Foreign Aid and Household Energy Availability in Developing Countries: Evidence from Cross-Sectional Analysis

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1. INTRODUCTION

Modern energy is fundamental for economic development and human well-being.

Sustainable Development Goals (SDG 7): “Ensure access to affordable, reliable, sustainable and modern energy for all” by 2030 (SE4ALL)
1. Introduction (CONT.)

Despite the critical importance of clean and modern energy

- around 1 billion – 13% of the world’s population – live without electricity

- 3 billion people – more than 40% of the world’s population — still rely on traditional fuels for cooking

- women and children are the prime collectors and users of traditional fuels — they are at most risk
1. Introduction (CONT.)

Official development assistance for energy (ODA) initiative

- The core objective of ODA is promote sustainable development and better human well-being (including energy sustainability)

During the period 2002-2017:

- the amount of ODA, from OECD countries, targeted sector of developing countries is approx. 59 billion (with 6 billion in 2017)

- this amount constitutes only 4% of the total aid to all sectors (with 5% in 2017)

- this amount has grown by 428% over the period 2002-2017
3. RESEARCH QUESTIONS

Has ODA:

1. Made a tangible contribution to household modern energy availability?
2. Helped developing countries reduce use of traditional fuels?

We focus on ODA that has been targeted at the energy infrastructure and productive capacity sectors
4. **Potential effects of energy aid on energy availability**

- Energy aid could increase/improve energy infrastructure endowment lowering cost of energy supply (particularly in rural and remote areas) and increases energy access and consumption.

- Energy aid could increase/improve energy infrastructure endowment promoting economic growth/households per capita incomes households’ greater appreciation for modern/clean energy, and could at the same time reducing traditional fuels consumption.

  - The latter point suggests that energy aid could be a potential reason for energy ladder (“energy ladder” model).

  - However, household might not switch away from traditional fuels as a result of increases in modern/clean energy, but could keep the same level or increase the level of traditional fuels consumption (“fuel stacking” model).
5. METHODOLOGY

- We use dataset for up to 144 developing countries over the period of 2002-2015
- We apply the following model on a cross-sectional dataset:

\[ Y_{EV}^{2015} - Y_{EV}^{2002} = \beta_0 + \beta_1 Y_{EV}^{2002} + \beta_2 \ln GDPp.c.^{2002} + \beta_3 \ln \text{aid for energy}_{aver} + \beta_4 X'_{aver} + \epsilon_{aver} \]

- dependent variables are:
  - the difference in access to electricity rate, % (2002-2015)
  - the percentage change, the growth (2002-2015) of:
    - household per capita electricity consumption (watt/hour)
    - Household per capita fuelwood consumption (cubic meter)
- We apply OLS technique with robust standard errors to correct for heteroscedasticity

- independent variables are:
  - Initial access to electricity (%) & ln initial per capita energy consumption (2011 I$, ppp term)
  - ln initial per capita GDP (2011 I$, ppp term)
  - ln per capita energy aid (2016 constant US$) &
  - ln per capita non-energy aid (2016 constant US$)
  - other independent variables for robustness test
  - B’s are coefficients
### 6. RESULTS

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>difference in access to electricity (%) over 2002-2015</th>
<th>difference in ln household pc electricity consumption over 2002-2015</th>
<th>difference in ln household pc fuelwood consumption over 2002-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Initial access to electricity (%)</td>
<td>-0.25***</td>
<td>-0.34***</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.10)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>Ln initial household per capita electricity consumption</td>
<td></td>
<td>-0.34***</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.10)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>Ln initial household per capita fuelwood consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln initial per capita GDP consumption</td>
<td>2.14</td>
<td>0.30***</td>
<td>-0.45</td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td>(0.09)</td>
<td>(0.37)</td>
</tr>
<tr>
<td>Ln per capita energy aid</td>
<td>1.71**</td>
<td>0.05**</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.84)</td>
<td>(0.02)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Ln per capita non-energy aid</td>
<td>0.30</td>
<td>-0.01</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>(1.26)</td>
<td>(0.05)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Other controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of observations</td>
<td>121</td>
<td>114</td>
<td>71</td>
</tr>
<tr>
<td>R2</td>
<td>0.406</td>
<td>0.407</td>
<td>0.159</td>
</tr>
</tbody>
</table>

Robust standard errors are in parentheses. ***, ** and * indicate statistical significant at 1%, 5% and 10% respectively.
6. RESULTS (CONT.)

1 p ↑ in per capita energy aid targeted energy infrastructure

⇒ (associated with) 0.02 pp of additional access to electricity rate over the period 2002-2015

⇒ (associated with) 0.05 of additional growth in per capita electricity consumption over the same period

No indication that foreign aid helps households reduce fuelwood energy use

Note: p denotes percent
pp denotes percentage point
7. ENERGY & ODA SUCCESS STORIES

Kenya:

- Since Mid-1990s, Kenya has seen one of the success energy sector reform in Sub-Saharan Africa
- Cooperation has been between the Kenya’s government, private sector and donors
- Global donor community initiatives include:
  - Lighting Africa (World Bank)
  - Power Africa (US)
  - Energy Fund for Africa (African Development Bank)
- Over the period 2002-2017, the total ODA to Kenya’s energy sector is approx. 1 billion (8% of total ODA to all sectors)
  - per capita ODA target energy sector increased by 1608%
- Over the period 2002-2017, the country access to electricity increased from 18% to 56%
- the period 2002-2015:
  - household per capita electricity consumption increased by 40%
  - household per capita fuelwood consumption declined by 69%
8. CONCLUSION

- Our results suggest that foreign aid has tangible effects on modern energy availability

  - Direct effects: foreign aid increases/improves infrastructure endowment > modern/clean energy availability
  - Indirect effects: foreign aid increases/improves infrastructure endowment > economic growth and/or per capita income > households’ appreciation of modern/clean energy increases
  - “energy ladder” model

- Our results indicate that fuelwood fuel is irresponsive to increase of:
  - foreign aid
  - income
  - “fuel stacking” model
8. CONCLUSION (CONT.)

Our results are suggestive of transmission mechanisms through which ODA operates.

- increased/improved energy infrastructure endowment
- increase modern energy availability
- economic development
- better human well-being

Transmission Mechanisms -> UN SDGs
Questions / comments welcome!
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