Justin Ho
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Computation of Utility Costs using LMPs:

Background:

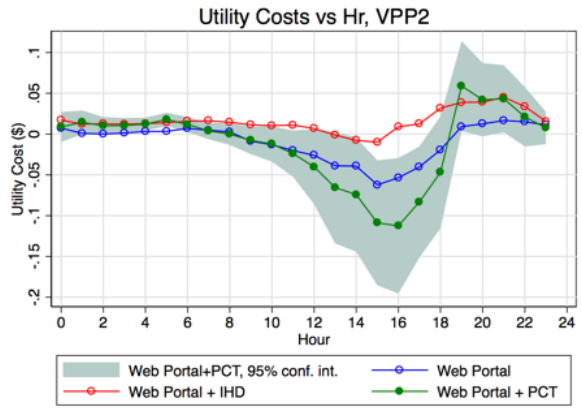
- LMP is the marginal cost of supplying, at least cost, the next increment of electric demand at a specific location (node) on the electric power network
- Locational marginal pricing reflects the value of the energy at specific location and time it is delivered
- Used to establish the price of energy purchases and sales in a wholesale electricity market: reflects the combination of actual operating conditions and congestion on the transmission system
    - Prices are determined by the bids/offers submitted by market participants
    - Differ by location when transmission congestion occurs– transmission congestion prevents energy from low-cost generation from meeting all loads and clearing the market.
- LMP for energy at each node is determined by adding 1MW of fixed load at the node and determining:
    - The least change of total system cost
    - While satisfying all transmission and other operational constraints.
- Hourly LMPs range from about $20/MWh - $50/MWh
- Consumption of households is on the scale of a few kWh

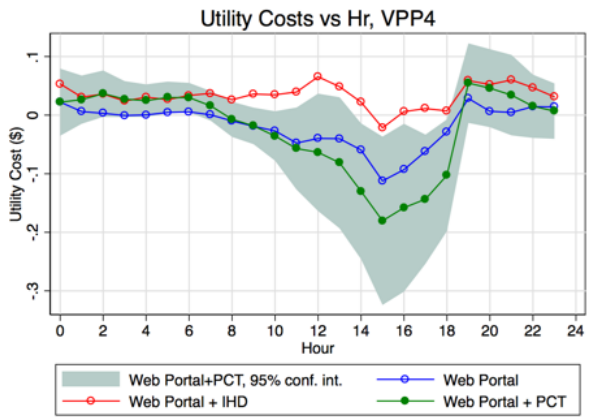
Methodology:

- Take an average of the hourly LMP at ~ 40 nodes across the OGE network (supplied by the SPP authority), binned by VPP days
- The data is available for all of the nodes across the SPP authority region, but I'm concentrating on the ~40 nodes that are associated with OGE (as opposed to including the nodes in other states in the SPP region)
- Not entirely comfortable with this: the LMP's should reflect demand, and demand is likely correlated with the weather controls included in the regression for the treatment effects on electricity consumption.
- But since I only have the hourly treatment effects binned by the VPP day, I binned the hourly LMP's based on VPP days as well
- The LMPs are already reported as marginal cost of supplying electricity at a given node, so the product of the LMP($/kwh) and the change in electricity consumption (in kWh) should reflect roughly, the least cost or least saving of the additional kWh supplied or saved.

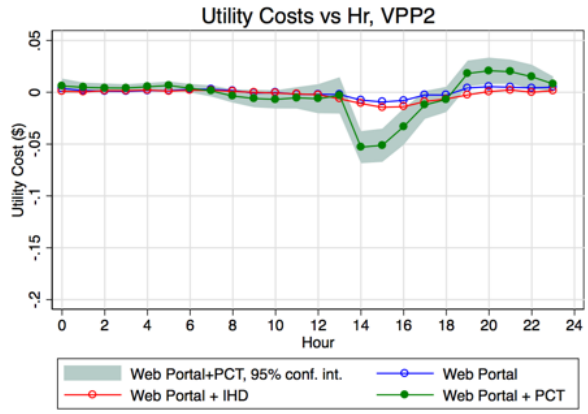
Results:

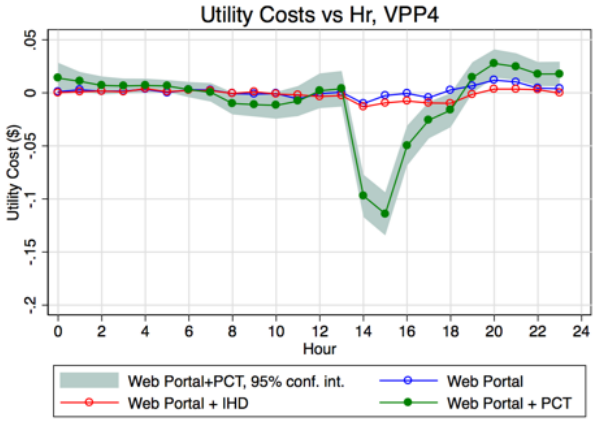
10% Quantile:



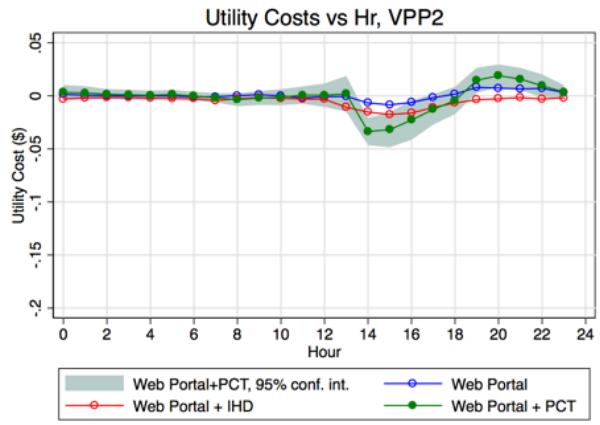


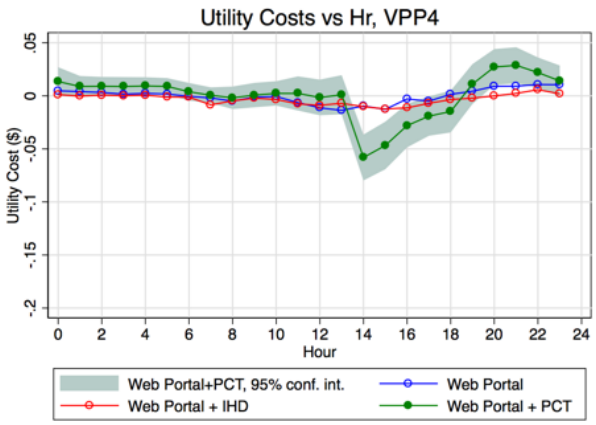
50% Quantile:





90% Quantile:


Utility Costs vs Hr, VPP2
Utility Cost ($)
.05
0
-.05
-.1
-.15
-.2
0 2 4 6 8 10 12 14 16 18 20 22 24
Hour
Web Portal+PCT, 95% conf. int.
Web Portal
Web Portal + IHD
Web Portal + PCT


Utility Costs vs Hr, VPP4
Utility Cost ($)
.05
0
-.05
-.1
-.15
-.2
0 2 4 6 8 10 12 14 16 18 20 22 24
Hour
Web Portal+PCT, 95% conf. int.
Web Portal
Web Portal + IHD
Web Portal + PCT