The Impact of Electricity of Economic Development: A Macroeconomic Perspective

David Stern, ANU
Paul Burke, ANU
Stephan Bruns, U. Göttingen

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Research Questions

- Has electrification prolonged or accelerated growth in developing countries?
- How serious do electricity supply problems have to be, to be a serious constraint on growth?
- What can be learnt from countries that were historically successful in electrification?
What Does Theory Tell Us?

- Energy essential input, hard to substitute other inputs for it
  - Therefore, energy can be a constraint when scarce
  - Energy (use, quality, productivity) contributed more to growth in developed countries in past
  - May contribute more to growth in developing than developed countries
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- Electricity highest quality energy carrier
  - More productive, flexible, clean than other energy, unique applications
  - Providing reliable electricity supply challenging, requires investment in peak capacity
  - Economies of scale in generation – oil fired power in small/island countries

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What Does the Data Tell Us?
Electricity Use and GDP per Capita

Electricity Use per Capita kWh vs GDP per Capita 2011 PPP Dollars
What Does the Data Tell Us?

- 1% increase in GDP associated with 0.8% increase in electricity use
  - Electricity use grows 2 % p.a. in a country with no economic growth!
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  - Weak correlation with growth (-ve for reliability)
Reliability of Electricity Supply and GDP per Capita

GDP per Capita 2011 PPP Dollars

WEF Reliability of Electricity Supply
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- Electricity costs high relative to GDP in poorer countries
Does Electricity Use Cause Growth?

- More than 500 papers use time series modeling to test for Granger causality or cointegration between energy or electricity use and GDP
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- Why?
  - Effect of energy on growth < effect of income on energy demand
  - Energy efficiency improvements reduce energy use increase GDP
Does Electricity Infrastructure Cause Growth?

- Few methodologically sound studies
- Best studies combine electricity infrastructure with other infrastructure
- Estimated effect on GDP of 1% increase in electricity infrastructure: 0.03%-0.1%
What About Electricity Reliability?

- Again, few well-designed studies
- Andersen and Dalgaard (2013): 1% increase in outages per month $\Rightarrow$ 0.018% reduction in rate of economic growth
- Calderón and Servén (2010): 1% increase in distribution & transmission losses: 0.05% reduction in GDP
What Can We Learn From Country Case Studies?

- Selection of countries:
  - GDP per capita 1971 < $2,500
  - Electricity access 2013 > 95%
  - Electricity consumption 2013 > 1 MWh per capita
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• Egypt: 5.5% economic growth rate (p.c.), electricity quality 2.7
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  - South Africa
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- But rapid growth recently in Ethiopia, Kenya…
Questions for Further Research

- What is the effect of electricity supply disruptions on economic growth?
- Does electricity sector success boost economic growth in country-level panel datasets?
- How robust is the effect of electricity infrastructure on economic growth?
- Are the key findings in the electricity-growth literature replicable?
- How can electricity be a “binding constraint” on economic growth?
- Can a new generation of time series models of energy and growth better identify the role of energy in growth?
Thank you