2017 AEAs – TPUG Sessions

(Note: Bolded authors are the presenting authors)

Session I:
Electricity Markets
Session Chair: Leopoldo E. Soto Arriagada, Federal Energy Regulatory Commission, leopoldo.sotoarriagada@gerc.gov

- "Limits to Arbitrage in Electricity Market."
  - John Birge, University of Chicago, jbirge@chicagobooth.edu
    Ali Hortacsu, University of Chicago and NBER, hortacsu@uchicago.edu
    Ignacia Mercadal, University of Chicago, ignaciamercadal@uchicago.edu
    Michael Pavlin, Wilfrid Laurier University, mpavlin@wlu.ca
  - Discussant: Dallas Burtraw, Resources for the Future, burtraw@rff.org
  - JEL Codes: Q4, L5

ABSTRACT: As in most commodities markets, deregulated electricity markets allow the participation of purely financial (virtual) traders to enhance informational and productive efficiency. The presence of financial players is expected, among other things, to help eliminate predictable pricing gaps between forward (day-ahead) and spot prices, which may arise in the presence of market power by physical suppliers or buyers. However, we find that the impact of financial players on reducing pricing gaps has been limited. A forward premium persists. We show that financial traders indeed decrease the difference between the spot and forward prices, but arbitrage is limited by three barriers. First, arbitrageurs do not have unlimited access to capital. Trading was reduced during the financial crisis, when capital availability was restricted. The second is regulation, the regulator imposed high charges on some transactions and introduced uncertainty over how charges would be calculated and thus reduced virtual trading. Lastly, large financial players may find it more attractive to use financial bids to improve their position in a related market. We observe that some large financial players appear to be betting in exactly the opposite direction of the pricing gap, sustaining large losses while doing so. We find evidence consistent with participants using forward market bids to affect congestion and thus increase the value of their Financial Transmission Rights (FTR), i.e. these financial players incur losses with one financial instrument to make larger profits with another, introducing artificial congestion to the system.

- "The Long-Run Price Elasticity of Electricity Demand."
  - **Tatyana Deryugina, University of Illinois and NBER**, deryugin@illinois.edu
    Alex MacKay, University of Chicago, mackay@uchicago.edu
    Julian Reif, University of Illinois, jreif@illinois.edu
  - Discussant: Rimvydas Baltaduonis, Gettysburg College, rbaltadu@gettysburg.edu
  - JEL Codes: Q41, Q48

ABSTRACT: The price elasticity of electricity use is a crucial parameter for predicting the effects of climate change policy. However, we have little information about the long-run response of usage to changes in price, primarily because existing estimates have relied on price shocks are

are transient or endogenous. We provide estimates of this elasticity in both the short-run and the long-run by evaluating the effects of a policy change in Illinois that resulted in (plausibly) exogenous, long-lasting price changes to a subset of communities. Participating communities experienced average price drops of 20-25 percent in the first year of implementation and 14-16 percent in the year after. We estimate that usage increased by 2-6 percent over different points over this time period. Correspondingly, we estimate that the magnitude of the aggregate elasticity increase from -0.17 in the first year of implementation to -0.37 in the second year. Our long-run estimate is substantially larger than many existing estimates and indicate accounting for the dynamics of response to a policy change is essential for welfare analysis.

- "Strategic Ability and Productive Efficiency in Electricity Markets."
  - Ali Hortacsu, University of Chicago and NBER, hortacsu@uchicago.edu
    Fernando Luco, Texas A&M University, fluco@tamu.edu
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  - Discussant: Karen Palmer, Resources for the Future, palmer@rff.org
  - JEL Codes: Q4, L5

ABSTRACT: Standard oligopoly models of short-run price competition in oligopoly settings predict that large firms can exercise market power and generate inefficiencies. However, productive inefficiency can also arise from other sources as well, such as in the presence of heterogeneity is strategic sophistication. This paper studies such a setting in the Texas electricity market, in which bidding behavior of some firms persistently and significantly deviates from Nash-equilibrium bidding. We leverage a unique dataset that contains information on bids and valuations to identify and estimate levels of strategic sophistication. We do this embedding a Cognitive Hierarchy model into a structural model of bidding behavior. (Preliminary) results show that larger firms have higher levels of strategic sophistication than smaller firms, though there is significant heterogeneity across firms. We then use the estimated distribution of types of strategic sophistication to perform counterfactual calculations about market efficiency under different scenarios that increase strategic sophistication of low-type firms either exogenously or through mergers with more sophisticated firms. We find that exogenously increasing sophistication of small firms increases productive efficiency. Furthermore, mergers that do not generate cost synergies and increase concentration may also increase efficiency.

- "The Long Run Impact of Environmental Policies on Wholesale Electricity Markets: A Dynamic Competitive Analysis."
  - **Joseph A. Cullen, Washington University**, jacullen@wustl.edu
    Stanley S. Reynolds, University of Arizona, Reynolds@eller.arizona.edu
  - Discussant: Ignacia Mercadal, University of Chicago, ignaciamercadal@uchicago.edu
  - JEL Codes: Q40, Q50, L19, L94

ABSTRACT: We develop a dynamic competition model of wholesale electricity markets that incorporates
supply side frictions in the form of minimum generation rates and generation

unit startup costs. Such frictions may have a large impact on wholesale market prices, output decisions, and generator profits. We prove an equivalence between competitive market equilibrium and the solution to a planner's dynamic programming problem. This planner's problem provides a computational platform for the model. We parameterize our model based on Energy Information Administration data on new power plants and demand and renewable energy data from the Electric Reliability Council of Texas. We use the resulting model to assess the impact of carbon prices on capacity investment, emissions, and power plant operations. We report three main findings. First, the ability of an electricity system to respond to a carbon price in the short-run with fixed generating capital is limited. However in the long-run, even a modest price on carbon can have a dramatic effect on emissions through reinvestment in capacity. Second, without subsidies, investment in renewables is limited by their intermittent production and by the dynamic constraints of conventional generators even under relatively high carbon prices. Finally, a static model that does not account for dynamic constraints for generators grossly overstates investment in renewable energy and mischaracterizes the impact of a carbon price on emissions.

Session II:
Water & Energy
Session Chair: Adrienne Ohler, Illinois State University, aohler@ilstu.edu

- "Proximity to a Water Supply Reservoir and Dams: Is There Heterogeneity in the Effects on Housing Prices?"
  - **Jeffrey P. Cohen, University of Connecticut**, Jeffrey.cohen@business.uconn.edu
    Joseph Danko, University of Connecticut, joseph.danko@uconn.edu
    Ke Yang, University of Hartford, kyang@hartford.edu
  - Discussant: D. P. Dupont, Brock University, diane.dupont@brocku.ca
  - JEL Codes: Q25, Q51

ABSTRACT: An understanding of the potential positive and negative impacts of living near reservoirs and dams is important in justifying the operation of water (and possibly other) utilities near residential properties. While there is a body of literature on the effects of proximity to dams and reservoirs on housing prices, little known research attempts to determine if various individual houses are impacted differently depending on their locations and years of sale. We examine properties in Barkhamstead, Connecticut that sold between 2001 and 2015. The reservoir in Barkhamstead supplies much of central Connecticut with its drinking water. We utilize nonparametric regression techniques (Geographically Weighted Regressions) to allow for the possibility that the major reservoir and dams in Barkhamstead affect various house prices differently, depending on their locations and when they are sold. We find that for the most part, proximity to dams leads to lower housing sale prices, with the magnitudes of these effects varying across geographic space and over time. The signs of the effects of proximity to the reservoir vary – some properties benefit from proximity while others experience lower sale prices when they are closer to the reservoir. We also control for other key housing characteristics and environmental variables, such as elevation, numbers of bedrooms and baths, age of properties, year of sale, square footage and acreage, and others. We generate maps of the signs and magnitudes of the coefficients for several of the key variables to illustrate the heterogeneity.

- "Floods and Droughts: Eliciting Customer Willingness-to-Pay and Adverse Event Likelihood Priors for Public Utility Pricing and Infrastructure Decisions."
  - **D.P. Dupont, Brock University**, diane.dupont@brocku.ca
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  - Discussant: Jeffrey P. Cohen, University of Connecticut, Jeffrey.cohen@business.uconn.edu
  - JEL Codes: Q51, R58, Q25

ABSTRACT: Devastating floods in Texas, Mississippi, Oklahoma and Louisiana and ongoing droughts in California highlight the infrastructure and management challenges facing North American water and wastewater utilities. While increasing variability in climate

has been the immediate culprit, the severity of events has been exacerbated by years of underinvestment in infrastructure improvements due to inadequate pricing of services provided (Copeland and Tiemann, 2008). A recent report by the American Water Resources Association (2015) identifies a crucial step that decision-makers – most of whom are public officials – need to take in order to identify appropriate pricing systems capable of generating the revenues to support future infrastructure decisions. This is to identify clearly what communities' priorities may be with respect to water and wastewater management, both of which provide public or community level goods and services. These include not only the provision of clean, safe reliable water and removal of waste but also a broader array of related services (e.g., flood control, etc.). Specifically, information that is important to the reform of pricing is the extent to which customers are aware of services provided by infrastructure and management since this can directly influence the extent to which they support paying higher water or wastewater bills in order to obtain improvements in these related services.

This paper describes the development and implementation of a method to elicit public preferences for improved water and wastewater management, specifically examining the relative desirability of engineering versus green infrastructure approaches to having more reliable water supplies and to mitigating the likelihood of rainfall-caused flooding events. The case study uses data from Canada collected in 2016. Data collected include respondent estimates of the prior likelihood of events, as well as data on self-protection measures. Using a choice modeling approach, the paper estimates household willingness-to-pay values for avoiding both unreliable water supplies and rain-based urban flooding. Choice attributes include reductions in the likelihood of adverse events, as well as type of infrastructure used to obtain the benefits, as well as increases in household water bills. Novel components include the use of respondent-specific status quo levels of likelihood priors, as well as data collected about beliefs that public officials will take their preferences into account and the certainty the respondent expresses about his/her choice. Results indicate a great deal of heterogeneity about prior beliefs on the likelihood of adverse events and that green infrastructure elicits a higher willingness-to-pay.

- "Emissions Allocation Design to Avoid Leakage Under the Clean Power Plan."
  - **Dallas Burtraw, Resources for the Future**, burtraw@rff.org
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    Karen Palmer, Resources for the Future, palmer@rff.org
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  - Discussant: Tatyana Deryugina, University of Illinois and NBER, deryugin@illinois.edu
  - JEL Codes: Q4, L5

  ABSTRACT: This paper uses simulation modeling to illustrate the environmental and electricity market effects of various approaches to using updating output-based allocation of emissions allowances to overcome leakage of generation and emissions to new sources under a mass based approach to implementation of the Clean Power Plan that focuses on existing generators only. In many emissions cap and trade programs, emissions allowances are allocated based on

past behavior (grandfathering) and that approach provides no incentives for specific behavior going forward. In contrast, updating allocation distributes the emissions asset value based on current or recent behavior and updates that allocation over time thereby providing an incentive to do more of that behavior. If the behavior is electricity generation (output), then eligible entities receive a share of the allocation based on their share of electricity generation. Because this allocation is updated over time, entities have an incentive to grow their generation in order to secure a larger portion of the allowance pool. Allowances may be allocated using multiple approaches applied to portions of the total allowance pool as envisioned in the proposed federal plan and model rule. Important aspects of the allocation decision are the determination of which entities are eligible to receive this production incentive, how many allowances will be distributed this way and if allocation rates (allowances per MWh) will be common for all eligible entities or differentiated by technology.

- "Abnormal Returns in Markets for Congestion Revenue Rights."
  - **Rimvydas Baltaduonis, Gettysburg College**, rbaltadu@gettysburg.edu
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  - Discussant: Joseph A. Cullen, Washington University, jacullen@wustl.edu
  - JEL Codes: C58, G1

ABSTRACT: In organized energy markets that use locational pricing, power generators and energy suppliers use Financial Transmission Rights (FTRs) to hedge against grid congestion charges, while third party speculators attempt to capture a return with these contracts. FTRs are defined between two locations on the power transmission grid, known as a path. These financial instruments accrue their value based on the energy price differential at two ends of a path. Having the only organized energy market in the Western Interconnection, California has also implemented a version of FTRs, officially known as Congestion Revenue Rights (CRRs). This paper investigates the performance of the CRR markets by estimating and analyzing the presence of abnormal returns among these financial instruments. Our analysis identifies the paths with abnormal CRR returns with the majority of them being positive.