

Using a Household Panel to Investigate National Household Electricity Access

A South African Application

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Introduction

- Public services such as electricity are delivered to household units.
- Therefore, research in this realm should look to focus on changes in household access - rather than simply considering changes in service access for individuals.
- In this regard, there are two key ways to think about how to use household surveys to investigate trends in electricity access / usage.
 - The first is a standard cross-sectional approach.
 - The second is the longitudinal approach.



Cross-Sectional Approach

- This approach entails:
 - Analysing cross-sectional data across different years;
 - Calculating electricity access rates for each year;
 - And using these rates to approximate a trend in electricity access over the period of interest.
 - If we do this using the first three waves of NIDS, we get the following results:
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Cross-sectional Analysis: Household Electricity Access, South Africa, 2008-2012

	Wave 1	Wave 2	Wave 3
	<u>Proportion</u>	<u>Proportion</u>	<u>Proportion</u>
Access	0.820	0.808	0.865

Between 2008 and 2010, we see a (minor) drop in the proportion of households with access. Then between 2010 and 2012, we see a significant increase in access.

Cross-Sectional Approach: Limitations

- Clearly, this approach is simple and useful. But is this enough?
 - Frankly, this methodology is very limited in its application.
- There are two key questions that cannot be answered by this cross-sectional technique, but should be interesting to those involved in this sphere:
 - **What is happening to existing households in terms of electricity access?**
 - **How does migration relate to electricity access?**
- **To answer these questions one requires a longitudinal data set that tracks the same household units over time (i.e. a panel of households).**
 - NIDS as it stands is a panel of individuals.
 - However, after transforming NIDS into a panel of households (and classifying households in every period as surviving / dissolving and new / surviving), we find the following:

Longitudinal Approach: Surviving Households

Panel Analysis: Transitions for Surviving Households, South Africa, 2008-2010

(Number of Households (and proportion))

		Wave 2		
		No Access	Access	Total
Wave 1	No Access	1 627 198 (0.7304)	590 054 (0.266)	2 217 252 (1.00)
	Access	698 129 (0.072)	8 936 050 (0.928)	9 634 179 (1.00)

Panel Analysis: Transitions for Surviving Households, South Africa, 2010-2012

(Number of Households)

		Wave 3		
		No Access	Access	Total
Wave 2	No Access	1 125 835 (0.537)	968 964 (0.463)	2 094 799 (1.00)
	Access	374 119 (0.043)	8 232 599 (0.957)	8 606 718 (1.00)

Longitudinal Approach: New and Dissolving Households

Panel Analysis: Proportion of Households with Access to Electricity, South Africa, 2008-2012 (within each formation/dissolution category)

	Dissolving Households	Newly Formed Households
Wave 1 - Wave 2	0.842	0.788
Wave 2 - Wave 3	0.781	0.882

- Households that dissolved between 2008 and 2010 were more likely to have access to electricity than those that survived over the period.
- Households that formed between 2008 and 2010 demonstrated a lower degree of electricity access than those that had survived (and those that had dissolved).
- **This suggests that household dissolution and formation processes could have contributed to the deterioration in electricity access over the period 2008-2010.**
- The proportion of new households that have access to electricity is far higher than the same proportion for dissolving units, and slightly higher than the proportion for surviving households.
- **This suggests that household formation and dissolution likely contributed to / worked with improvements in electricity access between 2010 and 2012.**

Longitudinal Approach: New and Dissolving Households

- So we see two core mechanisms behind these aggregate changes in electricity access:
 - Net change in access for surviving households (negative then positive)
 - Migration related changes (negative then positive)
- But it would also be interesting to know to what extent each of the identified effects contributed to the aggregate shifts in electricity access.
- Mathematically, we can break down these core mechanisms into three effects which lead to aggregate changes in access:
 - Within effect, or the net effect for surviving units
 - Replacement effect, or effect from new households replacing households that dissolved
 - Dilution effect, or the degree to which net household formation “dilutes” or increases electricity access – over and above the replacement effect
 - The latter two are related to migration.

Longitudinal Approach: Decomposition

Panel Analysis: Decomposition of Change in Household Electricity Access, South Africa, 2008-2012

	Within Change Effect	Replacement Effect	Dilution Effect	Total Change
Wave 1 - Wave 2	-0.008	-0.009	-0.001	-0.018
Contribution to change (%)	41.279	51.215	7.507	
Wave 2 - Wave 3	0.042	0.017	0.000	0.060
Contribution to change (%)	70.246	29.144	0.610	

Conclusions

- Both changes in access for surviving households and migration effects (household formation and dissolution) seem to be key mechanisms which determine the degree of improvement in electricity access at an aggregate level.
- In terms of the first process, we argue that is insufficient for policy makers to focus on extending electricity to a certain number of unconnected households ever year; because disconnections play as crucial a role in determining the development of service access.
- In terms of the second process, government cannot naively assume that migration processes will function in line with policy objectives.
- Notes:
 - Not sure what disconnection means? – infrastructure failure, administrative failure
 - Measurement error?