

Price Formation in Auctions for Financial Transmission Rights

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Electricity customers across the country lose money through FTR processes/auctions

- Since 2011, electricity customers experienced a \$1.7 billion shortfall in PJM (Monitoring Analytics, 2018)
- California electricity customers lost \$520 million in CRR auctions from 2012-2015 (CAISO DMM, 2016)

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- The auction process is inefficient (Olmstead, 2018)
- Financial traders must earn trading profits (Leslie, 2018)

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- Empirically test for the drivers outlined in the theoretical model
- Explore implications of the theoretical model in regions where subsidiary relationships exist

Examine auction outcomes through the lens of Auction Revenue Rights

- Auction Revenue Rights (ARRs) are given to load-serving entities to compensate for congestion rent
- ARR holders choose between converting an ARR into an FTR or selling the ARR in the annual FTR auction
- ARR holders decide where/how much FTR supply is available to bidders for reservation price \$0

ARR Configuration - Supply Shifter

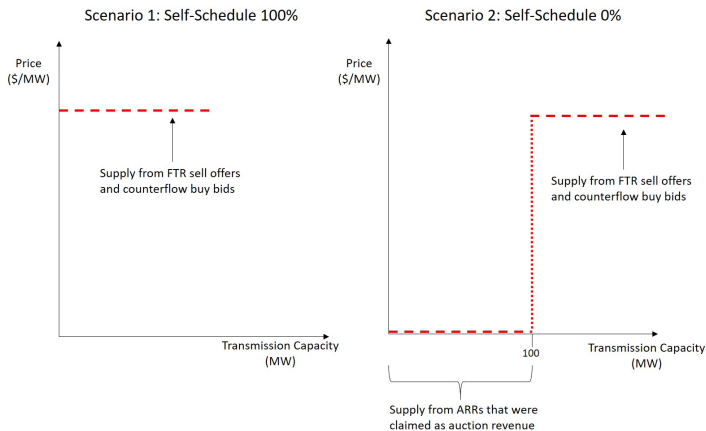


Figure 1: Stylized FTR supply when ARRs are self-scheduled into FTRs (left frame) vs. when ARRs are claimed as auction revenue (right frame)

Auction Equilibrium

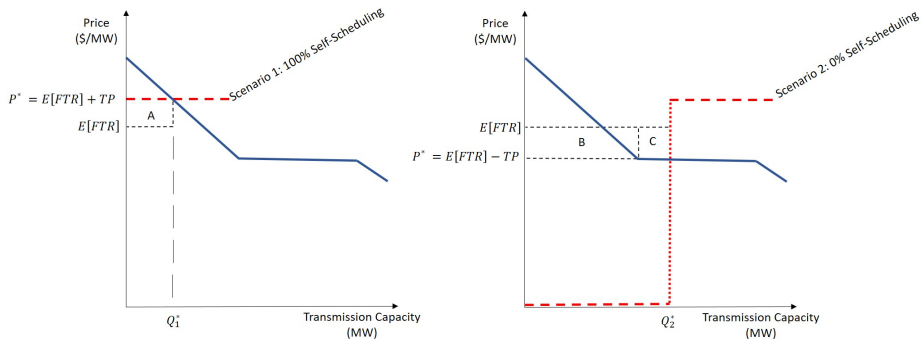


Figure 2: Stylized equilibrium when ARR are self-scheduled into FTRs (left frame) vs. when ARR are claimed as auction revenue (right frame)

PJM's Annual FTR Auction 2007-2017

- ARR allocations supplemented with auction prices and realized FTR values

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- Construct variable *Hedging Pressure* using bids from entities that own physical assets

OLS with year and region-year fixed effects

$$TA_{i,j,k} = \alpha_i + \lambda_{i,j} + \beta_1 AP_{i,j,k} + \beta_2 PC_{i,j,k} + \beta_3 HP_{i,j,k} + \epsilon_{i,j,k} \quad (1)$$

where

- TA is the *ex post* realized value of an FTR along ARR path k
- AP is the equilibrium auction price of an FTR along ARR path k
- PC is the quantity of ARR k (in MW) that is not self-scheduled into FTRs
- HP is the quantity of FTRs (in MW) purchased by physical asset owners in the auctions whose source node is the same as ARR k
- α is the fixed effect in year i
- λ is the fixed effect in year i and region j

Table 1: Dependent Variable: FTR Target Allocation (\$/MW)

Variable	Model 1	Model 2
Auction Price	0.83 ^{***} (0.01)	0.87 ^{***} (0.09)
Path Capacity	4.39 ^{***} (1.05)	3.21 ^{***} (1.12)
Hedging Pressure	-1.08 (1.10)	-0.91 (0.96)
Year FE	No	Yes
Region-Year FE	No	Yes
N	9,618	9,618
R ²	0.59	0.67

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Subsidiary Relationships

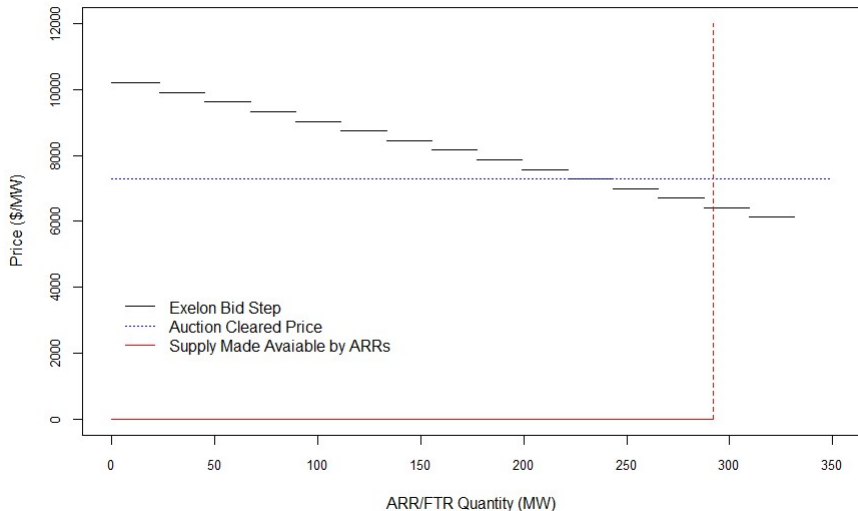
Some former vertically-integrated utilities were required to spin off generation assets to induce competition

Regulated utilities and competitive generation assets are legally separate entities under the same IOU

Regulated utility can help generation assets acquire cost-effective FTRs

Ample Supply, Strategic Bidding

Example Exelon FTR Bid Demand Function



Conclusion

Transmission capacity supplied through the ARR process creates profitable opportunities for speculators and hedgers

This cheap supply can create an opportunity to transfer wealth from regulated to unregulated subsidiaries of the same IOU

What is the rate of FTR rent pass-through by unregulated entities?