction procedure. In addition, we control for the endogeneity of lagged-dependent variable, *FDI per capita, institutional quality host*, *industry* and *services value added, LIC* and *LMIC* variables. The variables *population*, *rural population* and *population density* are considered pre-determined. *Year dummies* and *institutional quality home* are dealt as exogenous. Finally, some external instruments is added and treated as predetermined, i.e., the degrees of a country's globalization, social development and other aspects of economic development not inserted into the model. In fact, infrastructure and development are linked by a two-way relationship. Infrastructure enables social and economic development, through households' improved welfare, higher levels of income and consumption, reduced private costs, and saved time (Bryceson and Howe 1993; Khandker et al. 2009). Furthermore, they help social inclusion through increased social mobility (Kirubi et al., 2009) and stimulate country's globalization (Sapkota, 2011). At the same time, globalization and social and economic development spurs further demand for infrastructure services, and economic growth also helps to increase the quality and quantity of infrastructure services through increased investments in infrastructure development. In order to capture this phenomenon, the level of a country's globalization is proxied by means of the *KOF index of globalization* introduced by Dreher (2006), from the KOF Swiss Economic Institute. Levels of social development and inclusion are proxied by means of the *human flight and brain drain* and *group grievance* variables (Source: Fund for Peace). Finally, economic development is expressed by the *poverty and economic decline* variable that aggregates dimensions such as unemployment, youth unemployment, economic deficit, government depth, inflation, purchasing power and GDP growth (Source: Fund for Peace)[xx].

In addition, the corrected LSDV is also used to estimate the regression coefficients (Kiviet, 1995; Bruno, 2005). This estimator has the drawback of relying on the assumption that all other regressors other than the lagged-dependent variable are uncorrelated to any time-varying unobserved heterogeneity.

However, its advantage is that it corrects the endogeneity bias of the lagged-dependent variable without the use of any instruments. In recent studies this estimator emerged as one of the most accurate to cope with panel datasets, even under the condition of endogenous regressors, especially when there is the risk of unobserved heterogeneity and second order serial correlation, as in our case (Flannery and Hankins, 2013).

F. Descriptive Statistics and Correlations

Table 6 shows the correlation matrix and the descriptive statistics of the model variables. The overall pattern of our variables does not reveal a tendency toward multi-collinearity. However, as expected the access to electricity rate is highly correlated with quality of institutions, country's economic structure, level of economic development and population density. In addition, it can be observed that *access to electricity* varies from the worst case for the Republic Democratic of Congo, where only 5.8 percent of the population has access to electricity in 2005 and 2006, to the best case of Mauritius, where, in 2010, 100 percent of the population has access to electricity.

The *institutional quality host* factor is positively correlated with the host country income (i.e., *GDP per capita host*), on the economy bias toward services, population density and inward stock FDI per capita ($p<0.01$), and is negatively correlated with the size of the population and the rate of rural population ($p<0.01$). The *institutional quality home* factor is positively correlated with the home country income ($p<0.01$) and with *FDI per capita* ($p<0.1$).

[Insert Table 6 about Here]

IV. Results

Tables 7 and 8 present estimates obtained with the system-GMM and the corrected LSDV estimators. Specifically, Table 7 contains six Models computed with the system-GMM. Model 1 is the baseline that contains only control variables and the lagged-dependent variable in level. Explanatory variables and interaction terms are added one-by-one while moving from Model 2 to Model 6. For the sake of brevity, Table 8 reports only the corrected LSDV estimates for the most complete model[xxi].

The present section is organized as follows. Estimates for the explanatory variables and interaction terms are commented on first. Then the evidence related to the control variables is summarized. Finally, results of the marginal effects are discussed.

[Insert Table 7 about Here]

[Insert Table 8 about Here]

In all the Models in Tables 7 and 8, the lagged-dependent variable in level (*access to electricity*$_{i,t-1}$) is negative and significant. This means that the higher the access to the electricity rate at time t-1, the lower the growth rate of the access to electricity at time t. However, with the corrected LSDV estimator, even though the coefficient of the lagged-dependent variable in level is negative, it is close to 1 (magnitude of -0.9627 and $p<0.001$); this indicates that there is the risk that the model does not converge, leading to spurious estimations. In order to strengthen the results, stationarity tests are conducted for the *access to electricity* variable, i.e., the unit root tests. The methods developed by Im, Pesaran and Shin (2003) and Levin, Lin and Chu (2002), i.e., the so-called IPS and LLC tests, are used for this purpose. A global time trend is considered, because the variable has a significant correlation with time, and the series are demeaned, since there is no precise conjecture about the cross-country correlation. Unit root tests reveal that the *access to electricity* variable is stationary, which means that the results obtained with corrected LSDV are robust[xxii].

The *institutional quality host* variable is added to Model 2 in Table 7. In line with our conceptual framework, local institutions raise access to electricity ($p<0.1$). The *FDI per capita* variable is added to Model 3 in Table 7 but there is no evidence of its impact on the access to electricity growth (i.e., Δ*Access to electricity)*. However, when the interaction between *institutional quality host* and *FDI per capita* variables is included (Model 4 of Table 7), we find that FDI increase the access to electricity when the host institutions are weak, since the coefficient of the interaction term is negative and significant ($p<0.05$). In Model 5, the *institutional quality home* variable is added, but not significant impact is found. Finally, Model 6 in Table 7 and Model 1 in Table 8 displays results obtained with the system-GMM and the corrected LSDV estimators, respectively, for the most complete model where all the explanatory variables the interaction terms are considered. The estimates confirm that FDI foster access to electricity in countries affected by institutional voids. Hence, the coefficient of the interaction term *FDI per capita*Institutional quality host* is negative and significant with both, system-GMM ($p<0.05$) and corrected LSDV ($p<0.1$) estimators. Furthermore, the corrected LSDV estimator shows that this impact becomes stronger when the FDI comes from institutionally weak countries, i.e., the coefficient of the interaction term *FDI per capita*Institutional quality home* is negative and significant ($p<0.01$).

Most of the control variables maintain a steady sign and significance with the system-GMM across all the models (see Table 7). Some slight differences emerge with the results obtained with the corrected LSDV (Table 7)[xxiii]. One possible interpretation of this partial overlap is that the latter estimator assumes all the variables, except for the lagged dependent one, to be exogenous. It can be seen that *population* and *population density* have a positive and significant impact on Δ*Access to electricity* ($p<0.01$ for both variables). This means that, as expected, the size of the country and the level of the urbanization positively affect access to electricity growth, mainly because, as urban economists suggest, "the provision of many public services and facilities, such as schools, hospitals, utilities, and highways" and thus electricity infrastructure, "typically exhibits the characteristic of economies of scale" (Fujita, 1989 p.135). On the contrary, *rural population* is confirmed to be a barrier to the diffusion of access to electricity ($p<0.01$). In fact, in countries with low domestic saving rates and tax revenues, and a high percentage of rural population, such as sub-Saharan countries, the development of large national or regional grids is inefficient (IEA, 2014). For this reason, specific strategies and technical solutions should be considered for rural communities, e.g., off-grid or mini-grid (see Table A.1). As expected, the level of economic development of the host country has an important effect on Δ*Access to electricity*. Historical records in fact show that when households increment their income, they first use it for heating and lighting, in addition to food, education and health (Paul and Bhattacharya, 2004). For this reason, it is not surprising that the *LIC* dummy has a negative and highly significant impact on Δ*Access to electricity* ($p<0.01$), while the coefficient of the *LMIC* dummy is negative but not significant. Moreover, we find only evidence for the positive impact of the *services value added* ($p<0.05$), while we do have results on the role of the *industry value added* variable. Therefore, it is reasonable to assume that a higher level of valued added in services would correspond to a higher economic development, which in turn would foster access to electricity (Medlock and Soligo, 2001).

Specification tests have been done to detect possible autocorrelation and over-identification problems in the six system GMM models (Table 7) The tests for autocorrelation indicate that the model is well specified (see AR(1) and AR(2)), and Hansen tests confirm the validity of our instruments.

In addition, in order to test our hypotheses, we compute FDI marginal effects on the access to electricity growth, by means of Equations (4) and (5). Results are presented in Table 9.

In line with our conceptual framework, the first row of Table 9 illustrates that, based on both estimators, FDI would enhance access to electricity growth, when host institutions are weak (Equation (4)). H1 is confirmed at a standard significance level ($p<0.05$). We also find that the quality of home institutions may matter (second row of Table 9). We find that FDI might stimulate the access to electricity growth in host countries with underdeveloped institutions, if the quality of home institutions decreases from maximum to minimum levels (Equation (5)). H2 is confirmed only by one of the two estimators, i.e., corrected LSDV, at a standard significance level ($p<0.001$). However, we are confident about our results as in recent studies this estimator emerged as one of the most accurate for panel data analysis (Flannery and Hankins, 2013) .

[Insert Table 9 about Here]

In addition, in order to understand more in depth how the institutional quality of home and host countries moderates the impact of FDI, Graphs 3 and 4 simulate the response over time of access to electricity to an inward FDI stock shock, under different institutional scenarios. Namely, starting from a stationary condition, at time t=0 and access to electricity at its mean (59.91 percent, Table 6), we give a shock to the FDI per capita, equals to its standard deviation (1496.38 $ per capita, Table 6), and we see how the model presented in Equation (3) reacts over time, up to T (where T=10). The calculation of response over time is explained in section III (E. Model; see λ definition). Graph 3 simulates the response over time under three scenarios for the quality of host institutions (minimum, mean and maximum). The largest benefit from MNEs' presence accrues to countries with weak institutions (H1). Similarly, Graph 4 simulates the response over time in host countries with weak institutions, given three levels of home country institutional quality. Even in this case, it is apparent that the most beneficial FDI are those from low-institutional quality countries (H2).

[Insert Graph 3 about Here]

[Insert Graph 4 about Here]

We are aware that some cautions is needed in reporting our results, as they are contingent to our specification, in particular to the proxies used to measure quality of institutions. Indeed, despite the use of WGI is in line with similar studies (e.g., Winters and Martinez, 2015), these indicators describe only antecedents of institutional voids and do not give information about mechanisms through which FDI fill these voids. To overcome this limitation a firm level analysis would be needed. However, this goes beyond the scope of the paper. Additionally, in order to better understand how the impact of FDI is modeled by the quality of institutions, the model has been also run using the single WGIs instead of the institutional *quality host* and *home* factorial variables. Most models based on single indicators confirm our core results. As regards control of corruption in the host country, its role is uncertain and this does not allow us neither to confirm nor to exclude that bribery is a driver of MNEs involvement in electrification, opening questions for future researches[xxiv]. Finally, some caution is also needed because of the amount of data imputation done, a limitation that we partially try to overcome by running several robustness checks, as described in the following section.

V. Robustness checks

Robustness of our findings has been tested in several ways. Whenever not reported, robustness test results are available upon request from the authors.

First, we use a different indicator for the dependent variable. When we talk about access to electricity, we are more generally talking about access to modern energy services. Based on the definition provided by the IEA, modern energy services include not only electricity but also the adoption of clean and safe biomasses for cooking. These modern biomasses refer to biogas systems, liquefied petroleum gas (LPG) stoves and improved biomass cooking stoves, which have lower emissions and higher efficiency than traditional three-stone fires, widely used for cooking in developing countries (IEA, 2014). For this reason, our first robustness test consists in running our model by replacing the *access to electricity* variable with *use of traditional biomass* variable, which has also the advantage of a lower number of missing data, i.e., 16 percent (Source: IEA). As expected, the two variables are highly and negatively correlated (magnitude of -0.86 and $p<0.01$), and this reinforces the validity of the *use of traditional biomass* as an alternative dependent variable, even from an empirical point of view. Table 10 shows findings obtained with the system-GMM and the corrected LSDV estimators, while Table 11 reports the marginal effect estimates. Our results are confirmed only by means of the corrected LSDV estimates. A possible explanation of this partial overlap with results of Table 9, could be that in certain countries there might exist genuine differences between a large access to electricity and the abandon of traditional biomasses as an energy source, e.g., wood fuel might still be used in electrified households. However, the corrected LSDV estimator is likely to be more suitable for datasets as ours (Section III.E; Flannery and Hankins, 2013), strengthening our confidence in this first robustness check (see Table 9).

[Insert Table 10 about Here]

[Insert Table 11 about Here]

Another test consists in replacing the institutional quality variables drawn from the WGIs with variables constructed with six institutional indicators developed by the Fund-for-Peace (FFP). The six indicators considered are state legitimacy, state's ability to provide public services, presence of factionalized elites, interventions from external actors, human rights, rule of law and security apparatus[xxv]. According to the FFP's guidelines, a unique variable, i.e., *political strength*, is built, one for the home and another for the host countries. This variable is the inverse of the sum of the six previously mentioned indicators; it ranks from 1 to 60. Tables 12 and 13 show the results obtained when this new proxy of the institutional quality is adopted and the calculated marginal effects. The results are perfectly in line with our core evidences (see Table 9).

[Insert Table 12 about Here]

[Insert Table 13 about Here]

It is widely recognized that in SSA, FDI are significantly driven by the presence of natural resources (Asiedu, 2006). However, this aspect is not considered in our model (see section III), due to the high correlation with the country's economic structure, i.e., *industry* and *services value added* variables. For this reason, as a third robustness check, the host country's economic structure is replaced by the presence of natural resources, measured by the *natural resources rents* variable, expressed as a percentage of GDP (Source: World Bank)[xxvi]. Even in this case, our results are confirmed, adding robustness to the analysis.

We conduct a further check by replacing the two income dummies (LIC and LMIC) with the continuous variable GDP per capita (constant 2005 US$) sourced from the World Bank Development

Indicators. In this case, H1 is confirmed only by means of system-GMM estimator, while H2 by means of corrected LSDV.

Since missing values are an issue in our empirical dataset, we attempt to run our model without performing multiple imputation for the *access to electricity* and *FDI per capita* variables. Even in this case H1 is confirmed by the system-GMM estimator (magnitude of 0.046 and p<.05), while with the corrected LSDV estimator results for H2 have the same sign as those obtained after multiple imputation, but the significance is weakened (p=0.113). We are not able to conclude whether this weakness is due to a potential bias introduced in the analyses by missing value treatment or to the reduction in size of our sample (from 1547 to 1004 observations)[xxvii].

Furthermore, we formally test the role played by FDI from China (with Hong Kong) and European Union in our analyses, given the major presence of the two players in SSA. To the aim of a sensitivity analysis, we run our model (3) (section III) by removing the observations of European Union FDI from the sample. We re-run it by removing the observations of China FDI from the sample. In both cases, H1 is confirmed by the system-GMM estimator (p<0.1) and H2 is confirmed by the corrected LSDV (p<0.5)[xxviii]. Overlapping with our main results is only partial (see Table 9). A possible explanation could be that removing important groups of countries, especially European Union, dramatically reduces the size of our sample (from 1547 to 952 observations), weakening our estimates. Alternatively, it would be possible that observed phenomenon is partially driven by specific countries or group of countries, a topic that is left for future investigation.

Finally, we are aware that reverse causality might certainly be an issue in our setting. Economists, politicians and business leaders routinely call developing countries, especially in SSA, for infrastructure development as a strategy to attract FDI to the local economy (Wheeler and Mody, 1992; Ansar, 2013). In order to rule out this and other forms of endogeneity, a reverse causality analysis is performed.

Causality is confirmed to run from FDI inwards to access to electricity and, not the other way around, strengthening the interest of our findings.

In conclusion, as summarized by Table A.4 in Appendix, most of the robustness checks confirm both H1 and H2, at least with one of our estimators. The absence of reverse causality, the convergence of estimates with alternative indicators of modern energy access and institutional quality are particularly encouraging. Analyses of the sensitiveness of our results to the role of single home countries (European Union countries and China) and to the imputation of missing data returned mixed confirmations, also because these checks implied a reduction of the sample size. While improved and extended datasets will enable a more in depth analysis of these issues, the additional controls made in this section strengthened our overall confidence in the results of section IV.

VI. Discussion and conclusion

Electricity is a marker for development (Dinkelman, 2011); however, access to affordable, reliable, sustainable, and modern energy is far from being universal in developing countries, as made clear by the Seventh SDG of the 2030 Agenda of United Nations. Using a panel of more than 1547 home-host country pairs, observed from 2005 and 2011, our study aims to investigate those institutional conditions that moderate the impact of MNEs and FDI on the access to electricity of local population in SSA. Our findings, robust across several specifications and checks, show that in countries affected by institutional voids, MNEs can promote access to electricity, and this is more likely when they come from institutionally weak countries. Reasons could be many. First, MNEs need electricity for their business activities (Khavul and Bruton, 2013). Thus, it is reasonable to assume that MNEs raise access to electricity mainly by developing electricity infrastructure, as these assets are essential for their daily activities. However, infrastructure can also be employed as legitimation strategy with their stakeholders (Oetzel and Doh, 2009). In fact, we find that FDI from institutionally weak countries are more likely to increase access to electricity. We argue this is due to the fact that those MNEs generally suffer from a higher lack of legitimacy, compared with companies from highly institutionally developed economies (Cuervo-Cazurra and Ramamurti, 2014). At the same time, they are already familiar with difficult institutional conditions, and know how to deal with the lack of provision of electricity by local governments (Cuervo-Cazurra and Genc, 2008; Boddewyn and Doh, 2011).

On a long-term prospective, it would be interesting to study what happens when quality of institutional context of both host and host country improves. We assume that MNEs and FDI would still be important to the local context development, as the elimination of all institutional voids is improbable. However, they will tend to develop strong cooperation with local market and non-market actors, such as public agencies, NGOs or private suppliers of electricity (Buckley and Boddewyn, 2015); more investigations, nevertheless, would be needed in this direction.

We believe that with the present work we make an important contribution to the on-going debate on the impact of MNEs and institutions on poverty alleviation in developing countries (Kolk and Van Tulder, 2006; Sesan et al., 2013; Ahlbord et al., 2015), by showing contingencies that could accelerate their electrification process. Namely, we add to the institutional economics literature (Williamson 1976; Bergara et al., 1998; Henisz 2002). Indeed, our empirical evidence confirms that private sector performances, in terms of long-term and context-specific investment, are highly contingent to a country's institutional environment. These results raise some questions, as they are in contrast with the common idea that private enterprises are supposed to underinvest in countries where formal institutions are too weak to limit governmental opportunism (Levy and Spiller 1994). For this reason, we suggest that some further reflections and in-depth case studies would be required in the future.

Our work is not immune from limitations that, nevertheless, pave the way to further investigations. First, multiple imputation is required to fill missing data. As consequence, some caution is needed in interpreting our empirical findings also because the level of significance varies across specifications.

Second, the available stream of data does not allow us to distinguish between FDI in different sectors. Furthermore, only strong regulatory and formal institutions are considered while we know that also informal ones are important for infrastructure, particularly in developing countries (Ostrom et al., 1993). Finally, our empirical results rely on proxies that describe country-level antecedents of institutional voids. For this reason, a broader analysis of MNEs impacts would certainly benefit from data at the corporate or community level. This could help to study more in-depth the mechanisms through which MNEs fill institutional voids, and to better identify targeted stakeholders. For this reason, a more micro-level analysis ranks high in our research agenda.

In conclusion, the scope of the paper is to provide policy recommendations to both public, i.e., policy makers of developing countries, and private sector, i.e., MNE managers. Indeed, an analysis of the conditions that make a private investment effective in terms of energy poverty alleviation is fundamental to understand which type of MNEs should be attracted and to guide the development and implementation of specific energy policies in each country. At the same time, this paper should also concern MNEs themselves. In fact, these companies are under constant pressure to continuously increase shareholder returns. In order to achieve this objective, MNEs need to increase their investments in developing countries and participate in their long-term growth and prosperity (Oetzel and Doh, 2009; Gratton, 2014). In this perspective, the enhancement of access to electricity could be a viable strategy to create the conditions for settling-in durable and profitable new business activities in these countries.

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TABLES

Table 1. Sample: home-host country pairs and host countries

Home - Host Country Pair								SSA Host Countries
Angola	SouthAfrica	France	Congo	Luxembourg	SouthAfrica	Spain	Mauritius	Angola
Argentina	SouthAfrica	France	Gabon	Madagascar	SouthAfrica	Spain	SouthAfrica	Botswana
Aruba	SouthAfrica	France	Ghana	Malawi	SouthAfrica	SriLanka	Mauritius	Cameroon
Australia	Ghana	France	Kenya	Malaysia	Mauritius	Swaziland	Botswana	Congo
Australia	Mauritius	France	Mauritius	Malaysia	SouthAfrica	Swaziland	SouthAfrica	DemRepCongo
Australia	SouthAfrica	France	SouthAfrica	Maldives	SouthAfrica	Sweden	Ghana	Eritrea
Austria	Mauritius	France	Uganda	Malta	Mauritius	Sweden	Mauritius	Ethiopia
Austria	SouthAfrica	Germany	Ghana	Malta	SouthAfrica	Sweden	SouthAfrica	Gabon
Bahamas	Mauritius	Germany	Kenya	Mauritius	Botswana	Sweden	Uganda	Ghana
Bahamas	SouthAfrica	Germany	Mauritius	Mauritius	Ghana	Switzeland	SouthAfrica	Kenya
Bahrain	SouthAfrica	Germany	SouthAfrica	Mauritius	SouthAfrica	Switzerland	Botswana	Mauritius
Belgium	Angola	Ghana	SouthAfrica	Mauritius	Uganda	Switzerland	Ghana	Namibia
Belgium	Cameroon	Greece	SouthAfrica	Morocco	Cameroon	Switzerland	Kenya	Nigeria
Belgium	Congo	HongKong	Botswana	Morocco	Congo	Switzerland	Mauritius	SouthAfrica
Belgium	DemRepCongo	HongKong	Mauritius	Morocco	Gabon	Taiwan	SouthAfrica	Uganda
Belgium	Gabon	HongKong	SouthAfrica	Mozambique	SouthAfrica	Tanzania	SouthAfrica	
Belgium	Kenya	Hungary	SouthAfrica	Namibia	SouthAfrica	Thailand	SouthAfrica	
Belgium	Mauritius	Iceland	SouthAfrica	Netherlands	Angola	Togo	Ghana	
Belgium	SouthAfrica	India	Botswana	Netherlands	Botswana	Turkey	Ethiopia	
Belgium	Uganda	India	Ghana	Netherlands	Cameroon	Turkey	SouthAfrica	
Bermuda	SouthAfrica	India	Mauritius	Netherlands	Ghana	UnitedKingdom	Botswana	
Bermuda	Uganda	India	SouthAfrica	Netherlands	Kenya	UnitedKingdom	Ghana	
Botswana	SouthAfrica	India	Uganda	Netherlands	SouthAfrica	UnitedKingdom	Kenya	
Brazil	Angola	Indonesia	Mauritius	Netherlands	Uganda	UnitedKingdom	Mauritius	
Brazil	SouthAfrica	Ireland	Mauritius	NewZeland	SouthAfrica	UnitedKingdom	Nigeria	
Bulgaria	SouthAfrica	Ireland	SouthAfrica	Nigeria	Ghana	UnitedKingdom	SouthAfrica	
Canada	Ghana	Israel	SouthAfrica	Nigeria	SouthAfrica	UnitedKingdom	Uganda	
Canada	Mauritius	Italy	Angola	Norway	Angola	UnitedStatesAmerica	Angola	
Canada	SouthAfrica	Italy	Congo	Norway	Ghana	UnitedStatesAmerica	Botswana	
Cayman	Mauritius	Italy	DemRepCongo	Norway	Kenya	UnitedStatesAmerica	Cameroon	
China	Angola	Italy	Eritrea	Norway	SouthAfrica	UnitedStatesAmerica	Congo	
China	Cameroon	Italy	Ethiopia	Pakistan	Mauritius	UnitedStatesAmerica	Eritrea	
China	Congo	Italy	Gabon	Pakistan	SouthAfrica	UnitedStatesAmerica	Ethiopia	
China	DemRepCongo	Italy	Ghana	Panama	SouthAfrica	UnitedStatesAmerica	Gabon	
China	Eritrea	Italy	Kenya	Paraguay	SouthAfrica	UnitedStatesAmerica	Ghana	
China	Ethiopia	Italy	SouthAfrica	Philippines	Mauritius	UnitedStatesAmerica	Kenya	
China	Gabon	Japan	SouthAfrica	Philippines	SouthAfrica	UnitedStatesAmerica	Mauritius	
China	Ghana	Kenya	Ghana	Poland	SouthAfrica	UnitedStatesAmerica	Nigeria	
China	Kenya	Kenya	Mauritius	Portugal	Angola	UnitedStatesAmerica	SouthAfrica	
China	Mauritius	Kenya	SouthAfrica	Portugal	Kenya	UnitedStatesAmerica	Uganda	
China	SouthAfrica	Kenya	Uganda	Portugal	SouthAfrica	Uganda	SouthAfrica	
Coted'Ivoire	Ghana	KoreaRep	Angola	Russia	SouthAfrica	UnitedArabEmirates	Ghana	
Cyprus	SouthAfrica	KoreaRep	Cameroon	SaudiArabia	Mauritius	UnitedArabEmirates	Mauritius	
CzechRep	Mauritius	KoreaRep	Congo	Seychelles	Mauritius	UnitedArabEmirates	SouthAfrica	
CzechRep	SouthAfrica	KoreaRep	DemRepCongo	Seychelles	SouthAfrica	Uruguay	SouthAfrica	
Denmark	Angola	KoreaRep	Ethiopia	Singapore	Ghana	Zambia	SouthAfrica	
Denmark	Cameroon	KoreaRep	Gabon	Singapore	Mauritius	Zimbabwe	Botswana	
Denmark	Congo	KoreaRep	Kenya	Singapore	SouthAfrica	Zimbabwe	Mauritius	
Denmark	Ghana	KoreaRep	SouthAfrica	Singapore	Uganda	Zimbabwe	SouthAfrica	
Denmark	Kenya	Lebanon	Ghana	Slovenia	Gabon			
Denmark	Mauritius	Liberia	Botswana	SouthAfrica	Angola			
Denmark	SouthAfrica	Liberia	SouthAfrica	SouthAfrica	Botswana			
Finland	DemRepCongo	Libya	SouthAfrica	SouthAfrica	Ghana			
Finland	Mauritius	Liechtenstein	SouthAfrica	SouthAfrica	Kenya			
Finland	SouthAfrica	Luxembourg	Botswana	SouthAfrica	Mauritius			
France	Angola	Luxembourg	Ghana	SouthAfrica	Namibia			
France	Cameroon	Luxembourg	Mauritius	SouthAfrica	Uganda			

Source: Sample data from UNCTAD FDI Statistics Division on Investment and Enterprise (http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx) accessed on 15th March 2015.

Table 2. Access to electricity rate, household electricity consumption and electricity net production in host countries, 2005 and 2011

	2005	2011
(Households) access to electricity (percent)		
Sub-Saharan Africa	53	67
Angola	15	38
Botswana	39	46
Cameroon	47	54
Congo, Dem. Rep.	6	9
Congo, Rep.	20	37
Eritrea	20	32
Ethiopia	15	23
Gabon	48	60
Ghana	49	72
Kenya	14	19
Mauritius	94	99
Namibia	34	60
Nigeria	46	48
South Africa	70	85
Uganda	9	15
Households electricity consumption (KW-hours, million)		
Sub-Saharan Africa	13,046	15,547
Angola	1,450	3,232
Botswana	539	873
Cameroon	518	1,052
Congo, Dem. Rep.	1,562	2,253
Congo, Rep.	179	323
Eritrea	98	120
Ethiopia	769	1,741
Gabon	622	804
Ghana	1,986	4,345
Kenya	1,206	1,424
Mauritius	608	725
Nigeria	10,302	13,568
South Africa	36,970	40,480
Uganda	341	397
Electricity net production (KW-hours, million)		
Sub-Saharan Africa	79,487	91,510
Angola	2,492	5,512
Botswana	833	371
Cameroon	4,004	5,354
Congo, Dem. Rep.	7,379	7,382
Congo, Rep.	352	1,148
Eritrea	272	321
Ethiopia	2,619	5,969
Gabon	1,527	1,990
Ghana	6,759	11,175
Kenya	6,721	7,526
Mauritius	2,224	2,686
Nigeria	22,866	26,260
South Africa	231,107	247,575
Uganda	1,873	2,578

Source: Sample data from International Energy Agency (http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/) accessed on 24th February 2015 and United Nations Energy Statistics Database (http://data.un.org/Explorer.aspx?d=EDATA) accessed on 28th March 2015 and authors' calculation.

Table 3. Inward stock FDI per capita to SSA by home region, 2005 and 2011

Home regions	2005		2011		Cumulative from 2005 to 2011	
	FDI stock per capita ($ per capita)	percent	FDI stock per capita ($ per capita)	percent	FDI stock per capita ($ per capita)	percent
China (w/Hong Kong)	72.00	0.60	14,980.00	8.90	18,684.00	6.60
East Asia (w/o China and Hong Kong)	143.00	1.20	848.00	0.50	4,222.00	1.50
European Union	6,713.00	54.20	28,528.00	16.90	80,385.00	28.60
India	220.00	1.80	6,397.00	3.80	7,916.00	2.80
Latin America and Caribbean	57.00	0.50	18,368.00	10.90	20,713.00	7.40
North Africa and Middle East	696.00	5.60	635.00	0.40	6,541.00	2.30
North America	935.00	7.50	42,340.00	25.10	55,250.00	19.60
Oceania	42.00	0.30	9,685.00	5.70	12,014.00	4.30
Russia	37.00	0.30	8.00	0.00	153.00	0.10
South East Asia	100.00	0.80	36,635.00	21.70	42,543.00	15.10
South Asia (w/o India)	271.00	2.20	75.00	0.04	1,921.00	0.70
Sub-Saharan Africa	3,109.00	25.10	10,196.00	6.00	30,923.00	11.00
Total	*12,395*		*168,694*		*281,264*	

Source: Sample data from UNCTAD FDI Statistics Division on Investment and Enterprise (http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx) accessed on 15th March 2015 and authors' calculation.

Table 4. Institutional dimensions of the provision of electricity infrastructure

WORLDWIDE GOVERNANCE INDICATORS (WGIS)[A]	WGI DEFINITION[A]	INSTITUTIONAL DIMENSIONS[B]
Government Effectiveness	Quality of public and civil services and the degree of their independence from political pressures. Quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Government's ability in directly providing electricity; Credibility of regulatory system.
Political Stability and Absence of Violence and Terrorism	Likelihood of political instability and/or politically motivated violence, including terrorism.	Political stability.
Voice and Accountability	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.	Administrative capabilities of the country; Judicial independence and professionalism.
Regulatory Quality	Ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Credibility of regulatory system.
Control of Corruption	Extent to which public power is exercised for private gain as well as "capture" of the state by elites and private interests.	Credibility of regulatory system; Judicial independence and professionalism.
Rule of Law	Extent to which agents 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.	Administrative capabilities of the country; Judicial independence and professionalism.

Sources: [A] Worldwide Governance Indicators from the World Bank (http://info.worldbank.org/governance/wgi/index.aspx#home) accessed on 13rd July 2015.
[B] Bergara et al., 1998.

Table 5. Host countries and home regions: Institutional quality, 2005 and 2011

	2005	2011
Home countries		
Sub-Saharan Africa	*0.02*	*-0.02*
Angola	-1.79	-1.55
Botswana	1.21	1.04
Cameroon	-1.29	-1.32
Congo, Dem. Rep.	-2.39	-2.39
Congo, Rep.	-1.76	-1.51
Eritrea	-2.05	-1.61
Ethiopia	-1.53	-1.31
Gabon	-0.64	0.76
Ghana	-0.06	0.21
Kenya	-0.99	-0.97
Mauritius	1.09	1.25
Namibia	0.33	0.47
Nigeria	-1.58	-1.60
South Africa	0.68	0.44
Uganda	-0.93	-0.77
Home regions		
All	*0.02*	*-0.10*
China (w/Hong Kong)	-0.78	-0.87
East Asia (w/o China and Hong Kong)	0.17	0.18
Europe	0.72	0.73
India	-0.99	-1.14
Latin America and Caribbean	-0.18	-0.28
North Africa and Middle East	-0.74	-1.04
North America	0.64	0.68
Oceania	1.00	1.11
Russia	-1.54	-1.57
South East Asia	0.11	-0.06
South Asia (w/o) India	-1.14	-1.36
Sub-Saharan Africa	-1.85	-1.11

Source: Sample data from Worldwide Governance Indicators from the World Bank (http://data.worldbank.org/data-catalog/worldwide-governance-indicators) accessed on 21st March 2015 and authors' calculations.

Table 6. Variables: Descriptive statistics and correlation matrix (N= 1,547)

		Mean	s.d.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Access to electricity	58.91	28.07	5.80	100	1												
(2)	FDI per capita	181.81	1496.38	0.04	39379.23	0.11***	1											
(3)	Inst. Quality host	0	1	-2.50	1.27	0.78***	0.10***	1										
(4)	Inst. Quality home	0	1	-2.58	1.38	-0.09***	0.05*	-0.11***	1									
(5)	Population	29.21	24.55	1.20	160.00	-0.12***	-0.12**	-0.19***	-0.03	1								
(6)	Rural pop.	50.70	16.47	13.85	86.75	-0.42***	-0.02	-0.26***	0.10***	0.02	1							
(7)	Pop. density	170.76	205.00	2.46	633.52	0.62***	0.17***	0.57***	0.01	-0.47***	0.17***	1						
(8)	Ind. value added	32.79	13.74	10.39	77.41	-0.16***	-0.01	-0.34***	0.02	-0.27***	-0.48***	-0.28***	1					
(9)	Serv. valued added	55.23	14.12	18.91	70.94	0.63***	0.07***	0.76***	-0.09***	0.12***	-0.02	0.40***	-0.59***	1				
(10)	LIC	0.28	0.45	0	1	-0.59***	-0.07***	-0.46***	0.09***	0.21***	0.65***	-0.16***	-0.42***	-0.29***	1			
(11)	LMIC	0.13	0.34	0	1	-0.22***	-0.01	-0.44***	0.07***	-0.22***	-0.11***	-0.19***	0.49***	-0.54***	-0.24***	1		
(12)	GDP cap host	4999.94	12302.27	35.59	249730	0.17***	0.03	0.17***	-0.03	-0.14***	-0.11***	0.11***	0.10***	0.08***	-0.16***	-0.04	1	
(13)	GDP cap home	25321.17	20984.69	185.96	117493.6	-0.08***	0.04*	-0.09***	0.81***	-0.03	0.09***	0.012	0.01	-0.08***	0.12***	0.04*	-0.06	1

Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 7. System-GMM estimates

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Access Electricity t-1	-0.6706***	-0.6881***	-0.6889***	-0.6937***	-0.7422***	-0.7423***
	(0.063)	(0.065)	(0.065)	(0.065)	(0.069)	(0.070)
Inst. Qual. host t-1		1.8468*	1.9306*	2.0648*	1.8367	1.7575
		(1.088)	(1.087)	(1.079)	(1.196)	(1.235)
FDI per capita t-1			0.0001	0.0049**	0.0046*	0.0049**
			(0.001)	(0.002)	(0.002)	(0.002)
FDI per capita t-1 x Inst. Qual. host t-1				-0.0056**	-0.0050**	-0.0046**
				(0.002)	(0.002)	(0.002)
Inst. Qual. home t-1					0.2147	0.2925
					(0.352)	(0.389)
FDI per Capita t-1 x Inst. Qual. home t-1						-0.0013
						(0.002)
Pop. t-1	0.1160***	0.1349***	0.1370***	0.1401***	0.1424***	0.1425***
	(0.032)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Rural pop. t-1	-0.4206***	-0.4066***	-0.4081***	-0.4033***	-0.4379***	-0.4420***
	(0.087)	(0.085)	(0.085)	(0.085)	(0.092)	(0.095)
Pop. density t-1	0.0514***	0.0510***	0.0512***	0.0520***	0.0532***	0.0534***
	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Ind. value added t-1	-0.2895***	-0.2361**	-0.2329**	-0.2588**	-0.1403	-0.1384
	(0.090)	(0.099)	(0.097)	(0.101)	(0.119)	(0.117)
Serv. value added t-1	0.1168	0.0919	0.0892	0.0963	0.2855**	0.2898**
	(0.091)	(0.091)	(0.092)	(0.092)	(0.117)	(0.119)
LIC	-15.340***	-13.9427***	-13.8315***	-14.0651***	-12.0648***	-12.0008***
	(2.655)	(2.847)	(2.749)	(2.832)	(3.379)	(3.368)
LMIC	-2.4992	-1.3541	-1.3145	-1.3451	0.8223	0.8809
	(1.920)	(2.022)	(1.990)	(2.033)	(2.473)	(2.487)
Constant	59.7517***	58.9124***	54.0819***	58.9678***	48.2732***	48.1236***
	(9.466)	(9.565)	(9.537)	(9.670)	(10.370)	(10.262)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,326	1,326	1,326	1,326	1,105	1,105
Nbr pair countries	221	221	221	221	221	221
AR(1)	-5.4293	-5.4132	-5.4101	-5.3690	-4.8606	-4.8680
AR(2)	1.1073	1.1117	1.1120	1.0605	0.3824	0.3863
Hansen test	217.0206	217.9898	220.8259	220.9698	220.8573	220.7759
Chi-Square	198	202	202	205	198	197
Wald Chi-Square	256.82	261.71	255.67	258.91	279.91	277.88

Source: Authors' calculation.
Notes: Dependent variable ΔAccess to electricity. Two-step system-GMM. Robust standard errors in parentheses.
All AR(1) test statistics statistically significant at the 1 percent level. All AR(2) test statistics statistically insignificant.
All Hansen test statistics statistically insignificant.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 8. Corrected LSDV estimates

VARIABLES	(1)
Access to electricity t-1	-0.9627***
	(0.069)
Institutional quality host t-1	3.2124
	(2.476)
FDIs per capita t-1	0.0047**
	(0.002)
FDIs per capita t-1 x Institutional quality host t-1	-0.0011*
	(0.001)
Institutional quality home t-1	6.5806***
	(0.909)
FDIs per capita t-1 x Institutional quality home t-1	-0.0052***
	(0.001)
Population t-1	-0.0102
	(0.014)
Rural population t-1	0.0849**
	(0.033)
Population density t-1	0.0018
	(0.006)
Industry value added t-1	-0.2085***
	(0.069)
Services value added t-1	0.1283
	(0.119)
LIC	-8.6780*
	(5.219)
LMIC	0.1197
	(2.082)
Year FE	Yes
Country-pair FE	Yes
Observations	1,326
Nrb of pair countries	221

Notes: Dependent variable ΔAccess to electricity. Corrected LSDV estimator. Standard error in parentheses.
Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 9. Access to electricity growth: Marginal effects of FDI per capita

	(1) System-GMM	(2) Corrected LSDV
H1	0.0164**	0.0075**
	(0.008)	(0.004)
H2	0.0052	0.0207***
	(0.009)	(0.004)

Notes: Model (1) Two-steps system-GMM. Robust standard errors in parentheses.
Model (2) Bias corrected LSDV. Standard errors in parentheses.
Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 10. Use of traditional biomass: system GMM and corrected LSDV estimates

VARIABLES	(1)	(2)
Use of traditional biomass t-1	-0.4404***	-0.8805***
	(0.171)	(0.045)
FDI per capita t-1	-0.0038	-0.0074***
	(0.007)	(0.002)
Institutional quality host t-1	-3.6856	-6.4583***
	(2.465)	(1.060)
FDI per capita t-1 x Institutional quality host t-1	0.0030	0.0051***
	(0.005)	(0.001)
Institutional quality home t-1	-0.2496	-0.6070
	(1.314)	(0.693)
FDI per capita t-1 x Institutional quality home t-1	-0.0010	0.0001***
	(0.004)	(0.000)
Population t-1	-0.0252	-0.0520***
	(0.051)	(0.007)
Rural population t-1	0.1568	-0.0529**
	(0.106)	(0.026)
Population density t-1	-0.0071	0.0234***
	(0.017)	(0.004)
Industry value added t-1	-0.0267	-0.0077
	(0.201)	(0.074)
Services value added t-1	-0.1823	0.1435
	(0.219)	(0.092)
LIC	10.5206***	-0.9576
	(3.405)	(3.797)
LMIC	3.3604	-2.4810**
	(2.844)	(1.171)
Constant	16.4292	
	(22.864)	
Year fixed effects	Yes	Yes
Country pair fixed effects	Yes	Yes
Observations	1,105	1,326
Number of pair countries	221	221
AR(1)	-4.0881	
AR(2)	-0.0740	
Hansen test	220.0635	
Chi Square	197	
Wald Chi Square	212.84	

Notes: Dependent variable ΔUse of traditional biomass.
Model (1) Two-steps system-GMM. Robust standard errors in parentheses.
All AR(1) test statistics statistically significant at 1percent level; all AR(2) test statistics statistically insignificant.
Hansen test statistic statistically insignificant.
Model (2) Bias corrected LSDV. Standard errors in parentheses.
Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 11. Use of traditional biomass: Marginal effects of FDI per capita

	(1) System-GMM	(2) Corrected LSDV
H1	-0.0113	-0.0166***
	(0.018)	(0.004)
H2	0.0039	-0.005*
	(0.015)	(0.003)

Notes: Model (1) Two-steps system-GMM. Robust standard errors in parentheses.
Model (2) Bias corrected LSDV. Standard errors in parentheses.
Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 12. Fund for Peace: system GMM and corrected LSDV estimates

VARIABLES	(1)	(2)
Access to electricity t-1	-0.7582***	-0.9341***
	(0.061)	(0.065)
Political strength host t-1	0.0241***	0.0264***
	(0.009)	(0.009)
FDI per capita t-1	0.6738***	-0.1371
	(0.124)	(0.234)
FDI per capita t-1 x Political strength host t-1	-0.0005*	-0.0006*
	(0.000)	(0.000)
Political strength home t-1	0.0251	0.0721***
	(0.034)	(0.002)
FDI per capita t-1 x Political strength home t-1	-0.0001	-0.0001***
	(0.000)	(0.000)
Population t-1	0.1324***	-0.0280**
	(0.035)	(0.013)
Rural population t-1	-0.3045***	0.1029***
	(0.100)	(0.037)
Population density t-1	0.0455***	0.0035
	(0.008)	(0.003)
Industry value added t-1	-0.0679	-0.2793***
	(0.097)	(0.053)
Services value added t-1	0.2194**	0.1736*
	(0.110)	(0.089)
LIC	-9.3903***	-9.6922**
	(2.646)	(4.736)
LMIC	4.0223*	-0.5907
	(2.207)	(1.268)
Constant	22.9551**	
	(11.501)	
Year fixed effects	Yes	Yes
Country-pair fixed effects	Yes	Yes
Observations	1,105	1,326
Number of paired countries	221	221
AR(1)	-5.0002	
AR(2)	0.2408	
Hansen test	220.7460	
Chi Square	197	
Wald Chi Square	290.29	

Notes: Dependent variable ΔAccess to electricity.
Model (1) Two-steps system-GMM. Robust standard errors in parentheses.
All AR(1) test statistics statistically significant at 1 percent level; all AR(2) test statistics statistically insignificant.
Hansen test statistic statistically insignificant.
Model (2) Bias corrected LSDV. Standard errors in parentheses.
Source: Authors' calculation.
*** Significant at 1 percent level.
** Significant at 5 percent level.
* Significant at 10 percent level.

Table 13. Fund for Peace: Marginal effects of FDI per capita

	(1) System-GMM	(2) Corrected LSDV
H1	0.0178**	0.0197**
	(0.008)	(0.009)
H2	0.0067	0.0071***
	(0.005)	(0.001)

Notes: Model (1) Two-steps system-GMM. Robust standard errors in parentheses.
Model (2) Bias corrected LSDV. Standard errors in parentheses.

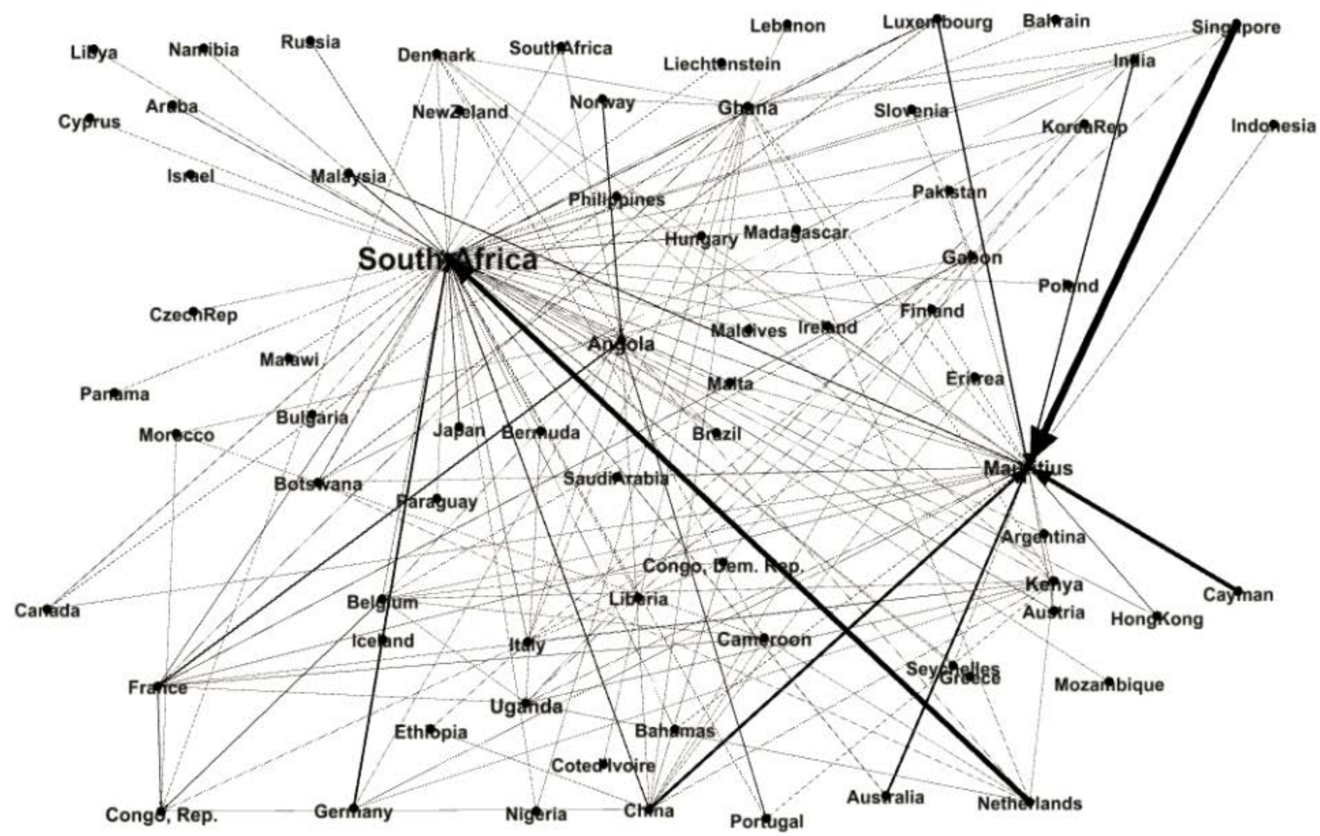
Source: Authors' calculation.

*** Significant at 1 percent level.

** Significant at 5 percent level.

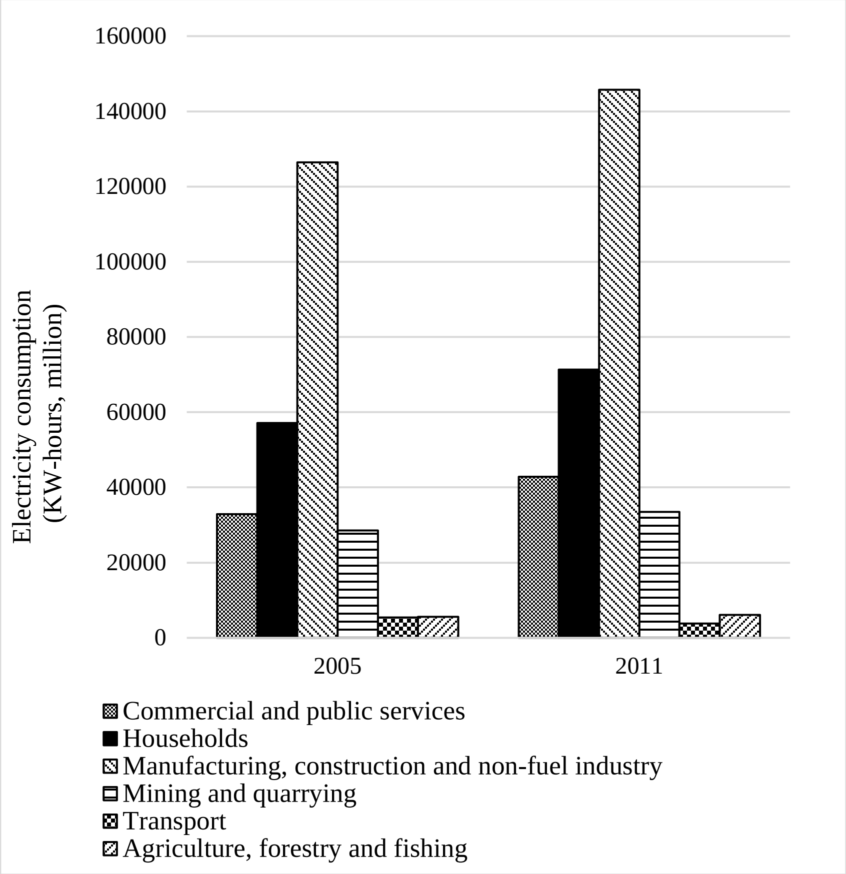
* Significant at 10 percent level.

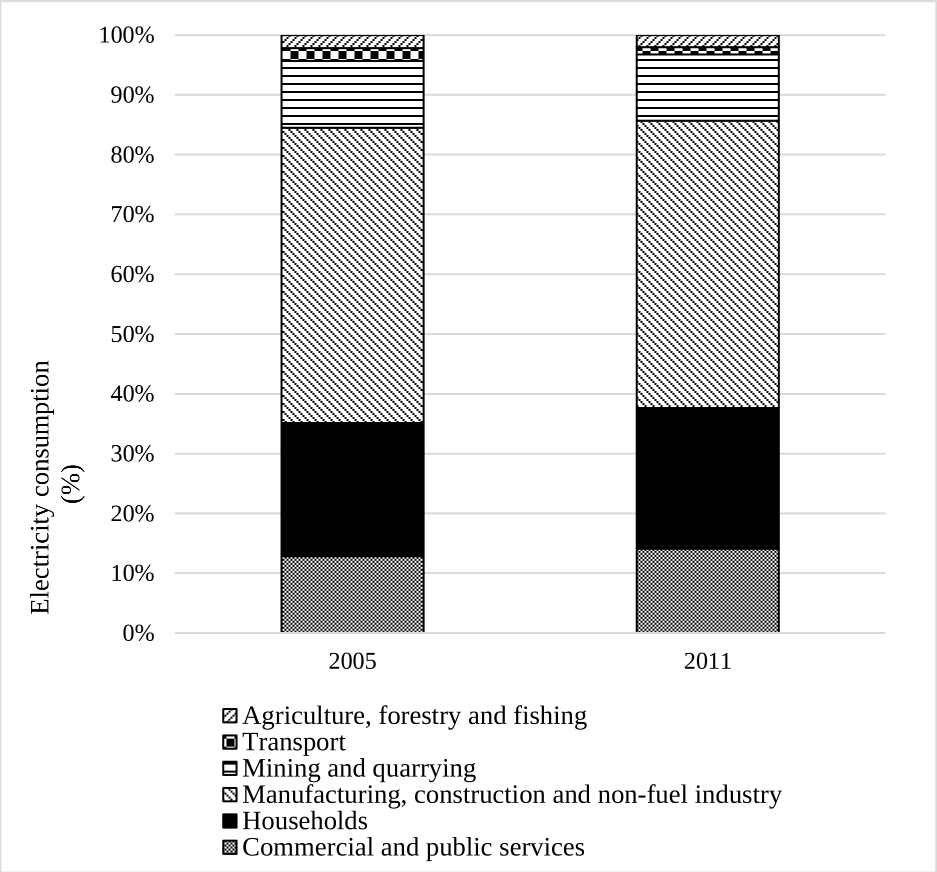
Graph 1. Network diagram of FDI stock per capita by home-host country pair



Source: Sample data from UNCTAD FDI Statistics Division on Investment and Enterprise (http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx) accessed on 15th March 2015 and authors' calculation.

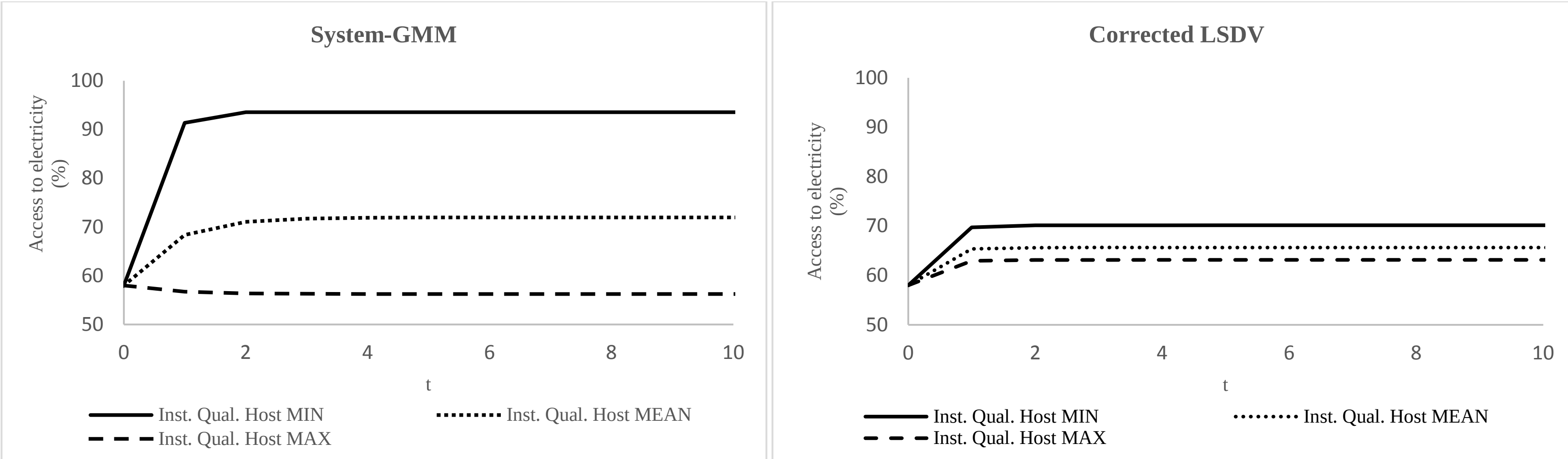
Graph 2. Electricity consumption in sub-Saharan African host countries by sector, 2005 and 2011





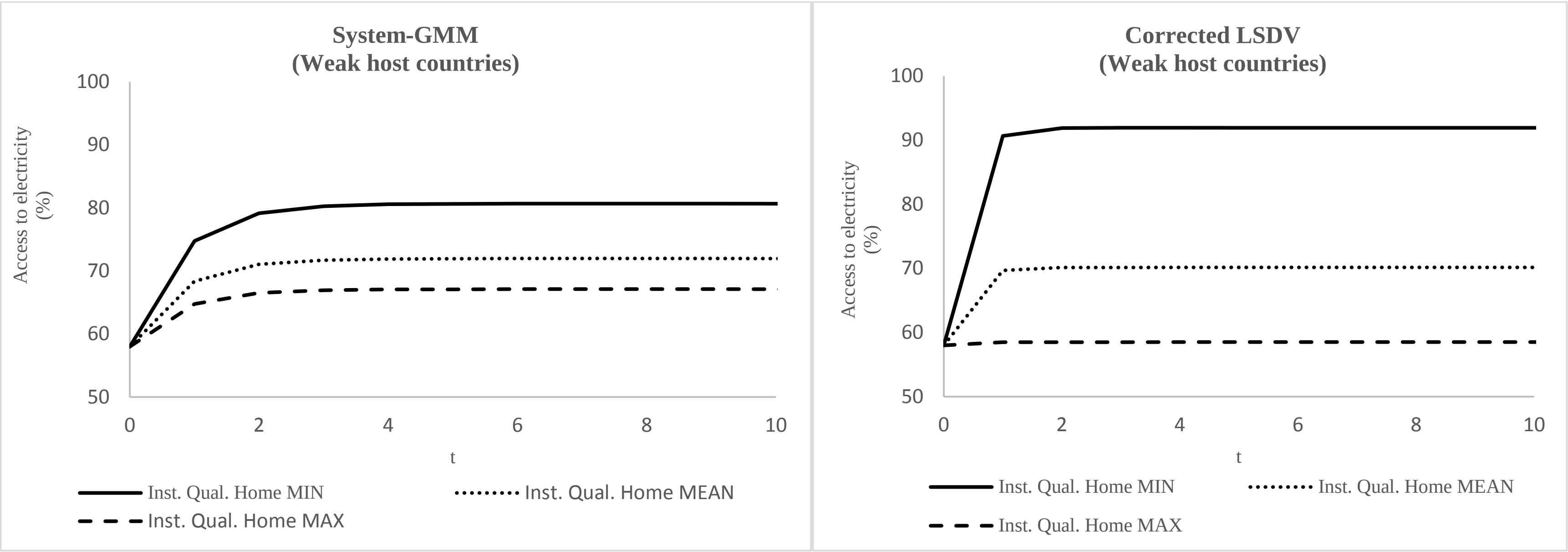
Source: Sample data from United Nations Energy Statistics Database (http://data.un.org/Explorer.aspx?d=EDATA) accessed on 24th March 2016.

Graph 3. Access to electricity response to a FDI shock over time, H1



Notes: All regressors, except for *FDI per capita* (variable) and *institutional quality host* (maximum, mean and minimum value) are set at the sample mean.
Sources: Authors' calculations.

Graph 4. Access to electricity response to a FDI shock over time, H2



Notes: All regressors, except for *FDI per capita* (variable), *institutional quality host* (minimum value) and *institutional quality home* (maximum, mean and minimum value) are set at the sample mean.
Sources: Authors' calculations.

APPENDIX

Table A.1. Characteristics of electricity provision in sub-Saharan Africa

Provision System *	Technology *	Target Population *	Infrastructure Features: Widespread domestic consumption	Infrastructure Features: Economies of scale and scope	Infrastructure Features: Sunk investment	MNE Engagement Channels
On-grid systems *(large international, national and regional grids)*	Large Solar Photovoltaics Farms Gas - Gas Turbines Plants Gas - Combined Cycles Gas Turbine Plants Onshore Wind Farms Large Hydropower Plants Coal Plants	Urban, Peri-Urban, Growing demand areas	Yes	Yes	Yes	Infrastructure planning, financing, constructing (greenfield or repowering), operating or maintaining
Distributed small-scale systems						
Mini - grid systems	Small Solar Photovoltaics Plants Small Hydropower Plants Small Wind Plants	Rural	Yes	Yes/No	Yes	Infrastructure planning, financing, constructing (greenfield or repowering), operating or maintaining
Off - grid systems	Stand-Alone Generators (fueled by diesel or gasoline)	Rural	No	No	Yes/No	No engagement

Sources: * IEA, 2014. # Levy and Spiller, 1994. § Ostrom et al., 1993.

Table A.2. Access to electricity rate, household electricity consumption and electricity net production (host countries): Correlation matrix from 2005 to 2011

		(1)	(2)	(3)
(1)	(Households) Access to electricity	1		
(2)	Households Electricity consumption	0.4542***	1	
(3)	Electricity net production	0.4526***	0.9989***	1

Source: Sample data from International Energy Agency (http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/) and United Nations Energy Statistics Database (http://data.un.org/Explorer.aspx?d=EDATA) accessed on 24th March 2015 and authors' calculations.

Table A.3. Factor analysis

World Bank Governance Indicators (WGIs)	Institutional Quality Host		Institutional Quality Home	
	Loadings	Uniqueness	Loadings	Uniqueness
Political stability	0.8230	0.3226	0.9449	0.1071
Rule of law	0.9615	0.0756	0.9554	0.0873
Voice and accountability	0.9467	0.1037	0.9502	0.0971
Control of corruption	0.9338	0.1280	0.8468	0.2829
Governance effectiveness	0.9644	0.0700	0.9628	0.0730
Regulatory quality	0.9357	0.1245	0.8520	0.2741
Cumulative proportion of WGIs variance explained by the factor	**86.26%**		**84.64%**	

Source: Author's calculations.

Table A.4. Overview of robustness checks

	H1		H2	
	System-GMM	Corrected LSDV	System-GMM	Corrected LSDV
Main Model	Confirmed	Confirmed	-	Confirmed
Robustness checks				
Use of traditional biomass (instead of access to electricity)	-	Confirmed	-	Confirmed
Fund for peace (instead of WGIs)	Confirmed	Confirmed	-	Confirmed
Natural resources (instead of industry and services value added)	Confirmed	Confirmed	-	Confirmed
GDP per capita (instead of LIC and LMIC)	Confirmed	-	-	Confirmed
Sample without FDI per capita stocks from EU	Confirmed	-	-	Confirmed
Sample FDI per capita stocks from China	Confirmed	-	-	Confirmed
Sample without multiple imputation	Confirmed	-	-	-
Reverse causality	Rejected			

Note: "-" Not significant.
Source: Authors' calculations.

ENDNOTES

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[i] See http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda.html (accessed on 14th March 2016).

[ii] Collective goods are commodities, functions and services that provide positive externalities to local collectivities and whose supply is assured by governments and/or private organizations. These goods are either non-excludable but rival or non-rival but excludable; public-economists call them “impure” public goods (Boddewyn and Doh, 2011).

[iii] See http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/ accessed on the 29th March 2015.

[iv] The three objectives of the Sustainable Energy for All Initiative (SE4All) are: (1) universal energy access; (2) Double the global rate of improvement in energy efficiency, and (3) Double the share of renewable energy in the global energy mix by 2030 (See: http://www.se4all.org/our-vision_our-objectives, accessed on 30th of March 2016).

[v] By *failure* we mean “non- or sub-performance on account of factors (e.g., uncertainty and bounded rationality) that prevent or hamper institutions, organizations and individuals from fulfilling their functions” (Boddewyn and Doh, 2011 p. 348).

[vi] Infrastructure refer to a range of facilities, services and installations that are essential for the distribution of products or services over geographic areas (Gómez-Ibáñez, 2009). Infrastructural assets usually comprise oil, gas, petrochemicals, electricity utilities, transportation, telecommunication, mining and other tangible, capital-intensive assets (Sawant, 2010).

[vii] On-grid-systems are large and medium-sized power plants connected to large-scale international, national or regional grids. Distributed mini-grid systems are small sized plants. Distributed off-grid systems are stand-alone generators (IEA, 2014).

[viii] Non-market strategies are the actions taken to favorably position the firm in its nonmarket environment by managing those uncertainties and resource dependences arising from the influence and/or resistance of other non-market actors that can affect the firm’s overall economic performances (Mahon et al., 2004).

[ix] See http://about-us.edf.com/strategy-and-sustainable-development/our-priorities/society/energy-access-developing-countries/projects-in-africa-84686.html and http://www.fres.nl/en/how-fres-works/fres-in-mali/86-10-jaar-ontwikkeling-in-mali-dankzij-zonne-energie.html (accessed on 26th March 2015).

[x] See http://ccsi.columbia.edu/files/2014/05/CCSI-Policy-Paper-Leveraging-mining-industrypercentE2percent80percent99s-energy-demand-to-improve-host-countrypercentE2percent80percent99s-power-infrastructure-Sept-20122.pdf (accessed on 13th July 2015).

[xi] We would like to thank anonymous reviewers for stimulating us to further elaborate upon our findings.

[xii] The only exceptions are Botswana and Democratic Republic of Congo where the electricity production remained stable or decreased over the period investigated.

[xiii] We would like to thank an anonymous reviewer for inviting us to better explain and contextualize the dependent variable.

[xiv] The multivariate imputation using chained equations (MICE) is one of the most popular choices for dealing with arbitrary missing-value pattern and continuous variables, and is a valid alternative to Bayesian simulation methods (Lee and Carlin, 2010).

[xv] The results of the multiple imputation are available upon request from the authors.

[xvi] FDI per capita from Chinese firms amounted only to $72 per capita (0.6 percent of total amount) in 2005, while they reached a pick of $15k per capita in 2011.

[xvii] The government's ability in directly providing electricity to the population has been proxied by the government effectiveness variable. Administrative capabilities have been proxied by the rule of law and, voice and accountability variables. Credibility of regulatory system has been measured by the government effectiveness, regulatory quality, and control of corruption. Judicial independence and professionalism by the control of corruption, rule of law and, voice and accountability variables. Finally, political stability has been proxied by the variable with the same name.

[xviii] See http://data.worldbank.org/data-catalog/world-development-indicators accessed on 22nd of March 2016.

[xix] The First-differenced GMM estimates of dynamic panel growth models may be biased because lagged levels of the variables are only weak instruments for subsequent first differences, if the time series are persistent and the number of time series observations is small; for this reason, the system-GMM estimator is preferable (Bond et al., 2001).

[xx] The Human Development Index (HDI), developed by the World Bank, has also been considered as an external instrument to capture economic and social development. However, due to the high amount of missing data, i.e., 25 percent, we prefer not to use it.

[xxi] The results of the intermediate models are available upon request from the authors.

[xxii] The results of the Unit Root tests are available upon request from the authors.

[xxiii] Compared with values obtained with system-GMM, with the corrected LSDV estimates of *population density, industry* and *services value added* have the same sign but are not significant, while *population* is not significant with an opposite sign.

[xxiv] Results of single Worldwide Governance Indicators are available upon request from the authors.

[xxv] See: http://fsi.fundforpeace.org/ (accessed on 22nd March 2016).

[xxvi] Natural resources rents are the sum of oil, natural gas, coal (hard and soft), mineral and forest (See http://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS, accessed on the 4th June 2015).

[xxvii] We would like to thank for comments provided on the treatment of missing data, and suggestions to test the stability of the results.

[xxviii] We would like to thank an anonymous reviewer for suggestions provided on the sensitivity analysis, and suggestions to test the stability of the results.