By capturing the peak of economic performance during the last business cycle, including the most recent "Great Recession" that began in 2008, and the slow recovery therefrom, we were able to show the relationship of electricity pricing to a more universal economic variable: productivity. The closest proxy of true labor productivity we were able to derive was an annual amount of gross state product produced per employee. This variable reflects both the shattered employment during the recessionary phase of the business cycle and the enhancement of technology that led to increases in labor productivity. Unfortunately, this variable also reflects the inflationary changes of the products imbedded in the measure of GDP and is ignorant of structural changes in the economy that are likely inflating the value of manufacturing products over time.

We have assumed the states' average industrial electricity prices to explain variation in manufacturing productivity among states and over time. Manufacturing performance, however, was influenced by more than just electricity prices. Some other influences were accounted for in our modeling. We also considered electricity market deregulation as an important policy choice that has influenced manufacturing productivity. In analyzing deregulation, we hypothesized a direct relationship between the variable expressing the year of deregulation in a given state and an increase in lagged manufacturing productivity the subsequent year.

Although industrial electricity prices and energy market deregulation were two policy variables of particular interest, we included a number of additional variables that fit two criteria: (1) they may influence the performance of manufacturing companies, and (2) the data for the variable were available for all five states and over time. This group of control variables included consideration of the following: business cycle phases; the dynamics of manufacturing employment; a presence of large manufacturing companies in the state; and the performance of the "Electric Power Generation, Transmission, and Distribution industry" (NAICS 2211) in the state.

Overall, the statistical model is built to test the effect of policy variables on manufacturing productivity (industrial electricity price and deregulation variables), controlling for the demand on the electricity market (manufacturing employment and significant presence of large manufacturing companies), the supply on the electricity market (size of power generation industry), and overall economic conditions (business cycle variable "*Recession*"). This logic of our statistical model can be expressed in the following equation:

Mnf Productivity = f (Industrial electricity price, Deregulation, Manufacturing employment, Presence of large manufacturing establishments, Size of power generation industry, Recession)

Where:

Mnf Productivity is the approximated productivity of a state's manufacturing sector; and the following variables can be defined as:

Industrial electricity price (IEP) - average state industrial electricity price;

Deregulation – an approximation based upon the change in policy deregulating the electricity market in a given state;

Manufacturing employment (%ch_mnf.emp) – the percentage change of manufacturing employment in a given state;

Presence of large manufacturing establishments (Mnf.1000LQ) – the change in relative number of large manufacturing companies in a state, compared to the number of large manufacturing companies in the United States;

Size of power generation industry (%ch._2211_GSP) – the percent change of gross state product produced by the *Electric Power Generation, Transmission, and Distribution* industry (NAICS 2211) in a state in a given year; and

Recession – approximating the trough of the business cycles between 1990 and 2010.

Variables for the Statistical Model

Dependent variable: Productivity of manufacturing sector in the state

Labor productivity is an indicator of value creation in the economy. Rather than employment or absolute value of gross state product, we believe that the indicator of GSP per employee best reflects the challenges of the manufacturing sector across different phases of the business cycle. Over the last two decades, the Ohio economy has demonstrated prolonged periods between the peaks and troughs of adjoining business cycles. The time period of this study—1990 to 2010—showcases this phenomenon and features several phases of the business cycle: the declining phase from July 1990 to March 1991; the historically long growth of the economy from 1991 to March 2001; the crash between March and November of 1991; the sluggish recovery through December 2007, which represented the shortest expansion phase since the 1990s; a new contraction, which led to a trough in June 2009; and, since then, an uncertain expansion of the economy.

Independent Variables

Industrial Electricity Price

The effect of energy cost on economic performance is a popular topic in academic studies exploring the impact of federal and state policies. In particular, electricity price has been proven to be an important factor in the site selection process of U.S. manufacturing companies. States with relatively low priced industrial electricity are proven to better attract firms looking

to reduce their production costs (Carlton, 1983).[23] Deschenes (2010), who employed a state panel data model similar to ours, was unable to disprove the hypothesis that no correlation exists between manufacturing employment and changes in state electricity prices.[24] This study anticipated that low industrial electricity prices may explain in part the economic growth and competitiveness of manufacturing industries in the five targeted states through demonstrated positive relationships with manufacturing productivity.

We used the annual average price of industrial electricity sold within a state as the measure of industrial electricity price (IEP) for the analysis. Industrial electricity prices vary among states and have changed between 1990 and 2010. The state's annual average industrial electricity price data are derived from the Energy Information Administration (EIA) and all price data are inflation-adjusted to 2012.

Electricity market restructuring in a state

Electricity market deregulation and restructuring was operationalized in the statistical model by a dichotomous variable. A state was coded as 1 if it had an active, restructured energy market or an effective legislative act in place allowing for the presence of a competitive electricity market in a given year. A state was coded as 0 if neither of the preceding elements existed. Information to construct this variable is recorded in Table 11.

Table 11. Status and Year of Electricity Market Restructuring and Deregulation in Selected States

State	Status	Enactment Year	Effective Year
IN	Not active	-	-
KA	Not active	-	-
MI	Active	June 3, 2000	January, 2002
OH	Active	July 6, 1999	January, 2001
PA	Active	December, 1996	January, 2000

Data source: U.S. Energy Information Administration
(http://www.eia.gov/cneaf/electricity/page/restructuring/restructure_elect.html)

This variable approximates the changes in state electricity markets, hypothesizing that the increased availability and diversity of sources for generating industrial electricity is likely to increase the supply of electricity and decrease industrial electricity prices. This variable alone would not explain the difference in electricity pricing among the states as it does not account for the flexibility and competitiveness of corresponding state wholesale and transmission markets. It is expected that states with deregulated electricity markets will show positive changes in manufacturing productivity.

[23] Carlton, D. (1983). The location and employment choices of new firms: An econometric model with discrete and continuous endogenous variables. *Review of Economics and Statistics*, *65*(3), 440-449.
[24] Deschenes, O. (2010). Climate policy and labor markets. *NBER Working Paper* #16111.

Employment in the manufacturing sector of the state (percentage change)

This variable approximates a fluctuation of the change in the whole manufacturing sector at the state level. This variable controls for changes in the demand for electricity in the state from large-scale electricity users such as manufacturers. In regulated electricity markets with low elasticity of demand and high cost of entrance (due to significant capital expenditures), even small changes in demand will influence the market price with restricted access to generation and transmission capacity of neighboring states. This variable will reinforce the disadvantage of regulated market-states in cases of demand fluctuation. We looked at annual percentage changes of manufacturing employment. Employment data estimates were obtained from Moody's Economy.com.

Share of large manufacturing firms (LQ)

The relative share of large manufacturing establishments in the state is calculated as a location quotient (LQ), which is measured as the share of the number of manufacturing establishments with 1,000 or more employees in the state, divided by the same average number in the whole United States. It hypothesizes that states with disproportionally high numbers of large manufacturing establishments might have more individually negotiated contracts (with more customer leverage) between large electricity users and supply companies, which is likely to push down the average industrial electricity price in the state. It also controls for labor productivity advantages within large firms or establishments due to the scale economy found by some academic studies (Miller, 1978).[25] In other word, large firms have a relatively high value added per employee and low unit-cost products, which leads to higher labor productivity when compared to smaller companies and establishments. The number of manufacturing establishments by size classes is available from the U.S. Census Bureau's County Business Pattern (CBP) database.

Size of power industry (% GSP change)

In our study, gross state product of the *Electric Power Generation, Transmission, and Distribution* industry (NAICS 2211) approximates the size and capacity of a state's power generation function. It reflects the supply side of the state's electricity market and, together with the deregulation variable, controls for the state's capacity to supply manufacturing companies with the industrial electricity needed to ensure growth in manufacturing productivity. The source of these data is Moody's Economy.com.

Business cycle (recession)

Variation in the demand for industrial electricity and, consequently, the supply of electricity markets and electricity prices is significantly affected by business cycle fluctuations. Historically,

[25] Miller, E. M. (1978). The extent of economies of scale: The effects of firm size on labor productivity and wage rates. *Southern Economic Journal*, 470-87.

recessionary years of economic activity and contraction of manufacturing production have yielded low demand for electricity and depressed electricity markets. The influence of the business cycle on state economies is approximated through this variable, which indicates business cycle troughs, or the lowest points of economic recession, between 1990 and 2010. For the years 1991, 2001, 2008, and 2009, when the national economy experienced a trough, the dichotomous variable is equal to 1; it is equal to 0 otherwise. Business cycle reference dates are available from the National Bureau of Economic Research.

Analysis Results

Industrial electricity price showed a statistically significant effect on manufacturing productivity across the five targeted states between 1990 and 2010 (Table 12). The industrial electricity price variable is statistically significant above the 99% critical value and is negatively associated with manufacturing productivity across the selected points of observation. In other words, the higher the industrial electricity prices were in the five selected states, the lower manufacturing productivity was in these states in 99% of cases. Using this history, we can assume with high confidence that higher industrial electricity rates in Ohio will most likely be associated with lower manufacturing productivity.

Moreover, the deregulation of the electricity market is positively associated with manufacturing productivity. This relationship is statistically significant above the 99% critical value.

Table 12. Regression Analysis Results: Determinants of Manufacturing Productivity

Manufacturing Productivity	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Std. Error	Beta		
(Constant)	108174.453	8370.131		12.924	.000
Industrial Electricity Price	-2527.259	795.915	-.274	-3.175	.002
Percentage Change of Manufacturing Employment	-72750.268	38965.873	-.212	-1.867	.065
Output LQ of Large Manufacturing Firms	13350.313	3099.256	.387	4.308	.000
Recession	-6344.511	3617.226	-.179	-1.754	.083
Percentage Change of Output of Power Industry	45218.611	20626.580	.173	2.192	.031
Deregulation	7263.441	2837.308	.236	2.560	.012

Adjusted R square = .404
N = 105

The variables characterizing the demand side of the electricity market show that the growth of manufacturing employment is negatively related to manufacturing productivity with statistical significance only above the 90% critical value. At the same time, the over-presence of large manufacturing establishments in the state is, as expected, positively associated with

manufacturing productivity at the 99% critical value. This indicates that manufacturing productivity might benefit from both economy of scale and the ability of large electricity consumers to negotiate individual contracts with suppliers at, most likely, lower than average market prices. This finding allows us to consider that enabling a lower market price across the board for manufacturing users might further benefit the productivity of the manufacturing sector in Ohio.

The control variable that represents the supply side of the electricity market, capacity of electricity production and distribution, is also positively related to manufacturing productivity and is statistically significant above the 99% critical value. Together with the positively associated deregulation variable, an increase in the state's capacity to generate, transmit, and distribute electricity will most likely support higher productivity in its manufacturing sector.

Finally, the variable approximating the national recession was negatively associated with manufacturing productivity. However the statistical association was weak, not quite reaching the 90% critical value.

These statistical results do not allow us to disprove the null hypotheses, i.e., that no statistically significant relationships exist between industrial electricity pricing and manufacturing productivity. On the contrary, an increase in the industrial electricity price by 1 cent per kilowatt-hour (16.3%) is likely, in 99% of cases, to decrease average manufacturing productivity in the five selected states, on average, by $2,527 of annual GSP per employee (2.2%). Although the increase of industrial electricity prices is most likely to inversely affect manufacturing productivity, it is necessary to assess the responsiveness of manufacturing productivity to the changes in industrial electricity. The most appropriate measure of a variable's sensitivity or responsiveness to a change in another variable is elasticity, which is usually expressed in the ratio of percentage changes. The productivity change resulting from industrial electricity price change has low elasticity: 2.2%/16.3%=0.13. The measure of elasticity below 1 is known as inelastic response. This means that for 1% increase of industrial electricity prices manufacturing productivity drops by 0.13%. Inelastic productivity change from the movement of industrial electricity price indicates that electricity is only one of the supply price factors influencing manufacturing productivity.

Impact of Electricity Market Deregulation on Electricity Prices and Economic Indicators

To assess the impact of electricity market restructuring, we ran an independent samples t-test to compare industrial electricity prices and other economic indicators[26] between the states that deregulated their wholesale electricity markets and the states that did not. We also probed deeper into the states that deregulated their electricity markets by comparing industrial

[26] The indicators and their abbreviations as listed in the Table 1 should be listed here. See Section IV for detailed definition and measure of variables.

electricity prices and other economic indicators within the states for the years before and after the restructuring. For Tables 3 and 4, a "1" in the "Deregulation" column represents observations across the years and states where electricity market deregulation occurred; "0" represents observations across the years and states (year-states) where deregulation did not take place.

Table 13 shows the results of an analysis comparing observations from all five target states, including Ohio, Michigan, and Pennsylvania, where deregulation occurred in the early 2000s, and Indiana and Kentucky, where the electricity markets were never deregulated.[27] The group of observations for each state in each year (year-states) with deregulated electricity markets contains 30 observations and the group representing markets that have not been restructured contains 75 observations (column "N" in Tables 13 and 14). The comparison of industrial electricity prices and economic indicators across year-states is a comparison of different values due to the existence of the deregulated energy market.

For all variables included in the t-test, the differences between observations representing deregulated and non-restructured markets were statistically significant above the 99% critical value (according to column "t" in Tables 13 and 14). A statistically significant difference exists in industrial electricity prices between deregulated electricity markets and non-restructured markets; specifically, the average industrial electricity price in deregulated markets was 6.8 cents per kilowatt hour (c/kWh) compared to 6.3 c/kWh for regulated markets (Table 13). At first blush, based upon this simple comparison, it appears that deregulation does not work to reduce electricity prices. However such a comparison would be misleading. Each non-deregulated state enjoyed considerably lower electricity prices than the deregulated states, prior to deregulation. To fully understand the effects of deregulation, it is necessary to examine the history of industrial electricity prices for the three deregulated states (Figure 11) before and after deregulation.

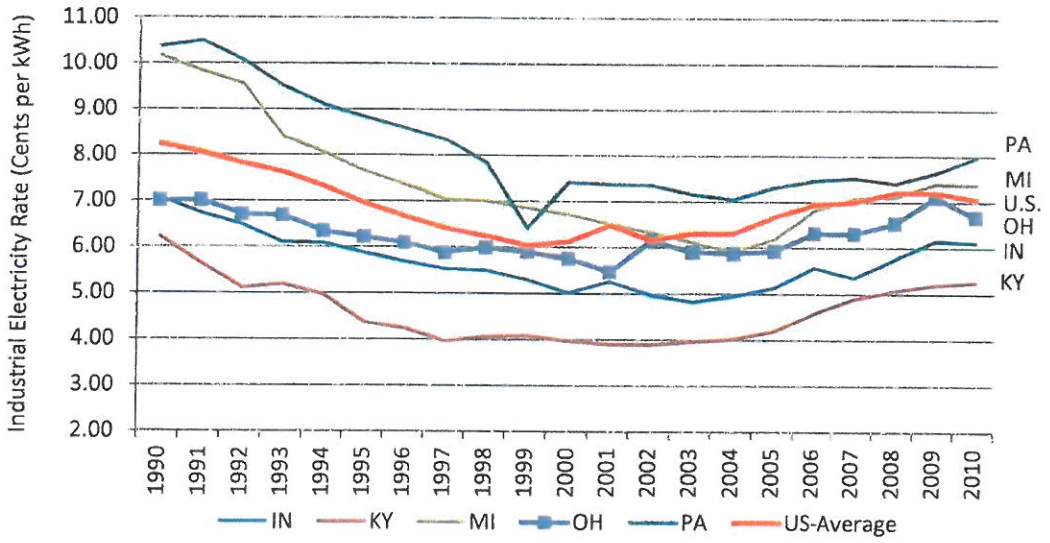
Figure 11 shows that Ohio, Michigan, and Pennsylvania—the three states that deregulated their electricity markets—had higher initial industrial electricity prices than the two states that never deregulated their markets (Indiana and Kentucky). Pennsylvania and Michigan started the study period with industrial electricity prices in 1990 above 10 c/kWh, and Ohio's industrial electricity price in 1990 was 7 c/kWh. In comparison, Indiana and Kentucky started with prices between 6 and 7 c/kWh.

[27] Ohio deregulated wholesale electricity markets in 2001 (Senate Bill 3, passed in 1999); Pennsylvania in 2000; and Michigan in 2002.

Table 13. Comparison of Variables in Regulated vs. Non-regulated Electricity Markets: Five States

Variables	Deregulation	N	Mean	Std. Deviation	t	df	P-value (2-tailed)
Industrial Electricity Price	1	30	6.81269	.665816	2.304	103.944	.023
	0	75	6.27469	1.726396			
Manufacturing Productivity	1	30	119891.59	9151.786	2.710	86.637	.008
	0	75	113335.88	15151.502			
Output LQ of Energy Intensive Manufacturing	1	30	1.62924	.395581	-3.849	93.580	.000
	0	75	2.05604	.728634			
Output LQ of Large Manufacturing Firms	1	30	1.34915	.408251	-2.288	103	.024
	0	75	1.54542	.392583			
Percentage Change of Output of Power Industry	1	30	.0424	.05440	2.378	103	.019
	0	75	.0155	.05166			

Figure 11. Industrial Electricity Price: Five-States and the U.S., 1990-2010



Source: Energy Information Administration

Table 13 and Figure 11 show that if we compare industrial electricity prices for the three states that restructured their markets to prices for those same states after deregulation occurred, the average industrial electricity price dropped from 7.7 c/kWh before deregulation to 6.8 c/kWh post-deregulation.

A similar dynamic related to the averages of indicators was observed on all other tested variables. Manufacturing sector productivity nearly doubled in Indiana and grew by at least $35,000 in the other four states between 1990 and 2010 (Figure 12). The difference in the

productivity of state manufacturing sectors (Mgf_Productivity) was statistically significant between deregulated and non-deregulated markets at the 99% critical value. Comparing average manufacturing productivity in all five target states, the difference in this indicator was $6,556 worth of gross state product per employee annually ($119,892 in deregulated markets compared to $113,336 in non-deregulated markets) (Table 13). If we compared state manufacturing productivity before and after deregulation in only Ohio, Michigan, and Pennsylvania, productivity increased by, on average, $14,869 ($105,023 before deregulation compared to $119,892 after deregulation) (Table 13).

The relative presence of electricity-intensive manufacturing establishments (LQ of mnf high intense)[28] also had larger averages in deregulated markets than in non-deregulated markets (Table 13). The difference between these averages is statistically significant. This finding indicates that in the five target states, the relative share of establishments in industries defined in Lendel (2012)[29] as high users of electricity (Table 15) was, on average, 1.6 times higher than in the national economy in non-deregulated markets and 2.1 times higher than in the national economy in deregulated markets. The relative shares of electricity-intensive manufacturing establishments were virtually the same before and after deregulation when considering only the three states that underwent the process.

The relative share of large manufacturing establishments in a state compared to the U.S. average share (mfg1000 LQ) was 1.55 for non-deregulated markets and 1.35 for deregulated markets in the sample including all five target states. In the sample of three states that experienced deregulation, the relative share was 1.33 before deregulation and 1.35 after deregulation, which shows no statistically significant difference.

Finally, the size of the *Electric Power Generation, Transmission, and Distribution* industry (NAICS 2211) (%change_2211GDP) was larger in states with deregulated markets than in states without deregulated markets (Table 13). The industry was also larger in Ohio, Michigan, and Pennsylvania after deregulation occurred, compared to before. These differences were statistically significant. This indicates that the industry producing and delivering electricity grew and delivered more supply after deregulation took place.

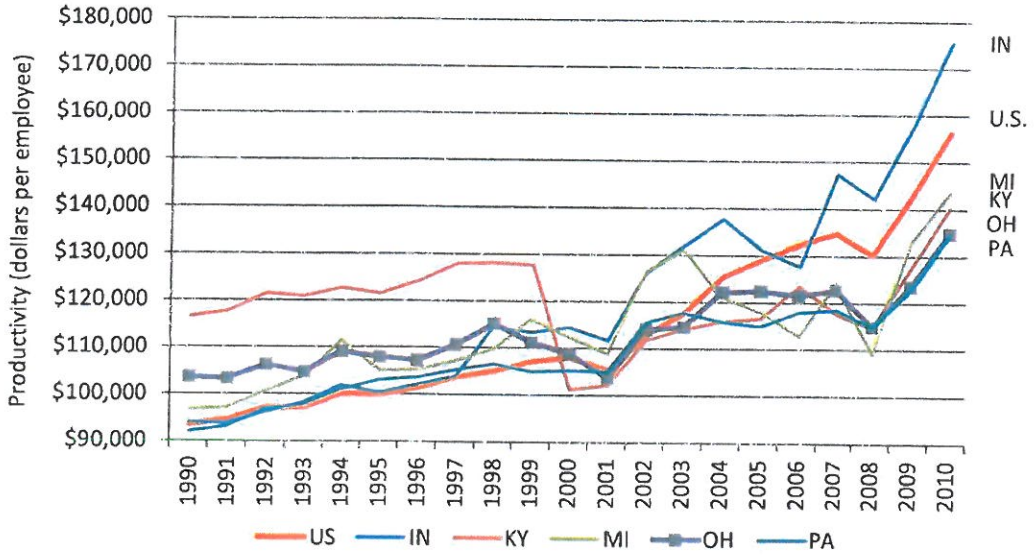
[28] Presence of energy-intense manufacturing establishments (LQ of mnf high intense) is defined as the change in relative number of energy-intense manufacturing companies in a state compared to the number of energy-intense manufacturing companies in the US.

[29] I. Lendel, et al, "Moving Ohio Manufacturing Forward: Competitive Electricity Pricing," the Urban Center, Levin College, Cleveland State University (March 2012).

Table 14. Comparison of Variables in States with Restructured Electricity Markets: MI, OH, PA

Variables	Deregulation	N	Mean	Std. Deviation	t	df	P-value (2-tailed)
Industrial Electricity Price	1	30	6.81269	.665816	-3.108	45.154	.003
	0	33	7.70435	1.492626			
Manufacturing Productivity	1	30	119891.59	9151.786	7.599	48.476	.000
	0	33	105023.28	5848.591			
Output LQ of Energy Intensive Manufacturing	1	30	1.62924	.395581	-.378	56.941	.707
	0	33	1.67591	.575377			
Output LQ of Large Manufacturing Firms	1	30	1.34915	.408251	.216	52.280	.830
	0	33	1.32960	.294151			
Percentage Change of Output of Power Industry	1	30	.0424	.05440	2.752	61	.008
	0	33	.0043	.05547			

Figure 12. Manufacturing Productivity: Five-states and the U.S., 1990-2010



Source: Moody's Economy.com

Table 15. Electricity Intensive Manufacturing Industries

NAICS	Industry Description
3313	Alumina and Aluminum Production and Processing
3221	Pulp, Paper, and Paperboard Mills
3274	Lime and Gypsum Product Manufacturing
3311	Iron and Steel Mills and Ferroalloy Manufacturing
3251	Basic Chemical Manufacturing
3272	Glass and Glass Product Manufacturing
3315	Foundries
3279	Other Nonmetallic Mineral Product Manufacturing
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing
3271	Clay Product and Refractory Manufacturing

Overall, deregulation seems to have had a positive effect on the change of industrial electricity prices, and some economic variables characterizing state of manufacturing industries in the five targeted states. The most profound effect deregulation had was on industrial electricity prices, which is evidenced by the significant drops in average price that Ohio, Michigan, and Pennsylvania—the states with the highest average base prices in 1990—experienced after deregulation occurred.

Conclusion

Identifying energy-intensive and large consumers of electricity industries

- ✓ There are 27 unit electricity-intensive industries and 21 industries that are large consumers of electricity in Ohio's manufacturing industries.
- ✓ We found 14 large electricity-intensive consumers (including both high- and medium-) manufacturing industries in Ohio, at the 4-digit NAICS level.
- ✓ All industries in primary metal manufacturing sector (NAICS 331) are defined as large, electricity-intensive consumers of electricity (NAICS 3311, 3312, 3313, 3314, 3315).
- ✓ Three chemical manufacturing industries (NAICS 3251, 3252, 3253); three food manufacturing industries (NAICS 3112, 3114, 3115); and paper, glass, and nonmetallic mineral product manufacturing (NAICS 3221, 3272, 3279) are large electricity-intensive consumer industries.
- ✓ Aluminum manufacturing is the top electricity-intensive consumer, with 5.7% of its expenditures on electricity. The iron and steel, chemical, glass and foundry manufacturing follow, each with a 2.3% or greater portion of its expenses made on the acquisition of electricity. In terms of total dollars spent, chemical manufacturing leads the state, with expenditures of over $352 million per year on electricity. Iron and steel industries, at $305 million, and aluminum at $244 million per year, are next. These industries all employ many thousands in Ohio, and are highly sensitive to increases in electricity costs.

- ✓ Besides manufacturing industries, eight 3-digit NAICS sectors and three 4-digit NAICS industries were identified as the largest electricity consumers and most electricity-intensive non-manufacturing industries in Ohio. They are accommodation (NAICS 721), nonmetallic mineral mining and quarrying (NAICS 2123), educational services (NAICS 611), amusement, gambling, and recreation industries (NAICS 713), coal mining (NAICS 2121), food services and drinking places (NAICS722), real estate (NAICS 531), warehousing and storage (NAICS 493), nursing and residential care facilities (NAICS 623), personal care services (NAICS 8121), and hospitals (NAICS 622).

Defining Ohio's economic base industries

- ✓ According to the location quotient of Ohio manufacturing industries' output or gross product in 2010, 52 4-digit NAICS industries are Ohio's economic base industries. They are represented by food manufacturing (NAICS 311), chemical manufacturing (NAICS 325), nonmetallic mineral product manufacturing (NAICS 327), primary metal manufacturing (NAICS 331), fabricated metal product manufacturing (NAICS 332), machinery manufacturing (NAICS 333), electrical equipment, appliance, and component manufacturing (NAICS 335), transportation equipment manufacturing (NAICS 336).

Ohio's electricity-intensive base manufacturing industries

- ✓ Twelve of 14 large electricity consumer manufacturing industries are part of Ohio's economic base.
- ✓ The Other fabricated metal product manufacturing industry (NAICS 3329) is the largest electricity consumer spending about $56 million per year on electricity consumption.
- ✓ Manufacturing industries that produce steel products, converted paper products, glass, nonmetallic minerals, motor vehicles, and specialty food are also Ohio's base industries that are large consumers of electricity.

Geographic distribution of electricity-intensive manufacturing base establishments

- ✓ The traditional Cleveland industrial belt in Northeast Ohio, especially among Cuyahoga, Summit, and Stark counties are where electricity-Intensive manufacturing base establishments are heavily concentrated (Map 8). Southwest Ohio, Hamilton County, which has Cincinnati at its core which has also a large number of electricity-intensive manufacturing establishments.

In the second part, we analyzed how industrial electricity pricing and electricity market deregulation influences the performance/productivity of the manufacturing industry in the state of Ohio and surrounding states

- ✓ Research area: Ohio and neighboring states of Indiana, Kentucky, Michigan, and Pennsylvania

- ✓ Period of study: 1990 and 2010
- ✓ Among five states, Ohio, Michigan, and Pennsylvania, which have relatively high industrial electricity price, deregulated their electricity market around early 2000 while Indiana and Kentucky did not restructure their electricity market.
- ✓ Analysis results present that the lower the industrial electricity prices were in the five selected states, the higher manufacturing productivity was in these state over the last 20 years. We can assume with a high degree of confidence that higher industrial electricity rates in Ohio will most likely be associated with lower manufacturing productivity.
- ✓ Deregulation of the electricity market explains the increase of manufacturing productivity in Ohio and neighboring states.
- ✓ Increasing the state's capacity to generate, transmit, and distribute electricity measured by % GDP change of power industry will most likely support higher productivity in its manufacturing sector.
- ✓ Manufacturing productivity in those five states is affected by the national economic recession.
- ✓ Manufacturing productivity might benefit from both economy of scale and the ability of large electricity consumers to negotiate individual contracts with suppliers at, most likely, lower than average market prices.
- ✓ Examining only three states that have deregulated their electricity market, Ohio, Michigan, and Pennsylvania

    - The average industrial electricity price dropped since deregulation.
    - Productivity in manufacturing industry increased after deregulation.
    - The size of power industry grew after deregulation occurred.

Appendix Table 1. Employment and Gross State Product of Electricity-Intensive Industries

NAICS	Description	Employment 2010	2010 GSP (in 2010 $)	% Empl of all OH industries	% GSP of all OH industries
3313	Alumina and Aluminum Production and Processing	3,291	$321,942	0.06%	0.07%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	9,890	$1,117,600	0.19%	0.23%
3251	Basic Chemical Manufacturing	8,737	$2,832,472	0.17%	0.59%
3272	Glass and Glass Product Manufacturing	7,685	$750,979	0.15%	0.16%
3315	Foundries	13,341	$968,942	0.26%	0.20%
3279	Other Nonmetallic Mineral Product Manufacturing	6,171	$708,435	0.12%	0.15%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	966	$585,050	0.02%	0.12%
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments	5,307	$1,286,891	0.10%	0.27%
3312	Steel Product Manufacturing from Purchased Steel	5,881	$702,124	0.11%	0.15%
3115	Dairy Product Manufacturing	8,179	$1,409,510	0.16%	0.30%
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	11,684	$1,834,442	0.23%	0.38%
3314	Nonferrous Metal (except Aluminum) Production and Processing	4,894	$450,210	0.09%	0.09%
311	**Food Manufacturing**	51,610	$8,256,565	1.00%	1.73%
325	**Chemical Manufacturing**	42,821	$10,716,810	0.83%	2.24%
327	**Nonmetallic Mineral Product Manufacturing**	23,987	$2,478,087	0.46%	0.52%
331	**Primary Metal Manufacturing**	37,297	$3,560,818	0.72%	0.75%

Note: Bolded are industries respective 3-digit NAICS sectors of electricity-intensive industries.
Source: Moody's Economy.com, November 2011.

Appendix Table 2. Industries by Energy-Intensive Categories

Industry Categories
Energy-Intensive Manufacturing
Food Products (NAICS 311)
Paper and Allied Products (NAICS 322)
Bulk Chemicals
Inorganic (NAICS 32512 to 32518)
Organic (NAICS 32511, 32519)
Resins (NAICS 3252)
Agricultural (NAICS 3253)
Glass and Glass Products (NAICS 3272)
Cement (NAICS 32731)
Iron And Steel (NAICS 3311)
Aluminum (NAICS 3313)
Non-Energy-Intensive Manufacturing
Metal-Based Durables
Fabricated Metals (NAICS 332)
Machinery (NAICS 333)
Computer and Electronics (NAICS 334)
Electrical Machinery (NAICS 335)
Transportation Equipment (NAICS 336)
Wood Products (NAICS 321)
Plastic Products (NAICS 326)
Balance of Manufacturing (all remaining manufacturing NAICS, excluding Petroleum Refining (32410))
Non-Manufacturing Industries
Agriculture, Crops (NAICS 111)
Agriculture, Other (NAICS 112-115)
Coal Mining (NAICS 2121)
Oil and Gas Mining (NAICS 211)
Other Mining (NAICS 2122-2123)
Construction (NAICS 233-235)

Note: NAICS = North American Industrial Classification System

Source: Office of Management and Budget, North American Industry Classification System, United States, 2007 (Springfield, VA, National Technical Information Service, 2007)

Summary: Exhibit Attachment EWH-2, Part III electronically filed by Ms. Rebecca L Hussey on behalf of OMAEG