



An econometric analysis of the effectiveness of development finance for the energy sector

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ARTICLE INFO

Article history:

Received 10 January 2013

Revised 27 June 2013

Accepted 28 November 2013

Available online 20 December 2013

Keywords:

International aid

Energy access

Aid effectiveness

ABSTRACT

Reaching the objective of universal access to modern energy services will require large investments in infrastructure in developing countries. An important part of funding will be provided in the form of development finance and its effectiveness in producing positive impacts is crucial for this achievement. This paper presents a panel analysis of the relationship between the installed capacity of electricity generation, the development finance committed for the energy sector, and the gross fixed capital formation. We tested four models with a large dataset and found development finance to have, in most cases, a positive influence on installed base.

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Introduction

The objective of this analysis is to understand if Official Development Finance (ODF) for the energy sector is effective in augmenting the installed electricity generation capacity of recipient countries. This study is a follow-up of previous research that focused on the allocation of aid and development finance for the energy sector, and it shares the same underlying dataset (Gualberti et al., 2012).

The 2012 UN Conference on Sustainable Development (Rio + 20) recognised that access to modern energy services is critical to achieve sustainable development, and committed to facilitate support for access to these services (UN, 2012). Reaching the associated goal of Universal Energy Access (UEA) will imply that many investments will be needed to expand the level of installed power generation capacity of developing countries, to refurbish old facilities, to expand the transmission and distribution infrastructure, and to increase the number of decentralised energy systems (IEA, 2011a; UN-AGECC, 2010).

An important share of the needed financing for lower income countries will be provided as development finance. The IEA calculates that bilateral and multilateral donors would be required to finance around 18 USD billion each year on average until 2030, representing the 37.5% of the total financing needed, the rest being equally split between government funding and private investments (IEA, 2011a). Therefore, the effectiveness of that development finance in leveraging other funding sources in order to produce positive impacts is of crucial importance.

The aid effectiveness literature is vast, although the examples of analysis of effectiveness per sector are much more limited. The

effectiveness of development finance for the energy sector has not yet been explored in literature to our knowledge, and thus we took inspiration from examples of aid effectiveness analysis of other sectors, in particular health and education.

We perform a panel data analysis using a large dataset of 160 countries (further subdivided in four country groupings) for 30 years. Our models explore the relation between the amount of installed base for electricity production, as a result of the general level of investments and of the amount of development finance for the energy sector provided by bilateral and multilateral donors. The main outcome of our analysis is that – in the great majority of the cases analysed – development finance for energy is positively correlated with the installed base of electricity generation.

This paper is divided into five sections: following this introduction, we present a brief analysis of the literature of aid effectiveness and the main policy developments of international assistance for the energy sector; we then describe our data, model and econometric techniques; we present the results of our exercise; and in the last section we draw conclusions.

Aid policies for the energy sector and aid effectiveness

Energy aid policies

Energy poverty has become a priority in the international development agenda since turn of the century. Excluded from the Millennium Development Goals, the centrality of energy for sustainable development and poverty reduction has been explicitly reaffirmed in all recent international development conferences and donors' policy guidelines and commitments.

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The ninth session of the United Nations Conference on Sustainable Development (UNCSD-9) was the first time the UN discussed energy as a separate agenda and, among other things, also assessed the international cooperation initiatives active for the energy sector (UNCSD-9, 2001). UNCSD-9 served as a basis for the subsequent World Summit on Sustainable Development of Johannesburg in 2002, that formulated an incitement to enhance international and regional cooperation to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services, as an integral part of poverty reduction programmes (UN-WSSD, 2002). The implementation plan of Johannesburg JPOI did not contain quantitative targets for financing energy access or any institutionalised mechanism to monitor progresses, due to lack of consensus between countries and regional blocks. However, a certain number of commitments and partnerships were signed at the summit, with total pledges of slightly less than 800 USD million, of which 700 from the EU (Spalding-Fecher et al., 2005).

Few years after the WSSD the international community addressed once again the energy theme in the 14th and 15th sessions of the UNCSD but was not able to reach consensus, due to disagreements on the role of energy sources, on the institutionalisation of energy in the UN and on the mechanism to revise the progresses in this area (Karlsson-Vinkhuyzen, 2010). The inability to reach a global agreement between member states did not stop international initiatives on energy, in particular from the UN-Secretariat, from international institutions outside the UN-System, and from donors.

The UN-Secretariat has been very active in promoting the energy agenda, with the inception in 2004 of the UN-Energy, an inter-agency devoted to coordinate UN work in the area, and the creation of the advisory group on energy and climate change in 2009 (UN-AGECC) (UN-Energy, 2010). The UN-AGECC in 2010 estimated that to reach universal access to modern energy services by 2030, at the basic needs level, there would be necessary around 10–15 USD billion per year in grants, plus loan capital for 20–25 USD billion, while the IEA puts the level of ODA needed to 18 USD billion (IEA, 2011a; UN-AGECC, 2010). Other estimates of the global financing and ODA needed have been formulated by development institutions and independent researchers (Bazilian et al., 2010, 2012a,b; EAC, 2006; Eberhard et al., 2010; ECOWAS, 2006; Rosnes and Vennemo, 2009; SNC Lavalin International Inc. and Parsons Brinckerhoff, 2011; UN-Energy/Africa, 2007, pag. 85; Van Ruijven et al., 2012; World Bank, 2006, 2010).

In 2012, two events further supported the energy agenda and development finance commitments to the sector: the establishment of 2012 as the International Year of Sustainable Energy for All (SE4All), and the Rio + 20 summit. The SE4All plan, whose objectives are universal access, improved energy efficiency and higher share of renewable energies by 2030, was largely endorsed by developing countries, donors, international institutions and businesses: in particular development banks committed more than 30 USD billion in new resources, of which 20 from the African Development Bank AfDB; the World Bank committed to double the leverage of its energy portfolio to 16 USD billion a year; large bilateral donors (US, EU and Norway) also committed new development finance resources for the energy sector (Holliday and Yumkella, 2012). The Rio + 20 summit supported the SE4All agenda although, exactly as its predecessors, did not approve any multilateral agreement, timetable, target, financing or monitoring mechanism for the energy sector (Bazilian et al., 2012a,b; Halle, 2012; UN, 2012).

Aid effectiveness

The effectiveness of aid is a highly disputed topic both in the academic literature and in the broader public debate. It is also a high political priority for developing countries and bilateral and multilateral donors that agreed with the Paris Declaration (2005), the Accra Agenda for Action (2008), and the Busan Declaration to implement a detailed multi-year programme toward its improvement (4th High Level Forum on Aid Effectiveness, 2011; OECD, 2008, 2011).

The research on the effectiveness of aid has primarily followed three approaches: econometric approaches that focus on investigating the relation between aid flows and economic outcomes (Selaya and Sunesen, 2012), qualitative studies that explore inside the “black box” of the institutional and policy processes between aid delivery and desired outcomes (Arndt et al., 2011), and studies that analysed the implementation process of the Paris Declaration and aid quality issues (Knack et al., 2011; Owa, 2011).

A large part of previous econometric analysis on aid effectiveness attempts to understand if aid has an effect on economic growth under various conditions.¹ Typically the aid-growth debate took into account aggregate flows of aid without making distinction by purpose or sector (Mavrotas and Nunnenkamp, 2007). Some examples of sectorial analysis of aid exist; in particular some scholars compared the allocation of aid per sector against selected Millennium Development Goals (MDGs) indicators (Baulch, 2006; Hailu and Tsukada, 2012; Thiele et al., 2007). Some empirical studies on the effectiveness of aid per sector also exist, in particular for health and education. These studies often took advantage of the availability of sector specific data collected in the framework of the MDGs (UN, 2008).

Sectorial aid effectiveness has been evaluated with various techniques: heuristically, a sector indicator (such as an MDG indicator) is set as the dependent variable, while a measure of aid and of the national spending for the sector are set as explanatory variables; in some cases additional variables are tested covering other institutional, social, or economic factors. Models are generally tested with various specifications and econometric techniques, and specific sectorial analysis tools have been proposed (Elbers et al., 2009).

For example, in the health sector, Wilson estimates with various econometric models if mortality indicators (dependent variables) are improved by donor assistance in the health sector, increases in GDP, democracy indicators, or aid in other sectors. He finds significant results only for GDP (Wilson, 2011). Williamson specified a fixed effects model with inherent endogeneity to explain five health indicators with a similar set of explanatory variables, and using instrumental variables, estimators found GDP only significant for infant mortality, and that aid was generally not significant (Williamson, 2008).

Mishra and Newhouse, however, arrive to the opposite conclusion with a dynamic panel model with country fixed effects estimated by generalized method of moments (GMM); they found that income and health aid (and lagged infant mortality) were all significant to explain variation in infant mortality (Mishra and Newhouse, 2009). Quisumbing (2003) made a panel analysis to understand, behind other things, the effects of various forms of food-aid with child nutritional status indicators in Ethiopia and found a positive impact. Hayman et al. (2011) make a systematic review of more than 30 studies on the impact of aid on maternal and reproductive health (the majority of which are limited to one or few countries) and found that the studies suggest that aid interventions might be associated (but not necessarily be the cause) with some positive change in the MDG 5 indicators.

Some examples for the education sector: Dreher et al. (2007) use net primary school enrolment as a dependent variable and aid given to the education sector and overall spending on education as explanatory variables in the single equation specification to their model,² finding that aid for education was strongly effective in increasing enrolment. Michaelowa and Weber (2007) analysed the same research question with a dynamic panel analysis, again estimated by GMM, and found a positive (but small) effect of aid on school enrolment and completion. Finally, Wolf (2007) analyses simultaneously the effects of aid levels

¹ On the aid-growth debate, see Burnside and Dollar (2000, 2004), Easterly et al. (2004), Easterly (2003), Roodman (2007), Bourguignon and Sundberg (2007), Arndt et al. (2011), Doucouliagos and Paldam (2009), Clemens et al. (2011), Hansen and Tarp (2000), Lessmann and Markwardt (2012), Hudson and Mosley (2008), Kimura et al. (2012), Kodama (2012), and Kosack and Haven (2003).

² They also test more multiple equation models accounting for institutional quality and determinants of spending.

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