

Econometric Model of NYISO LBMP: A First Look



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Electricity Price Is Largely Predictable



- Electricity price is determined by intersection of a supply curve and a demand curve
- The demand curve shifts hourly in reasonably well-understood ways, largely dependent on hours, weekdays and seasons
- The supply curve is largely fixed, but nonetheless shifts owing to:
 - Random outages, planned outages, semi-planned outages
 - Changes in fuel prices
 - Unit additions and retirements
 - Ambient conditions
 - Transmission conditions
 - Opportunities outside the NYISO

- Observed Average Day-Ahead LBMP and Integrated Loads, Hourly, in eleven NYISO regions from 6/21/2001 – 12/31/2006, taken from NYISO website
 - For most of this period, NYC and Long Island loads are reported jointly. These were split according to the ratio observed when the values were separated (NYC=2.4 LI)
 - There are some minor anomalies in this data which are being investigated but do not contribute materially to the results
- Daily Observed Gas Prices from the Texas Eastern Transmission M3 (New York City), Interpolated Across Weekends and Holidays
- Annual July Reserve Margin Including Uncommitted Resources taken from NERC Annual Reports

The Model



$$\begin{aligned} LBMP_{ymdhi} = & \beta_0 + \beta_1 \times load_{ymdhi} + \beta_2 \times load_{ymdhi}^2 + \\ & \beta_3 \times load_{ydmh} + \beta_4 \times load_{ydmh}^2 + \gamma_m \times gasp_{ydm} \\ & \lambda_m \times rm_y + \varphi_{dow(ymd)} + \mu_m + \nu_h + \rho_{mh} + \kappa_y + \psi_y \end{aligned}$$

$LBMP_{ymdhi} = \alpha + \beta_1 \times zoneload_{ymdhi} + \beta_2 \times zoneload_{ymdhi}^2 + \beta_3 \times aggload_{ymdhi} + \beta_4 \times aggload_{ymdhi}^2 + \sum_m \gamma_m \times gasp_{ymd}$

Even without any explicit measures of outages or congestion, this model explains about $\frac{3}{4}$ of the variance in market prices

Does The Model Estimate Well?



Region	Explained Variance
Overall	0.7296
Capital	0.7376
Central	0.7308
Dunwood	0.7326
Genesee	0.7179
Hudson Valley	0.7450
Long Island	0.6221
Mohawk Valley	0.7355
Millwood	0.7361
New York City	0.7485
North	0.7406
West	0.6913

What About the Spikes?



- On 8/9/2001 at 2:00 PM, LBMPs were all around \$1000, while predicted prices were all around \$125.
- Similarly for 8/1/2006, although predicted prices were closer to \$225
- This is an endemic feature to regression, but it becomes no problem at all when prices are simulated using historic error values. We simply substitute observed residuals for given levels of load and reserves to yield a probability distribution of possible prices

Possible Modifications



- May modify the model to better reflect Long Island's grid connections, allowing LI price to be more closely related to local load than other regions are
- May add weather
- May add more precise targeting of gas prices to the times they are on the margin
- In general, a log specification makes more sense than a level specification. Cannot proceed down this road, however, until data anomalies are corrected

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