

Impacts of switching to prepaid electricity: Evidence from Cape Town, South Africa

Kelsey Jack (Tufts)
Grant Smith (University of Cape Town)

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The revenue recovery challenge

Expanding electricity access is key to economic growth

Yet with new electricity connections come new challenges

- ▶ Customers: Poor households struggle to pay monthly bills
- ▶ Utilities: Disconnection is costly and often politically infeasible

Prepaid electricity: A possible solution?

Relative to postpaid metering:

- ▶ enforcement shifted from the utility to the customer
 - ▶ customers pay for every kWh they consume
- ▶ consumption more likely to match income flows
 - ▶ Jack and Smith (2015): low property value customers purchase smaller amounts, more frequently and more often on payday
- ▶ other differences: meters provide more information, customers may interact differently with the meter (commitment device, savings account)

The need for evidence

Lots of practical experience, but no causal evidence on impacts

Measure effect on existing customers in a “mature” and stable metering environment

- ▶ Separate effect of meter type from effect of electricity access
- ▶ Avoid confounds from unreliable supply or unpredictable prices
- ▶ Study objective: Causal evidence on how prepaid metering affects
 - ▶ electricity usage
 - ▶ revenue
 - ▶ other billing outcomes

Study setting: Electricity in Cape Town

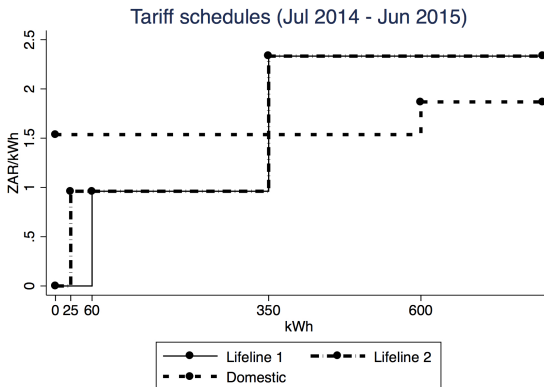
Municipal utility provides electricity to ~80% of residents

- ▶ Overall electrification rates close to 100%
- ▶ Average cost of residential supply: 1.5 ZAR/kWh
- ▶ Modest supply shortages in winter

Tariffs in Cape Town

- ▶ Increasing block tariffs, adjusted in July each year
- ▶ Subsidized “Lifeline” tariff provides “free basic electricity”
- ▶ Tariff resets on the first of each month

Study setting: Tariffs in Cape Town



Study setting: Mitchells Plain

Low-income suburb with ~60,000 residential electricity customers

2011 Census:

- ▶ 99.3% of properties are electrified
- ▶ 38% of hh have income <ZAR 3200/month (<USD 400)
- ▶ median hh spends 8-10% of monthly income on electricity
- ▶ 76% of 15-65 y.o. are unemployed
- ▶ 65% of individuals <20 yo did not complete secondary school

Study design: Data sources

Non-disclosure agreement with City of Cape Town to access:

1. Billing records (2012-2015)
2. Prepaid transaction records (2012-2015)
3. Property value / GIS dataset (2012)

Study design: Randomised phase-in approach

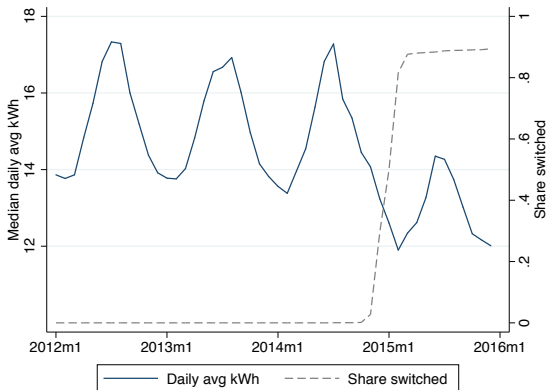
Study sample: ~2300 postpaid customers switched to prepaid electricity between November 2014 and February 2015

- ▶ Standard approaches to roll-out makes it hard to compare switched customers to not-switched
- ▶ Research design: Randomise the order in which households are switched

Collaboration with the City of Cape Town

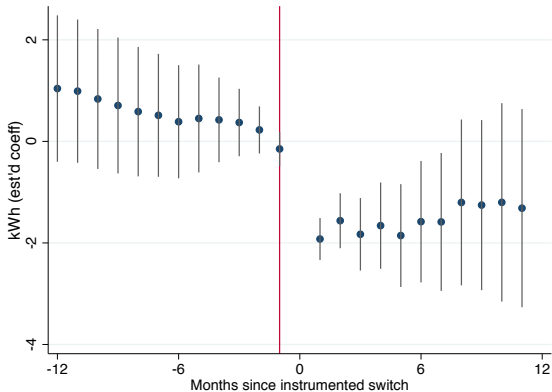
- ▶ Worked with contractor to complete prepaid installations
- ▶ ~90% of targeted customers successfully switched

Results: Usage (kWh/day)



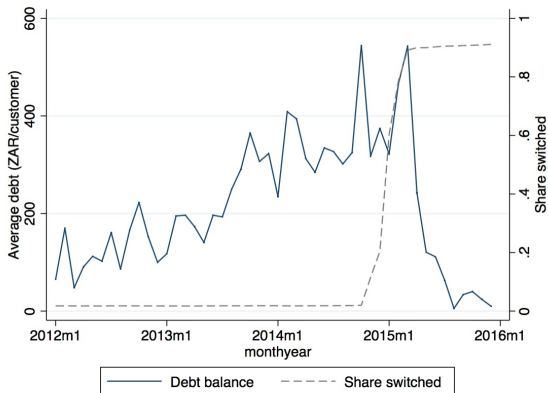
Switch to prepaid results in 1.3 or 11% fewer kWh per customer per day

Results: Usage over time (kWh/day)



Reductions in consumption are fairly stable over time

Results: Outstanding balance



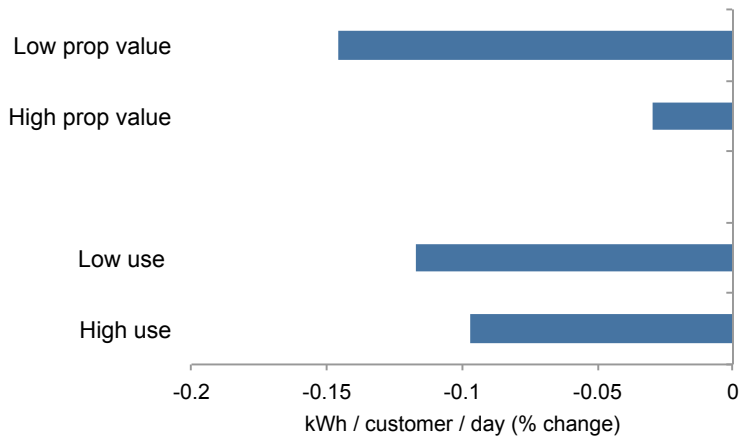
For a few customers (not included), prepaid meter used to recover debts

Whose usage changes? And so what?

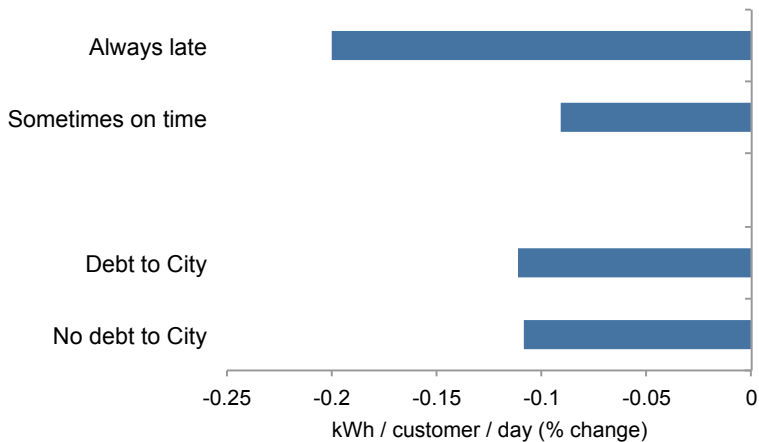
When switched to a prepaid meter, daily kWh falls by ~10%

- ▶ Whose usage changes?
 - ▶ Not all reductions are beneficial for revenue
- ▶ Cost benefit calculations
 - ▶ Bottom line for Cape Town
 - ▶ Implications for other settings

Who responds to prepaid metering?



Who responds to prepaid metering?

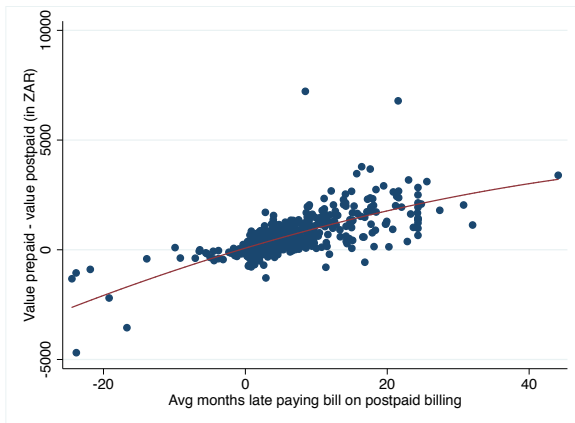


Implications: Cost-benefit analysis

	Postpaid	Prepaid
Customer responses		
Average monthly kWh	492	419
Days between use and payment	92	-3.6
One-time costs (c^{meter})		
Meter and installation	30	65
Recurring costs (c^{bill})		
Meter reading	1.15	0
Billing	0.89	0
Vending network maintenance	0	–

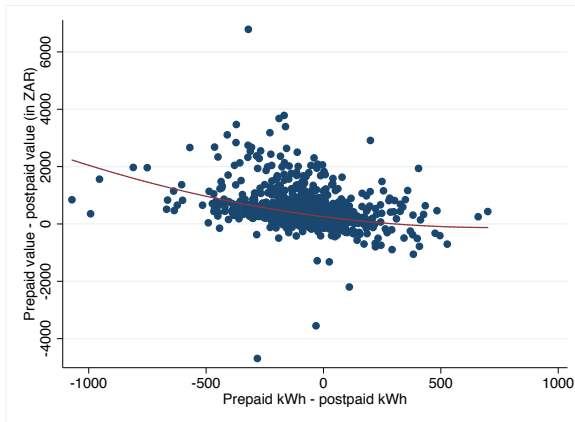
Bottom line: over a 5 year period, the average customer is ~40% more profitable on prepaid than postpaid

Implications: Cost-benefit analysis



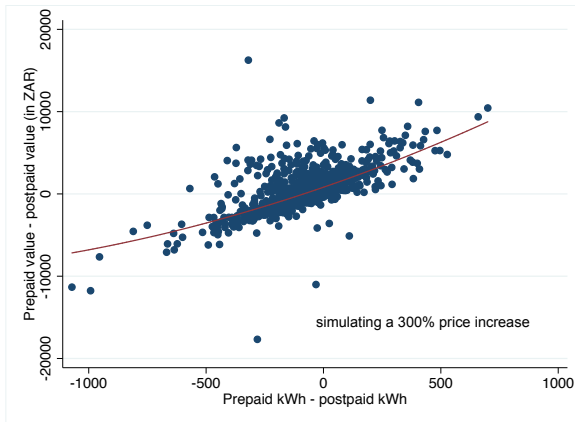
Value of prepaid is increasing in payment delinquency on postpaid

Implications: Cost-benefit analysis



Value of prepaid is higher when the usage reduction is higher

Implications: Cost-benefit analysis



...because the average customer's electricity is subsidized in Cape Town

Relevance for Zambia

Prepaid metering in both electricity and water are expanding rapidly across Zambia

Cape Town setting is obviously very different but customer responses and revenue implications have some relevance

- ▶ Reduction in electricity use likely to extend to water and electricity in Zambia though magnitudes might differ
- ▶ Revenue effects – and the factors making prepaid metering more or less advantageous – are also likely relevant
- ▶ Future work is needed to identify impacts in other settings

Energy for Economic Growth (EEG)

Announcing new research program in Energy for Economic Growth (EEG)

- ▶ Co-led by the Center for Effective Global Action (CEGA) and Oxford Policy Management (OPM)
- ▶ Funded by DFID (USD \$18 million over 5 years)
- ▶ East Africa energy policy workshop to be held **July 14th in Dar es Salaam, Tanzania**
- ▶ Multiple funding rounds for empirical research on energy & growth to begin in early 2017
- ▶ Contact: Carson Christiano, christiano@berkeley.edu

Thank you

Collaboration and data sharing: City of Cape Town

- ▶ Electricity Department
- ▶ ERP
- ▶ Utilities Division

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