On the (in)effectiveness of DST to Reduce Electricity Consumption in Argentina

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Daylight Saving Time

- DST is one of the most widely applied policies for electricity consumption reduction in the world
  - About 70 countries usually apply some variation of DST
  - 1.8 billion people have to adjust their clocks every year
- Logic behind DST
  - Suppose that at a place
    - Sun rises at 6:00 and sunset happens at 19:00
    - Majority of activities in the city begin at 7:00 and end up after sunset at 21:00
  - Policy relocate activities by changing the clocks $\Rightarrow$ shift one hour forward (summertime DST)
    - Supposed to be costless
    - Its effectiveness depends on people behaving by the clocks

Related Literature

- Studies relying on simulations and "before-after" evaluations
  - Conclude that DST is effective in reducing energy demand by about 0.5% to 4%
- Studies relying on quasi-experiments
  - Kellog and Wolff (JEEM 2008) $\Rightarrow$ DST in two States just before the 2000 Summer Olympic Games (Australia)
  - Kotchen and Grant (REStats 2011) $\Rightarrow$ DST in counties in the State of Indiana (United Sates)
  - Conclude that DST had no impact (Kellog and Wolff) or modest positive impact (Kotchen and Grant) on electricity consumption and no impact on peak demand (Kellog and Wolff)

Our Paper

- Use a quasi-experiment to study the effectiveness of Argentine summertime DST during 2007/08-2008/09
  1. Total energy consumption
  2. Peak demand
  3. Peak demand time
- We found no evidence that DST was effective due to behavioral response to the policy
  - To some extent people behave by the sun and not by the clocks (e.g. have dinner after dusk)

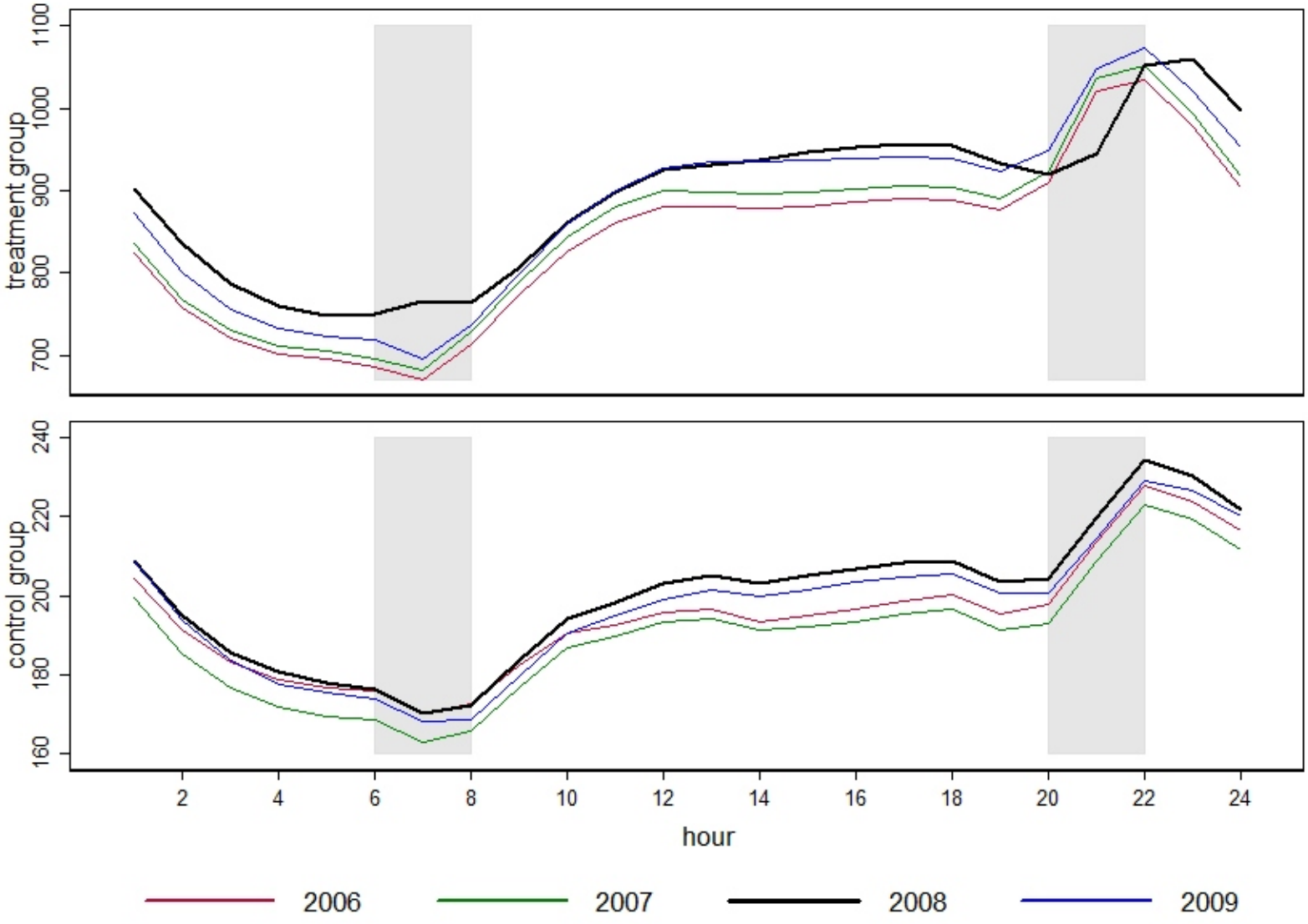
Energy Policy and DST in Argentina

- Energy sector during economic recovery post 2001
  - Insufficient investments in the energy sector
  - Exponential increase in electricity demand
- Objective of DTS was to reduce electricity consumption
  - On December 2007 a presidential decree reintroduced DST in Argentina as part of a national plan for energy efficiency
  - The decree ordered to adjust the clocks forward one hour (from GMT-3 to GMT-2) from December 30, 2007 until March 16, 2008 $\Rightarrow$ Summer DST
  - The policy was mandatory the first summer and voluntary (province) during the 2008/09 summertime October 18 until March 16

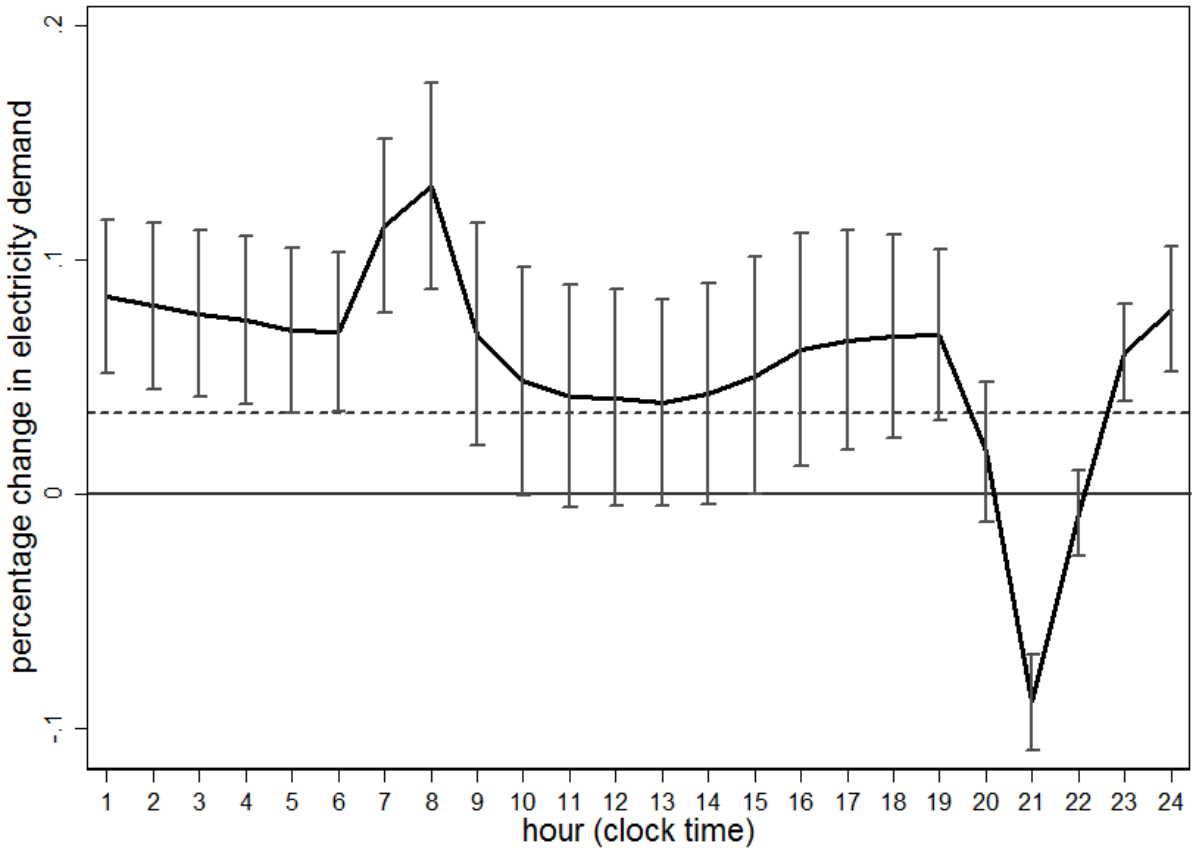
DST in Argentina

- Quasi-experiment
  1. Measure the impact of any day under DST
  2. Measure the impact of DST during October 18 to Dec 30, 2008
- But DST was voluntary during Oct 18 to Dec 30
  - May be was applied in provinces where DST was expected to be more effective
  - It should bias the impact towards its effectiveness
  - Not really a problem if results indicate it was ineffective

DST in Argentina (Oct 18 - Dec 30)



DST in Argentina for treated group (Oct 18 - Dec 30)



Data

Variables	Description
LHS variables	
total cons	Total electricity demand in megawatt per hour (MWh)
peak cons	Peak electricity demand in megawatt (MW)
peak hour	Time of peak demand in minutes
RHS variables	
DST	= 1 if province had DST (GTM−2)
users	Number of electricity users
Temperature (T)	Mean temperature in degree Celsius
Precipitation (P)	Precipitation in millimeters
Wind intensity (WI)	Maximum wind speed in km per hour
Wind direction (WD)	Direction of maximum wind in azimuth degrees
Hours of light (HL)	Total hours of daylight
Holiday	= 1 if holiday
GDP	Province GDP per capita
day of week	Dummy variable for each day in week
month-day	Dummy variable for each month-day
year	Dummy variable for each year

Results: total electricity consumption

Log *ED*	Total	Morning	Mid-day	Night
Full sample				
33k obs.	0.016	0.057	0.005	-0.051
	[0.011]*	[0.014]***	[0.011]	[0.012]***
Oct18 - Dec31				
6k obs.	0.017	0.070	0.004	-0.012
	[0.017]	[0.019]***	[0.016]	[0.007]*

Specifications include controls for: holiday, daylight hours, temperature, precipitation, wind intensity, users, and Provincial GDP.

Specifications include FE by: year, month-day, day of week.

Results: peak demand and time

	log peak *ED*	peak time
Full sample		
	-0.003	30.48
	[0.014]	[12.182] **
Oct18 - Dec31		
	-0.004	30.85
	[0.016]	[12.208]**

Specifications include controls for: holiday, daylight hours, temperature, precipitation, wind intensity, users, and Provincial GDP.

Specifications include FE by: year, month-day, day of week.

Conclusions

- Main impacts of DST
  1. Increased (or at least did not reduce) electricity consumption
     - higher consumption during the early morning and late night more than offset early night savings
     - mid-day consumption not affected by DST
  2. No impact on peak demand
  3. Shifted peak demand later at night
- We have also analyzed
  - How quick people responded to the policy
  - False experiment $\Rightarrow$ simulate a DST in a non-DST period

Conclusions

- Was there behavioral adaptation to the policy?
  - It seem likely that people behave to some extent by the sun and not by the clocks.
  - Adaptation reduces DST effectiveness
- DST was nos applied again after 2009 despite official documents suggesting it was effective
- Higher electricity prices might be more effective in reducing consumption
- DST is also related to higher car accident rates, higher suicide rates, lower labor productivity, and lower SAT scores