Who Pays in Deregulated Energy Markets?

A Panel Analysis of Cross-Subsidization from Ohio Complete Bill Data

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Select Literature Review

Bushnell, Mansur, & Novan (2017): “Arguably, the most fundamental question regarding restructuring relates to its impact on consumers’ electricity prices. Here, again, the empirical research is somewhat muddled” (p. 11).

**Early Price Studies:**

- Apt (2005): No impact on Industrial (Ind.) price from retail restructuring.
- Kwoka (2008): Early studies flawed by empirical limitations, confounding changes.

**Recent Price Studies:**

- Swadley & Yücel (2011): Retail price mark-ups decline relative to wholesale price.
- Ros (2017): Savings to all classes, but benefit greatest / lasting to Ind.

**Cross-Subsidy Studies:**

- Erdogdu (2011): Developed countries, subsidy to res. increases with reform.
Benefits to using complete bill data (instead of EIA 826 data)

Not included in EIA, but included in our data  
(Deflates the numerator)

Included in EIA, but excluded in our data  
(Inflates the denominator)

Revenue to:

$\textit{r}_d$ Distribution company

$\textit{r}_c$ Parent corporation

$\textit{r}_g$ Arms-length genco

Bill = \( \frac{\textit{r}_d + \textit{r}_c + \textit{r}_g}{\textit{c}_{SSO} + \textit{c}_{CRES}} \)

Consumption of Electricity by...

\(\textit{c}_{SSO}\) SSO Customers (unswitched)

\(\textit{c}_{CRES}\) CRES Customers (switched)
History of Deregulation in Ohio

Timeline of Major Market Events in Ohio’s Electric Restructuring

Regulatory / Legislative Events

- SB 3 takes effect. Competition introduced to OH’s retail electric market (7/6/1999)
- Recovery of generation stranded costs ends (12/31/2005)
- Rate Stabilization Plans takes effect (1/1/2006)
- PUCO approves initial ESPs (12/17/2008 to 6/24/2009)
- Recovery of regulatory stranded cost ends (12/31/2010)
- Market development period (1/1/2001 to 12/31/2005)
- Rate Stabilization Plan ends for AEP, FirstEnergy, and Duke (12/31/2008)
- Rate Stabilization Plan ends for DP&L (12/31/2010)

First competitive SSO auction for Duke (12/14/2011)
First competitive SSO auction for AEP (2/25/2014)
First MRO/ESP proposal from DP&L (10/10/2008)
First competitive SSO auction for FirstEnergy (5/13/2009)
First competitive SSO auction for DP&L (10/28/2013)

Source: Dormady, Jiang & Hoyt (2017)
## Data Sources

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Unit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price_Residential</strong></td>
<td>Monthly indicative residential marginal price by metro area based on complete bill and usage fixed at 750 kWh</td>
<td>₦/kWh</td>
<td>PUCO</td>
</tr>
<tr>
<td><strong>Price_Commercial</strong></td>
<td>Monthly indicative commercial marginal price by metro area based on complete bill and usage fixed at 300,000 kWh</td>
<td>₦/kWh</td>
<td>PUCO</td>
</tr>
<tr>
<td><strong>Price_Industrial</strong></td>
<td>Monthly indicative industrial marginal price by metro area based on complete bill and usage fixed at 6,000,000 kWh</td>
<td>₦/kWh</td>
<td>PUCO</td>
</tr>
<tr>
<td><strong>NatGasDeliv_Price</strong></td>
<td>Monthly wholesale fuel price for natural gas inclusive of cost for delivery to Ohio</td>
<td>$/mmBTU</td>
<td>EIA, EPM, Table 4.10.A</td>
</tr>
<tr>
<td><strong>CoalDeliv_Price</strong></td>
<td>Monthly wholesale fuel price for coal inclusive of cost for delivery to Ohio</td>
<td>$/mmBTU</td>
<td>EIA, EPM, Table 4.10.A</td>
</tr>
<tr>
<td><strong>LMP</strong></td>
<td>Hourly PJM and MISO LMPs weighted by hourly load and aggregated into monthly rates</td>
<td>₦/kWh</td>
<td>PJM, MISO</td>
</tr>
<tr>
<td><strong>Div_Com_Stock</strong></td>
<td>Dollar amount of dividends issued to common stock holders</td>
<td>Billions</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
<tr>
<td><strong>Div_Pref_Stock</strong></td>
<td>Dollar amount of dividends issued to preferred stock holders</td>
<td>Billions</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
<tr>
<td><strong>Tot_Op_Expn</strong></td>
<td>Dollar amount of operations for the reporting electric entity</td>
<td>Billions</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
<tr>
<td><strong>Res_Sales_MWh</strong></td>
<td>Megawatt-hours provided to residential customers by the reporting electric entity</td>
<td>Million MWh</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
<tr>
<td><strong>Comm_Sales_MWh</strong></td>
<td>Megawatt-hours provided to small commercial firms by the reporting electric entity</td>
<td>Million MWh</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
<tr>
<td><strong>Ind_Sales_MWh</strong></td>
<td>Megawatt-hours provided to large commercial firms by the reporting electric entity</td>
<td>Million MWh</td>
<td>FERC Form 1/ 3-Q</td>
</tr>
</tbody>
</table>
Theoretical Contribution: *Deconstructing Cross-Subsidization*

Type I (Inter-class) Consumption side

- Residential
- Cross-subsidy
- Commercial
- Industrial

Type II (Inter-firm) Production side

- Parent Corp.
- Riders & Surcharges
- Arms-length Genco
- Distribution Utility
Type I: Price Ratios (pre- & post-restructuring)

Vertical line indicates implementation of retail electric deregulation beginning January 2009
Theoretical Contribution: *Deconstructing Cross-Subsidization*

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- Distribution Utility
- Riders & Surcharges
- Arms-length Genco
Econometric Approach (xtscc: Driscoll-Kraay estimator)

\[ p_{it,\tau} = d_{i,\tau} \delta + z_{t,\tau}^{gas} \gamma_{gas} + d_{i,\tau} z_{t,\tau}^{gas} \zeta_{gas} + z_{t,\tau}^{coal} \gamma_{coal} + W_{it,\tau} \omega + C_{it,\tau} \phi + X_{it,\tau} \chi + T_{\tau} \alpha + \nu_i + \epsilon_{it,\tau} \]

Alternative model specifications replace input fuels with load-weighted wholesale LMP
Results: Retail Restructuring

Retail Restructuring (total effect)

¢/kWh

Residential  Commercial  Industrial
Residential  Commercial  Industrial
Residential  Commercial  Industrial
Residential  Commercial  Industrial

First Energy  AEP  Duke  DP&L

Model 2  Model 4
Natural Gas Price Results

Natural Gas Price (Coefficients)

¢/kWh

$./mmBTU

First Energy

Residential, Commercial, Industrial

AEP

Residential, Commercial, Industrial

Duke

Residential, Commercial, Industrial

DP&L

Overall Effect

Post-Restructuring Effect
In Conclusion...

- **Type I Cross-subsidization (inter-class)**
  - Where customers observed savings → *greatest savings to industrial customers*
  - Where customers observed costs → *greatest costs to residential customers*

- **Type II Cross-subsidization (inter-firm)**
  - Market-based pricing construct of retail deregulation *should have* resulted in savings of historic low gas price and low wholesale prices being passed on to consumers
  - Historic low gas prices/wholesale prices reduced revenues of arms-length gencos (predominantly coal-fired)
  - Utilities used commission-approved riders and surcharges to offset losses of gencos
  - Those cost pass-thrus more than cancelled out any benefit customers observed from retail restructuring
In Conclusion...

• **Implications for future research:**
  • Maintain a healthy skepticism of multi-state studies that lack details of state-level regulatory interventions
    • E.g., Severe flaws of EIA 826 data
    • E.g., Severe flaws of EIA’s Status of Electricity Restructuring Reports
    • E.g., Not accounting for holding company structures, affiliates, revenue flow thurs

• **Implications for practice:**
  • Do it (deregulation) right
    • Divestiture should be thorough → no remaining vestiges of vertical integration
  • Ohio is not alone
    • Several states failed to require thorough divestiture
    • Several states are still collecting transition revenues (whether they call it that or not) → And federal data is not identifying it
Thank you
Input Price Delivered Trends
Time Series Plot of Marginal Price by Sector and Metro Area

Graphs by City

Price (Constant 2016$)

Date

- Price_Residential
- Price_Industrial
- Price_Commercial

Toledo

Akron

Canton

Cinci

Cleveland

Columbus

Dayton
Statewide Aggregate Electricity Price
Time Series Plot of Marginal Price Ratios

Graphs by City

- Residential/Commercial Ratio
- Residential/Industrial Ratio

Dates:
- 2004m1
- 2016m12

Cities:
- Akron
- Canton
- Cinci
- Cleveland
- Columbus
- Dayton
- Toledo
# of Intervening Attorneys in Recent AEP ESP Rate Case by Sector

Count of Intervening Attorneys

<table>
<thead>
<tr>
<th>Industry</th>
<th>Environment/Social Justice</th>
<th>Regulated Utility</th>
<th>Consumers</th>
<th>Wholesaler (Unregulated Utility)</th>
<th>Electric Retailer</th>
<th>Commission Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
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</table>

The chart shows the count of intervening attorneys by sector in recent AEP ESP rate cases.