Misunderstanding nonlinear prices: Evidence from a natural experiment

BLAKE SHAFFER, STANFORD AND UNIVERSITY OF CALGARY

NBER WORKSHOP ON ELECTRICITY MARKETS AND REGULATION
MAY 2019


TORONTO
RAPTORS
LET'S GO
RAPTORS!

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… but what if our expectations are wrong?

Efficient rate design

1. Get prices right
2. Understand how consumers *actually* respond to prices, and to which?!?
3. See #1

1. Getting prices right

Long history…

- Kahn, Boiteux, Joskow, Borenstein,…
  - *"Set P=MSC" (… then deal with fixed cost recovery)*
- Borenstein and Bushnell (2019):
  - Look at whether prices in the US are "too high or too low" based on marginal price vs marginal social cost

2. How do consumers *actually* respond

- Information: Jessoe and Rapson (2012)
- Moral suasion: Ito, Ida & Tanaka (2018)
- Marginal vs average price: Ito (2014)

- Or… are some just **confused**???

Ito (2014)

- Finds consumers in southern California respond to **average price**, not marginal price

➢ If this is the case, policies based on marginal pricing may not be efficient

My paper

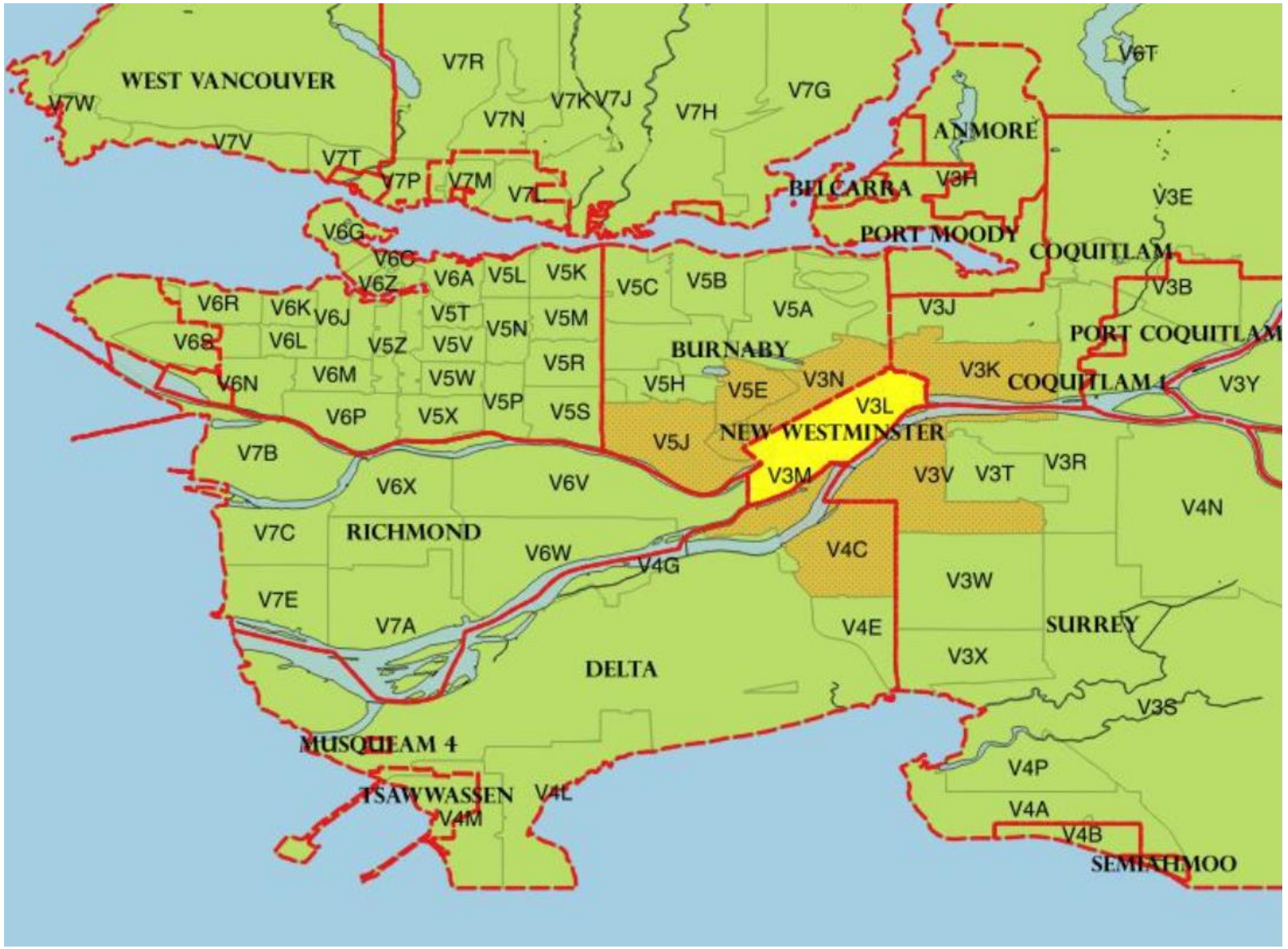
- Looks at introduction of increasing-block pricing in British Columbia in 2008
- Takes advantage of well-placed control group that stayed on a flat rate

Map of Lower Mainland of BC

In 2008, B.C. Hydro switched to an increasing block rate.

The city of New Westminster (YELLOW) remained on a flat rate.

I have monthly billing data for all New Westminster customers and B.C. Hydro customers in the regions that border New Westminster (ORANGE)

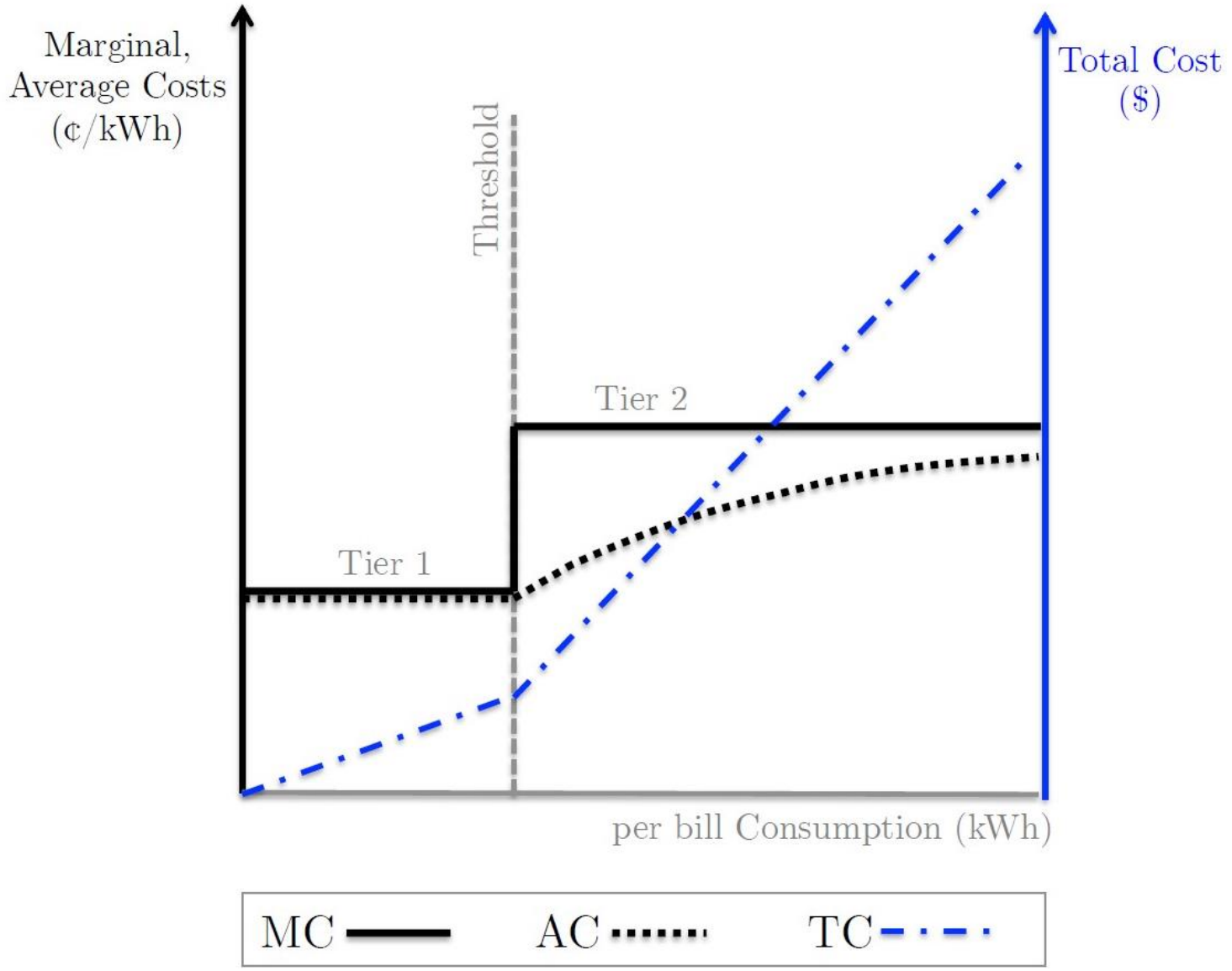


Increasing-block rate structure

Marginal price has a low price tier up to a common threshold, then jumps to a high price tier.

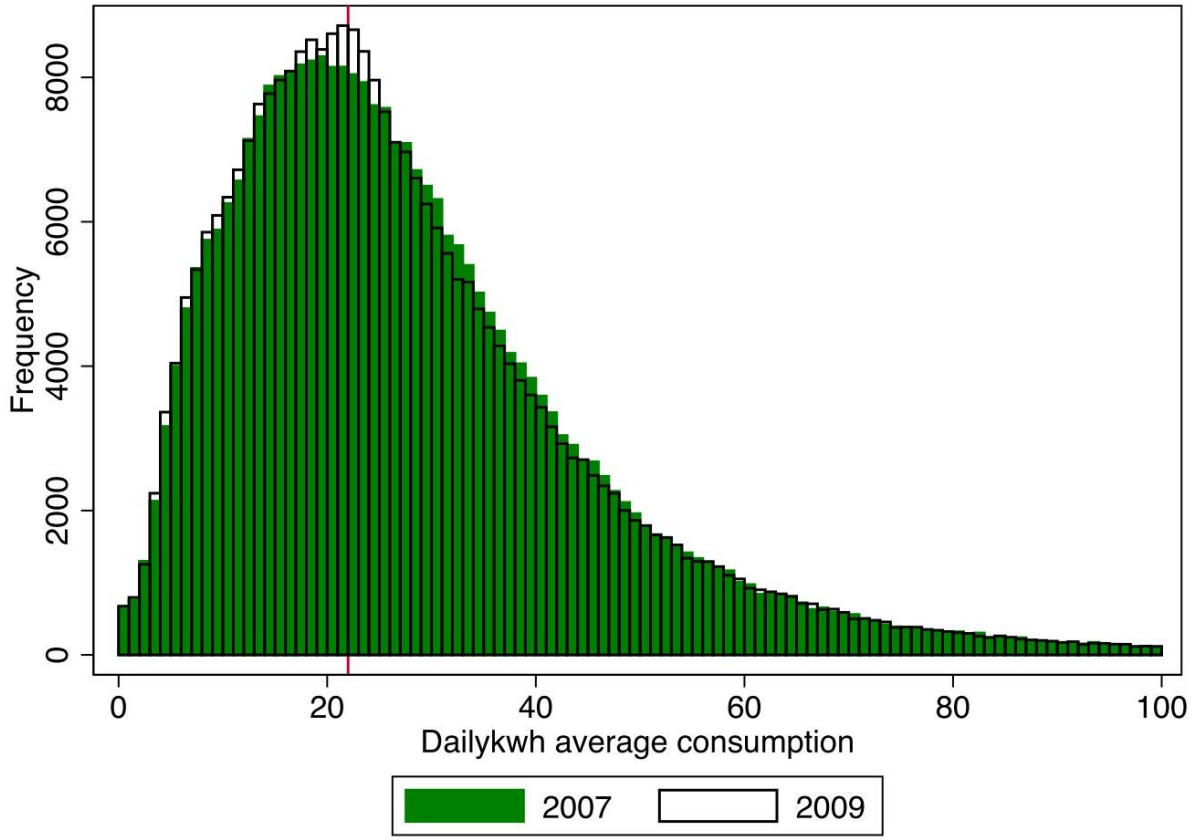
Average price begins to rise after the threshold in a concave asymptotic fashion towards the high tier.

The slope of total cost kinks (steeper) at the threshold.



What I find

- Bunching
- Encompassing test
- Conditional DD



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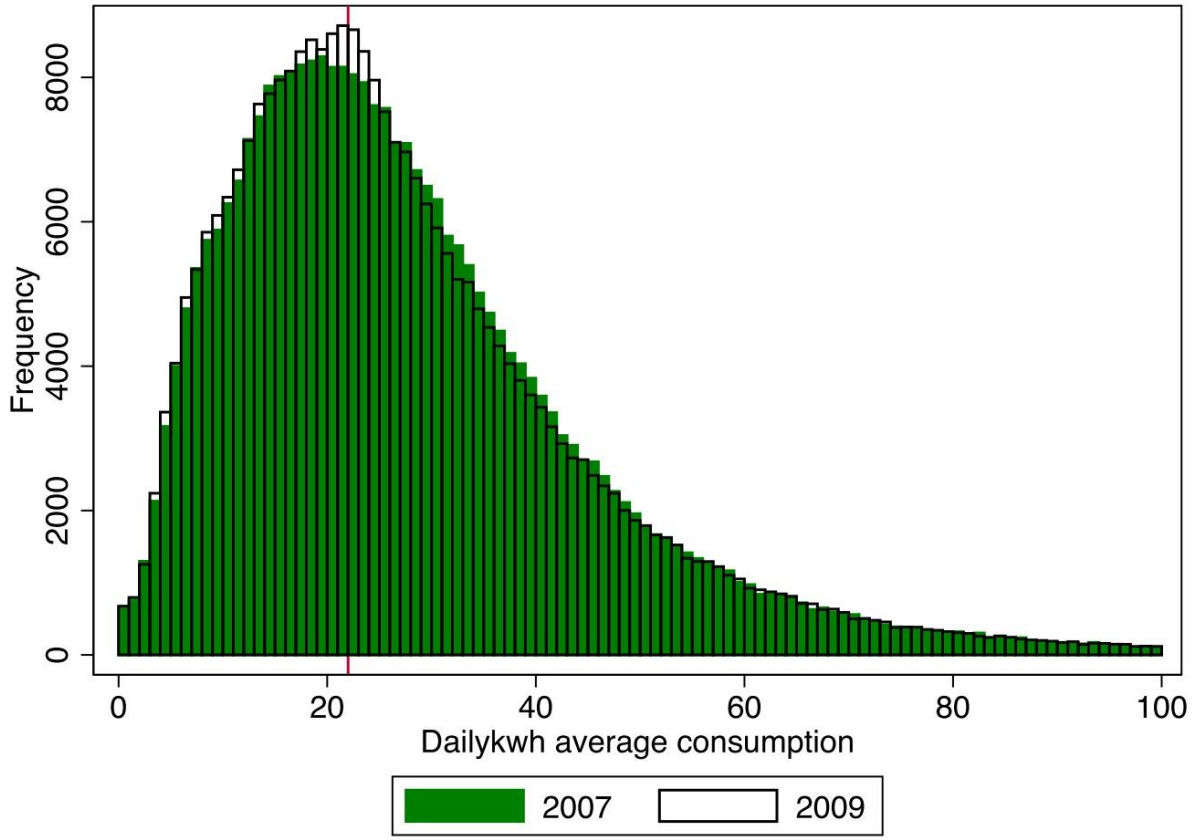
Marginal price response!

Estimated elasticity ~ -0.05



What I find

- Bunching
- **Encompassing test**
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Table 2: ELASTICITY ESTIMATES USING IV METHOD

DEPENDENT VARIABLE: $\Delta \ln dailykwh$

	(1)	(2)	(3)
$\Delta \ln MP$	-0.136	·	-0.141
	(0.007)	·	(0.010)
$\Delta \ln AP$	·	-0.133	0.010
	·	(0.009)	(0.013)

Standard errors clustered at household level in parentheses.

What I find

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Marginal price response!

Estimated elasticity ~ -0.14

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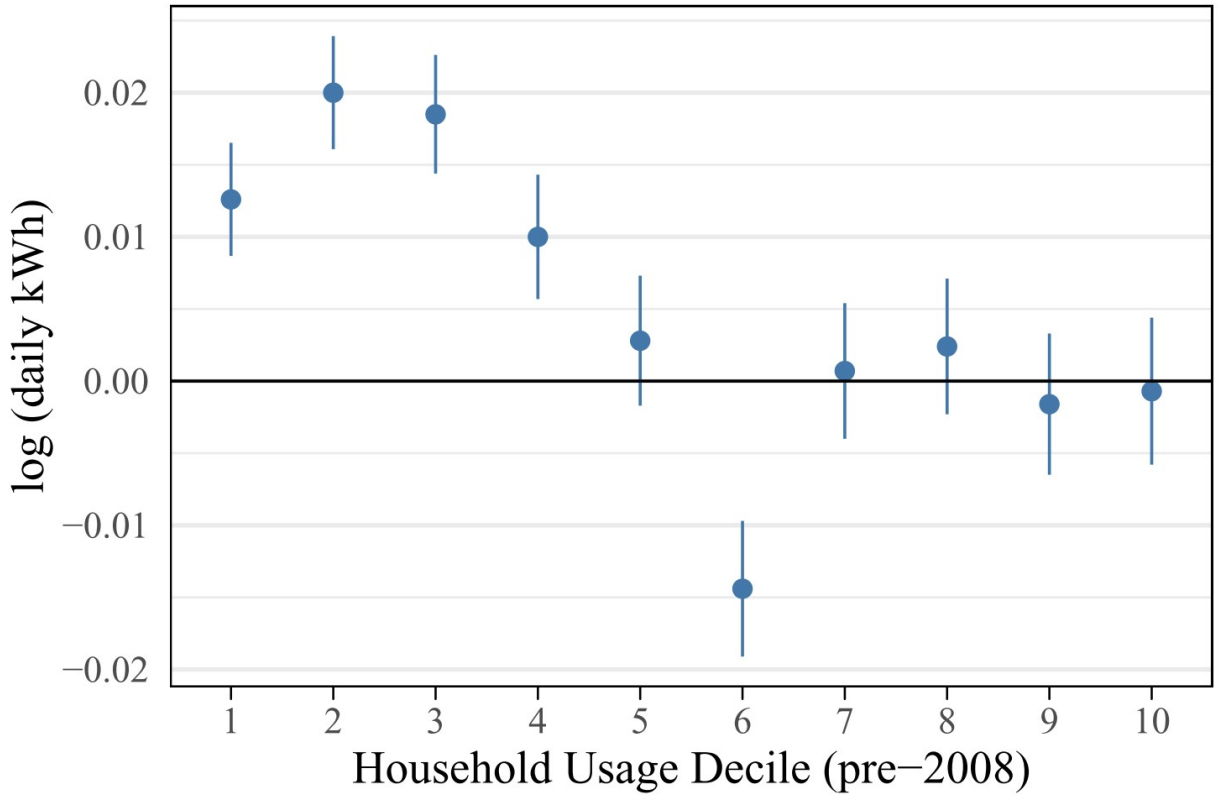

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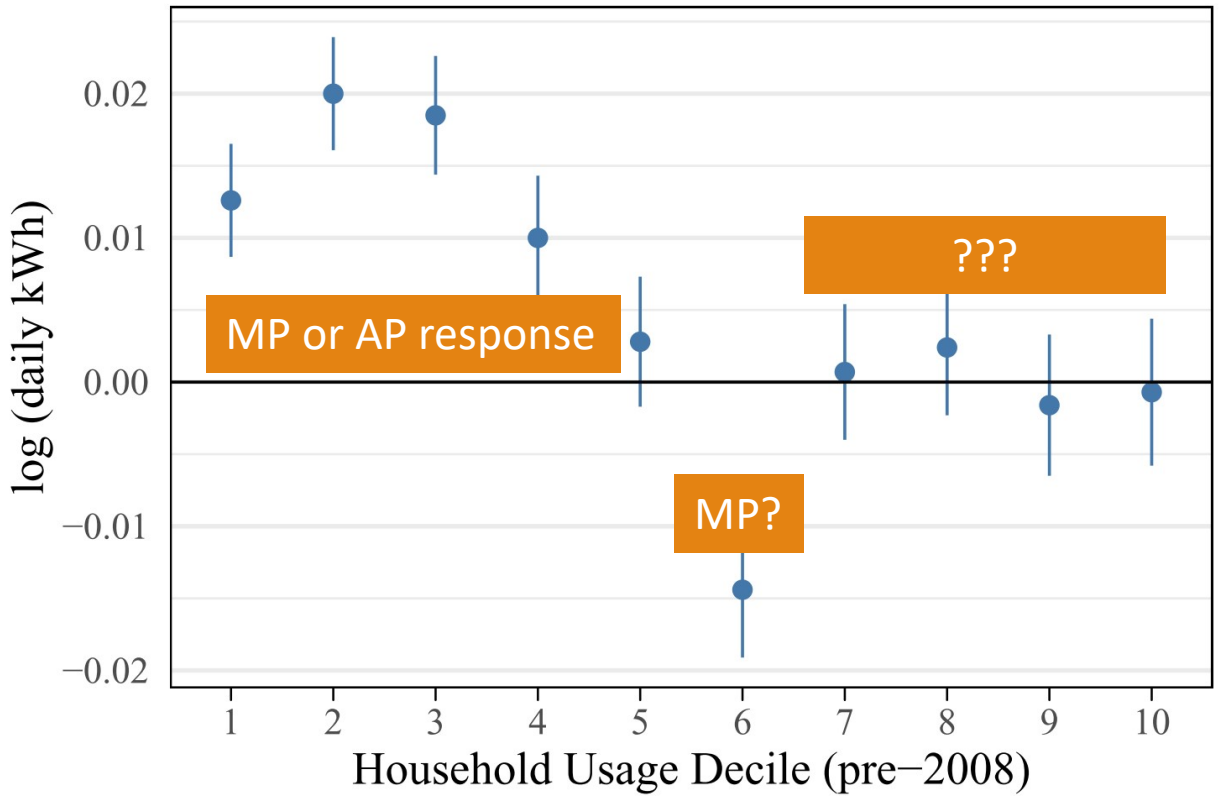

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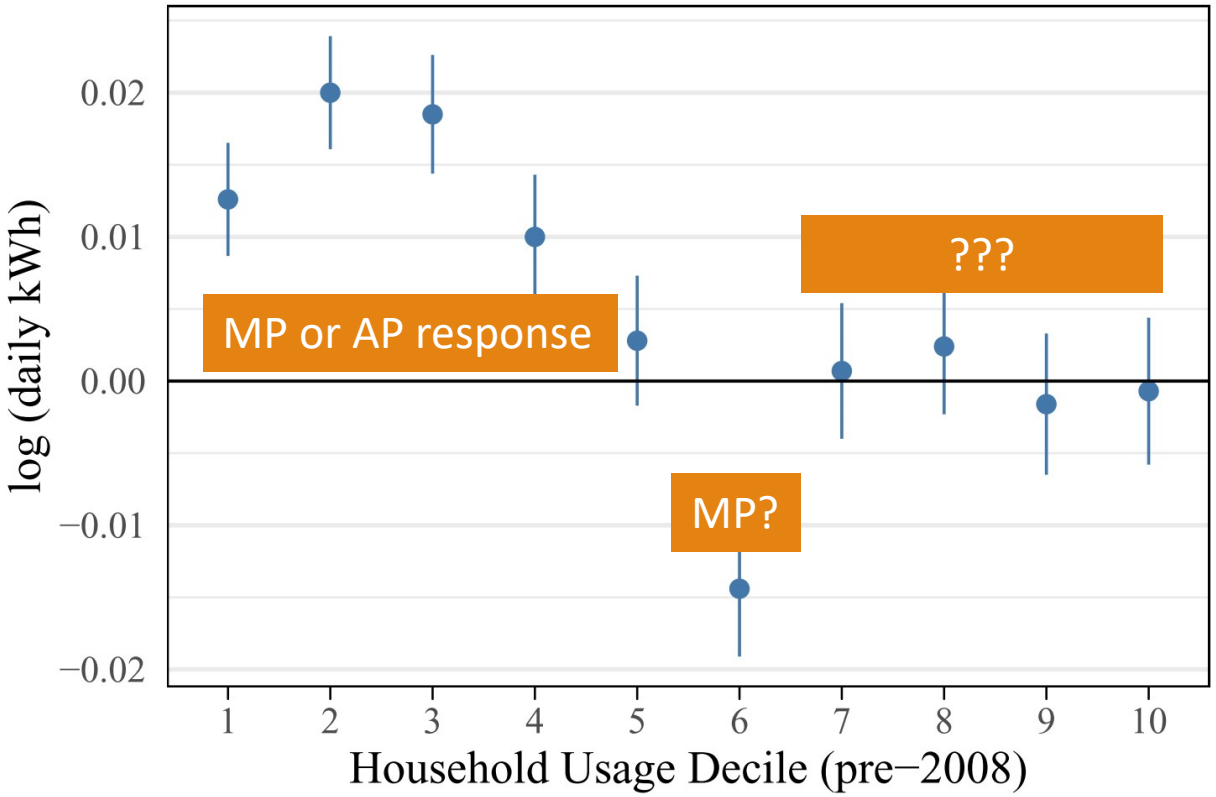
Something else!?!
Can't explain large jump at Decile 6 purely from MP or AP



Could this be explained by *heterogeneity* in types?

i.e. differences in price perception / understanding?

Indirect Inference (Gourieroux et. al., 1993)

- **Find the mix of types that best rationalizes the data**
- Involves matching moments between estimates from the reduced form model to estimates in a (simple) economic model of heterogeneous types
- Solve for parameters (mix of types, elasticity) that minimizes distance between the models

Results

I find a mix of the following best fits the data:

- 85% average price responders
- 7% marginal price responders
- **8% “confused” types**

Implications

- Methodological
  - ➢ Caution when using bunching estimators with heterogeneity
- Policy
  - ➢ Not achieving conservation goals
- Welfare
  - ➢ Confused types have a DWL of 10% of their electricity expenditure

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Where do we go from here?

- Clearly increasing block tariffs have efficiency issues (potential equity benefits)
- **Is it (finally) time for dynamic prices?**
  - Better/cheaper sensor and control technology **(ability)**
  - Growth of discretionary EV charging loads **(magnitude)**
  - More supply side variability from RE **(need)**