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Restructuring, Ownership and Efficiency: The Case of Labor in Electricity Generation

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Abstract
This analysis considers improvements in productive efficiency that can result from a movement from a regulated framework to one that allows for market-based incentives for industry participants. Specifically, I look at the case of restructuring in the electricity generation industry. As numerous industries and economies have undergone this sort of transition to varying degrees, it is instructive to assess the performance of market-based incentives relative to what was observed under tighter regulation. Using data from the electricity industry, this analysis considers the total effect of restructuring on one input to the production process, labor, as reflected in employment levels, payroll per employee and aggregate establishment payroll. Using concurrent payroll and employment data from non-utility ("merchant") and utility generators in both restructured and nonrestructured states, I estimate the effect of market liberalization, comprising both new entry and state-level legislation, on employment and payroll in this industry. I find that merchant owners of divested generation assets employ significantly fewer people, but that the payroll per employee is not significantly different from what workers at utility-owned plants are paid. As a result, the new merchant owners of these plants have significantly lower aggregate payroll expenses. Decomposing the effect into a merchant effect and a divestiture effect, I find that merchant ownership is the primary driver of these results.

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I. Industry Restructuring and Productive Efficiency

Restructuring[1,2] affected a number of regulated industries in the U.S. over the latter part of the twentieth century. Over this time period, airlines, telecommunications, utilities and trucking transportation underwent significant shifts toward a more liberalized model. Internationally, there was a considerable privatization movement that gained momentum in the 1990s. As governments and industries continue to consider the benefits of a more market-oriented system, it is instructive to assess the performance of market incentives in industries that have recently undergone the transition.

The U.S. electric utility industry was a target of restructuring efforts during the 1990s. The federal government and individual states sought to lower prices in the industry through the introduction of market-based incentives and the relaxation of rules limiting market participants. Utilities in many states were living with financial decisions made in the 1970s and 1980s that proved *ex post* to be cost inflating. For example, in the early 1980s, a number of states were worried about the energy crisis that had taken place in the previous decade and as a result encouraged utilities to sign long-term energy provision arrangements. These arrangements effectively locked in the high prices of that time period. In addition, some states had promoted the construction of nuclear plants as a response to these high fossil fuel prices. By the 1990s, however, energy prices had shifted substantially again and it was clear that these arrangements were no longer cost saving. The federal government and the states began to explore ways to undo the damage and prevent these sorts of out-of-market solutions going forward.

The unbundling of power generation from electricity transmission and distribution was one of the ways states encouraged market reform in this sector. Because of concerns of market power, some states encouraged or required the incumbent utility to divest itself of generation assets. Some utilities voluntarily chose to exit the generation portion of the industry. The generation assets were then either purchased by non-utility ("merchant") firms or transferred to unregulated affiliates of the utility, which would function as a separate company. Merchants also obtained generation assets by building plants from the ground up. These merchant firms do not have load obligations, so the power that they produce is sold to an electricity distributor, either through a formal power market or via bilateral contracts with utilities. Because of such efforts, merchants have played an increasingly important role in the generation industry over the last two decades. The primary purpose of this paper is to analyze how input decisions, specifically the price and quantity of labor, vary according to ownership type and regulatory regime.

Electricity is an excellent industry in which to study the effects of restructuring. From an analytical perspective, one reason for its attractiveness is that identification of its effects

[1] The electricity generation industry, like many other industries we consider "deregulated," was not truly deregulated. While some states have relaxed restrictions on firms, numerous regulations still affect the participants in this industry. Thus, I refer to the industry as being "restructured" or "liberalized" throughout this paper.

[2] Restructuring in this industry was achieved through the encouragement of the participation of non-utility (merchant) generation ownership as well as through the passage of legislation that introduced market incentives to the regulated utilities. This paper will evaluate these restructuring approaches separately.

is plausible because restructuring legislation was largely enacted on a state-by-state basis. Not all states passed this type of legislation, and the states that did restructure did not do so simultaneously. Additionally, merchant penetration varies over time and by state. Divestitures of utility plants to merchant owners also did not occur at once, and construction of new plants by merchants took place throughout the sample period. By using concurrent payroll and employment data from both merchant and utility generators in both restructured and nonrestructured states over a period of several years, I can estimate the effect of market liberalization, comprising both new entry and legislation, on employees in this industry. The geographic and chronological nature of the evolution of the industry allows me to exploit both cross-sectional and longitudinal variation in the data.

Another useful characteristic of power plants is that their physical locations are fixed. If there is, for example, an unfavorable change in regulatory status, the plant cannot simply be moved to another location with more favorable conditions. This means that individual plants cannot easily select into or out of treatment groups. Additionally, homogeneity of output makes comparison of generation plants more straightforward, as there is no need to adjust for quality or other unobserved differences in the output.

Why would merchant plants have enhanced incentives to cost-minimize relative to regulated utilities?[3] Regulated utilities come from a long tradition of cost recovery in which rates are based on the actual costs incurred by the firms (plus a rate of return). This means that regulated utilities have generally been able to recover prudently-incurred costs. Any savings achieved by the utility would be temporary; at the next rate hearing the regulators would base the rates on the lowered costs, thus muting the benefit of the cost savings. Some incentive-based plans have been introduced more recently, but cost-of-service or rate-of-return legislation has historically been the dominant form of regulation in this industry.[4]

Indeed, the goal of regulation is typically to limit rents, not to encourage productive efficiency. Historically, there has been little downside of exceeding minimal cost. Since the determination of rates has generally been based on incurred costs, the upside of cost minimization has been small as well. Moreover, because of political considerations, labor is an area in which regulators have not been likely to challenge costs. Until fairly recently, unions were pervasive in this industry and even today the unionization rate in electricity is over double that of the economy as a whole,[5] which is either a source or a sign of labor's strength in the industry.

Looking at the establishment-level data, it is clear that the owners of power plants responded to the differential incentives implied by merchant ownership. There are three

[3] See also Bailey (1986) for evidence of post-deregulation cost minimization in the telecommunications, passenger air transport and freight transport industries. She further finds evidence that labor exhibited productivity improvements in each of these industries.
[4] See Comnes, Stoft, Greene and Hill (1995) for a description of historical and pilot performance-based regulation in this industry.
[5] Bureau of Labor Statistics, *Career Guide to Industries 2006-07*, p. 95.

key facts that emerge from the analysis of plant-level employment and payroll data. First, after controlling for plant characteristics, employment at plants that are merchant either by birth or by divestiture is significantly and substantially lower than employment at utility firms. Second, the merchant plants' total payroll costs are lower. Third, payroll per employee at divested plants is not distinguishable from payroll per employee at non-divested plants, while native merchant plants have significantly higher payroll per employee costs than utility plants. All three findings are consistent with what I was told by industry management and union representatives, who said that in California merchants eliminated approximately 40% of the work force after the transfer of ownership, while wages have kept pace with the existing wage trend. Moreover, it was noted that merchants have broadened job descriptions considerably and have largely eliminated the apprenticeship programs that were previously the primary source of new skilled labor.[6] These practices would lead to higher payroll costs per employee, even if wages by occupation were unchanged. Of course, it is far too early to judge whether eliminating the practice of on-the-job-training will prove to be optimal for the continued provision of an adequately skilled labor force. The aggregate data in this analysis cannot be used to examine wage distribution, but it is conceivable that microdata would support this assessment.

In this analysis, I focus on merchant and utility differences in the choice of labor inputs. The alternative approach is to estimate a production function, which would more directly address the question of whether employment and aggregate labor costs decreased due to generators substituting capital or materials for labor. However, because of data availability issues[7] this is not a feasible approach. For the following reasons, substitution of labor is not likely to be the complete explanation for the results presented here. There are four categories of inputs to electricity generation: fuel, capital, materials and labor. Electricity generation is a fuel-intensive process; from a technical perspective, firms have very limited ability to decrease employment by using more fuel. Regarding the potential for capital-labor substitution, the vast majority of capital expenses are incurred at the time of construction of the plant. There could be a shift in the labor-capital mix upon conception and construction of a new plant, but it is hard to alter capital decisions in a substantial way once the plant has been built.[8] Since I am looking at labor decisions within a plant, capital is essentially fixed and therefore there is limited opportunity for substitution. Finally, there is the possibility that materials could substitute for labor. Fabrizio, Wolfram and Rose (2006) find that both employment and non-fuel expenses (which include labor costs) are lower at legislatively-restructured plants. On a percentage basis, non-fuel expenses have fallen in excess of employment declines, indicating that true efficiencies have occurred in this industry.

[6] Anecdotally, it seems that the decommissioning of military bases has aided this to some extent. Every military base is required to have its own independent power source. As bases close or individuals retire, merchant companies can hire fully-trained power plant employees that received their training on the dime of the U.S. government, allowing them to eliminate some of the workers at the lower end of the wage distribution.

[7] While financial and operational data are widely available for utility plants, merchant plants are not required to publicly disclose these data.

[8] See also Fabrizio, Wolfram and Rose (2006).

In this paper, I use three separate but related markers of liberalization to analyze how generators are changing their employment practices. First, I look at plants that were divested from utility ownership as compared to native merchant plants and utility plants that were not divested. The post-divestiture owners are either merchant firms or they are unregulated affiliates of the utilities. The advantage of looking at this group is that it is a very strong identification strategy – I can look at plants over time that have changed only with respect to ownership type. On the other hand, plants that are merchants as a result of divestiture may be quite different from plants that were constructed as merchant plants. Since new plants continue to be built, it is useful to consider whether the plants built by utilities and merchants have inherent operational differences. Consequently, I also look more broadly at the effect of all types of merchant ownership on plant operations. Here, I compare divested plants and plants that were constructed by merchant firms to plants that are utility-owned throughout the sample. The third category is the set of plants that operate in states that enacted state-specific restructuring legislation in addition to the federal initiatives that affected all states. These plants are compared to plants in nonrestructured states to determine the effect of legislation on operations.

Both the regressions that focus on divested plants and those that explore employment at native merchant plants show a strong negative employment effect of merchant ownership. The range of the estimated effect is 30% to 70%, after controlling for plant characteristics, either through plant fixed effects or using descriptive attributes of the plants. The equations that consider the payroll per employee show that average pay at divested plants is not different from nondivested plants. The regressions that identify a merchant effect, however, indicate that while divested plants may have higher payroll per employee than utility plants, they have lower payroll per employee than native merchant plants. Considering the net of the negative employment effect and the positive payroll per employee effect, the establishment-level payroll equations demonstrate that there are real differences in the labor practices at merchant and utility power plants. The divested plants show a large and significant decrease in total payroll, as do the regressions that identify an effect based on plant characteristics. Again, when separating the effect of divestiture from the effect of merchant ownership, I find that the vast majority of the downward pressure on payroll is due to merchant ownership. This suggests that building new merchant capacity may be as effective, or even more effective, than divestiture as a way to encourage productive efficiency in this industry. This is an important point to keep in mind as new power plants are built to meet expanding electricity demand.

This study uses plant-level annual employment and payroll data. These data allow me to look at the effect of changes in ownership and state-level regulatory legislation at individual plants. I use two approaches to consider the effect of ownership. First, I consider the effect of a discrete change in ownership on operating decisions, that is, divestiture of the asset to a merchant firm. Then, I analyze whether plants with either native or divestiture-derived merchant ownership are different from other plants. Results of both approaches suggest significant differences in labor practices at merchant firms that are consistent with a greater incentive to cost-minimize at merchant plants. Separating these two types of merchant plants, I find that merchant ownership is a far more important determinant of the merchant/utility differential than is divestiture.

Divested plants provided essentially no more opportunity for improving cost efficiency than native merchant plants, and it may actually be more difficult to reduce costs at these plants.

This dataset is unique in that it includes both utility and merchant power plants and contains observations both before and after legislation and ownership changes. Both utility-owned and merchant-owned plants are required to submit detailed operations and financial data to regulatory entities such as the Federal Energy Regulatory Commission (FERC) and the Energy Information Administration (EIA). However, because in many cases only the utility data are considered non-proprietary, previous studies such as Fabrizio, Rose and Wolfram (FRW 2006) have focused on the behavior of utility plants when presented with a changed regulatory environment. Bushnell and Wolfram (2005) look at efficiency gains in both merchant and utility plants. In contrast to this analysis, they focus on the physical efficiency of plant operations, rather than examining employment data.

II. Objectives and Background

a. The Electricity Generation Industry

This paper analyzes whether merchants behave as though their incentives to cost-minimize are stronger than those of utilities and whether state-level legislation has encouraged firms to cost-minimize beyond this. All generators decreased employment over the late 1990s and early 2000s, but did they do so differentially according to ownership type or as a result of a change in regulatory regime?

Regulators, industry participants and union leaders have all indicated that a primary goal of restructuring was to reduce costs in states that had higher-than-average retail rates. Union leaders were "reluctant" to support market liberalization and "would have been happier if none of this [deregulation] happened" because of the anticipated negative impact on employment in the industry.[9] Independent industry employment forecasts have predicted that this industry should expect a continued decline in employment. At the same time, it has been noted that professionals with a high level of technical expertise should face generally favorable job prospects, with continued strong demand for their skill sets.[10]

This is consistent with the theory that under regulation, labor was indeed able to capture significant rents in this industry.[11] Here, I examine whether restructuring was accompanied by an erosion of these rents. If so, were rents reduced through wage changes, through reductions in the workforce or through some combination of the two?

In this analysis, I measure changes in labor costs (which is a function of both wages and the number of employees) in the various groups of interest to examine how labor's

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[9] "How Labor Built Up Its Energy Clout in California," *The Electricity Daily*, Vol. 12, No. 120, June 23, 1999.

[10] See the employment outlook for the utilities industry in the Bureau of Labor Statistics *Career Guide to Industries 2006-2007*.

[11] See, e.g., Rose (1987) and Hendricks (1975, 1977).

position has changed under a more competitive system. I expect to find that because in a competitive environment the firm is the residual claimant on profits, labor has less power to extract rents in the merchant framework. Additionally, state-level legislation was designed to allow utilities to similarly benefit from reduced expenditures, so it is expected that labor has also become less powerful in these states. This is in contrast to the traditional regulated regime, in which firms are generally able to pass through labor costs via higher rates. Labor, in particular, is a relatively uncontroversial cost element of this industry. Meanwhile, the cost of a strike is potentially quite high as it could lead to service interruptions that could conceivably jeopardize the entire system. As a result, there was perhaps even less pressure to economize in this area of operations.

Under traditional rate-of-return regulation, there is an incentive in the short term to reduce labor costs to take advantage of regulatory lag; however, this incentive is dampened by the fact that rates will at some point be reset using the lowered costs. Regulated utilities typically propose their operating costs for some period of time; regulators approve rates that are based on these costs (plus a specified return). Rates are reset periodically. Thus, regulated firms are able to pass labor costs through to customers and in the long term do not have a strong incentive to cut costs.[12]

By contrast, in either a legislatively-restructured or merchant environment, firms are the residual claimants in perpetuity on any cost savings they are able to achieve. Output prices are no longer explicitly determined by production costs, so any cost savings will be a direct improvement to the firm's financial situation. Utilities that pass generation ownership to their unregulated subsidiaries have incentives that are similar to those of merchant plants.

Utility plants also have an incentive to become more efficient in a restructured environment, as they must now compete with the merchant generators for dispatch priority, which is typically based on generation costs. Moreover, merchant generators have pulled back the curtain on the industry to some extent. Merchant plants that locate in a utility's service territory provide a useful benchmark for utility plants with similar characteristics. In this way, cost improvements and efficiencies implemented by merchant plants are likely to eventually filter through to utility plants, assuming that the lower costs are sustainable in the long term.

Utility plants in states that were not restructured, on the other hand, have somewhat different incentives. Because in such states the utility itself decides how to dispatch electricity, they do not have to worry about dispatch priority or prices set by the market. They can largely choose whether to buy power from merchant plants and do so through bilateral contracts only when it is to their own advantage. At the same time, the threat of restructuring may have affected the utility's incentive to engage in cost-cutting proactively in an attempt to convince regulators that there was no cause to restructure the market. Comparing the merchant plants to utility plants, and comparing plants in

[12] In the short term, however, reducing costs can increase margins due to regulatory lag. The firm is the residual claimant on savings achieved after costs have been approved. However, these lower costs will be considered in future rate determinations and so in the long run the savings are short-lived.

restructured states to plants in nonrestructured states is appealing from a practical perspective. However, it fails to measure the extent to which even nonrestructured states and utility plants were affected by the change in the regulatory environment in neighboring jurisdictions. While I do not attempt to measure how the threat of restructuring in all states contributed to the reduction in employment and payroll at all plants, it is likely that all plants were affected by the prevailing mood during this time period.

Total electricity generation employment in 2003 was almost 250,000 people (both full and part-time; all classes of ownership). This reflects a significant reduction from 1990 levels, when employment in this industry was a bit over 350,000.[13] At the same time, the industry has expanded output, rising from just over 3 billion megawatt-hours (MWh) of output to just under 4 billion MWh nationwide. It is also an economically important industry; in 2004, the wholesale value of electricity in the U.S. was over $150 billion.[14] But beyond simply being a study of what happened in electricity generation, the findings can provide insight into how these incentive changes affect the real-world decisions of the affected firms. This industry provides an important data point when considering the realistic outcomes of these types of shifts in market structure.

A brief look at the publicly available state-level data indicates that average wages for generation workers have increased in excess of inflation over the period 1990-2003. Moreover, wages have increased somewhat more rapidly in restructured states. Figure 1, which was constructed using aggregated data from the Quarterly Census of Employment and Wages (QCEW), illustrates the change in the industry average annual wage, calculated as (deflated) payroll divided by average annual employment. From the graph, it is evident that workers in this industry are seeing their wages rise, even after accounting for inflation.

Concurrent with the dramatic decrease in employment in the industry was a continued expansion of capacity and output. Using employees per megawatt (MW) capacity as a measure of productivity, Figure 2 shows that plants in legislatively-restructured states have decreased this ratio (improved productivity) by about 53%, while the decrease in nonrestructured states was somewhat less dramatic – there was a 46% decrease from 1990-2003.[15] The effects of merchant entry and enhanced market incentives on industry-wide employment have not been well-studied and are worth exploring in conjunction with wage effects to arrive at a more complete understanding of the effects of liberalization programs.

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[13] Data are taken from the Current Employment Statistics survey; national data available on the BLS website (http://data.bls.gov/PDQ/outside.jsp?survey=ce).
[14] According to EIA data, the national average wholesale price of electricity was $39.40 per megawatt-hour. In the same year, net electricity generation approached 4 billion megawatt-hours.
[15] Employment data are from the QCEW. MW capacity and MWh generation data are from Energy Information Administration (EIA). See http://www.eia.doe.gov/cneaf/electricity/epa/generation_state.xls

What is the dollar value of the savings that generators have been able to achieve? Industry payroll[16] in 1990, expressed in 2004 dollars, was approximately $18.8 billion. Industry payroll in 2004 was $14.4 billion. Meanwhile, industry production and capacity expanded considerably over this time period. In 1990, the electricity industry had payroll costs of approximately $6.19 per megawatt-hour (MWh), in 2004 dollars. Multiplying this by the actual 2004 output implies a total payroll cost of $24.6 billion. Thus, correcting for output differences, the industry's payroll expenses in 1990 were 71% higher than they were in 2004. In dollar terms, this is a savings of over $10 billion. Performing a similar calculation using industry capacity in place of output yields a similar conclusion – payroll costs would have been approximately 72% higher if 1990 employment-capacity ratios had been in effect in 2004. [17] This simple calculation, while not definitive, does suggest that the issue merits further attention. This paper will consider the influence restructuring had on employment, controlling for plant characteristics. I specifically focus on the effect of the shift from utility to competitive ownership of power plants.

b. Prior Literature

This paper fits into the literature on regulatory rents, productive efficiency and firm privatization. A number of authors have addressed these issues in various industries, with the general conclusion that restructuring or an increase in competitive pressure is accompanied by efficiency gains that are sometimes quite large.

Specifically, Rose (1987) discusses regulatory rents in the trucking industry, which was deregulated in the 1970s. She does this by considering wages in the industry and finds that in the regulated era union members were able to capture a significant share of regulatory rents. Upon deregulation, these rents were dissipated.

In contrast to Rose's findings, Card (1986, 1996) finds little evidence that employees capture significant regulatory rents. He concludes this after examining the experience of the airline industry, examining the evolution of wages, while controlling for job titles.

Hendricks' (1975) work on firm incentives in labor negotiations with unions indicates that wages are decreasing in firm profitability. Hendricks (1977) further finds that regulated industries have, on average, lower wages than unregulated industries. He does not, however, consider employment or aggregate payroll expenses in his analyses, focusing on the price rather than the quantity of labor employed. It is difficult to assess the conclusions about occupation-controlled wages with the establishment-level payroll data available in this paper. This is, however, something that I will address in future work using individual-level data.

[16] This is an approximation based on total employment in the electricity generation industry times the average weekly production wage times 52. Data are taken from the Current Employment Statistics survey; national data available on the BLS website (http://data.bls.gov/PDQ/outside.jsp?survey=ce).
[17] Output and capacity data taken from the *Annual Energy Review 2005*, Energy Information Administration (available on the web at http://www.eia.doe.gov/emeu/aer/elect.html).

Fabrizio, Rose and Wolfram (2006) consider the response of utility electricity generators to changing legislative incentives in this industry. They find that plants in states that enacted restructuring legislation reduced employment and nonfuel operating expenses. The efficiency improvements they identify are modest, but do indicate that markets provide enhanced incentives for power plants to find ways to become more efficient. Because they use publicly-available data, they focus on utilities in their analysis rather than on competitive generators.

Olley and Pakes (1996) look at the effect of deregulation on productivity in the telecommunications equipment industry. Although they take quite a different approach, the conclusion of their analysis also supports the theory that deregulation encourages firms to behave more efficiently. In particular, they find evidence of improvements in allocative efficiency across plants engaged in equipment production.

In addition to the literature on the relationship between efficiency and market liberalization, there is a significant literature on the relationship between productive efficiency and firm profits. Borenstein and Farrell (forthcoming) find empirically that there is a concave relationship the market value of gold mining companies and the price of gold. This suggests that in this industry firms become less efficient ("fatter") as the wealth of the company increases. This is consistent with the hypothesis that firms that experience less pressure to improve profits do not cost minimize.

Along these lines, Galdón-Sánchez and Schmitz (2002) consider improvements in labor productivity that occurred among iron ore producers in the 1980s that faced falling prices. They point out that the iron ore mines located in regions of faltering steel production faced increased competitive pressure relative to those located near thriving mines. An additional source of competitive pressure that was more directly under the mine's control was production costs. In the face of near-doom, these at-risk mines experienced remarkable productivity improvements of 50 to 100%.

Papers on privatization of formerly state owned and operated enterprises have largely found that privately-owned companies exhibit improved productivity. While most utilities are not state-owned, it is conceivable that tightly regulated output prices provide some of the same efficiency incentives. Megginson and Netter (2001) provide an excellent evaluation and survey of the progress and conclusions of the privatization literature. Most of the studies they cite agree with the conclusion of this paper that competitive (private) firms have higher productivity than regulated (state-owned) firms, sometimes much higher.

c. Restructuring Timeline and Specifics

In the context of the electricity industry, restructuring can take place at the level of generation, transmission or distribution. Of these different levels, that of the generation industry has progressed the furthest from a national perspective. This is because it is widely believed that electricity generation is unlikely to be a natural monopoly.[18] It is

[18] See, e.g., Christensen and Greene (1976), who fail to find evidence of significant economies of scale at the firm level in electricity generation above a moderate level of output. More specifically, introducing

easy to argue that there is little use in building two sets of transmission lines to transport electricity over long distances. Likewise, there is probably no reason to run more than one set of the distribution wires that connect the transmission backbone to individual homes. Generation facilities, however, are different. Once transmission and distribution is established, energy can (for the most part) be delivered to and from any point on the grid. Moreover, energy needs are expanding over time and new power plants continue to be built. A large number of plants are necessary in order to provide the electricity demanded by consumers. The competitive process can help eliminate inefficiencies that may arise from full-scale regulation.

The liberalization of the electricity generation industry began in earnest with the Energy Policy Act of 1992.[19] This legislation opened the sector to nonutility (merchant) provision of wholesale power at the national level, by encouraging merchant ownership of generation assets and allowing access to the transmission network on a case-by-case basis. In 1996, FERC Order 888 continued the push toward a more competitive generation market by requiring utilities to provide open access to transmission lines at nondiscriminatory rates. The restructuring of the industry and the establishment of competitive generation markets have been accompanied by the sale of utility-owned plants to merchant generators (divestiture), by the transfer of regulated utility assets to unregulated affiliates and by the construction of new plants.[20] As a result, the proportion of electricity provided by merchant generators increased markedly over the decade of the 1990s.[21] As shown in Table 1, less than 6% of total capacity was owned by non-utilities in 1990. By 2003, this proportion had increased to over 43%. The state-level restructuring programs of the 1990s catalyzed merchant participation in the industry; merchant ownership started to increase rapidly in 1998, around the time that the first restructuring programs were implemented and coincident with the first set of plant divestitures. Clearly, merchant generators are important players in the industry and are increasing their activities apace.

In 1993, the first state – New York – held restructuring hearings. By the close of the millennium, every state had instituted formal hearings to consider whether to restructure. Currently, almost half of all states have restructured their electricity markets to some extent, although in response to the rolling blackouts and price spikes in California during 2000 and 2001, some of these states have since suspended or delayed restructuring activity pending further review.[22] The movement to liberalize this industry persists today,

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more firms to the generation industry does not materially compromise firm efficiency relative to a market consisting of very few large firms.

[19] Although merchant generation existed prior to this, it was on a much smaller scale and was largely controlled by the transmission owners (incumbent utilities).

[20] As part of their restructuring programs, many states required utilities to divest their generation assets. There were voluntary divestitures as well.

[21] As of 2000, South Dakota was the only state that had no non-utility generation (NUG) facilities; by 2003, even South Dakota had a small merchant presence. Although all states currently have merchant (non-utility) generation, the percent of capacity owned by merchant generators varies widely from state to state.

[22] Restructured states are: AZ, CT, DE, IL, ME, MD, MA, MI, NH, NJ, NY, OH, OR, PA, RI, TX, VA, plus DC. Restructuring has been delayed in: AR, MT, NV, NM and OK. CA has suspended restructuring. Source: http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html, data as of Feb. 2003. AR and NM ultimately repealed restructuring legislation.

as some states continue to monitor industry conditions as part of the ongoing debate regarding whether to move to a more deregulated model.

III. Employment Data and Plant Descriptive Data

a. Plant-Level Employment Data

This study uses data from state unemployment insurance (UI) programs, as compiled by the Bureau of Labor Statistics (BLS) through what is also known as ES-202 data. The data cover the time period 1990-2004 and include quarterly employment and payroll at the establishment (power plant) level. These data are then aggregated to the annual level to match data on plant characteristics and production that is collected by the EIA. In the BLS data, establishments are tracked over time using a BLS-generated identification number that is unique to the establishment across years. This number is unique to the establishment rather than unique to the owner of the establishment.

Unfortunately, this dataset only covers direct employees. Contract employees are reported under the firm that is the direct employer, i.e., the entity that provides the employee's paycheck. This is a limitation of the dataset, but it is not likely that it is the sole explanation for the results presented here. I discuss this issue in more depth after the description of BLS data.

The UI data are the foundation for the Quarterly Census of Employment and Wages, which is also available publicly at the state and national levels from the BLS website. According to BLS documentation, this data source covers the vast majority – 97.1% – of non-farm employment.[23]

The UI data include establishment-level monthly payroll and employee counts. There is no differentiation between full-time and part-time employees, so the monthly data exceeds the number of full-time equivalent employees to the extent that workers are part-time. Anecdotally, I have found no indication that there has been a shift toward or away from full-time employment in this industry. Establishments report earnings for all employees that fall under the UI program. Detailed determinations of which employees are covered by the UI program vary by state, but as noted above the vast majority of employees fall under this system.

Projects that make use of the confidential BLS microdata undergo two levels of approval. At the top level, the BLS evaluates the proposal. Once the project is approved, it must be approved by each state that provides the microdata. States have varying data sharing arrangements with the BLS. Some states allow access to all BLS-approved researchers; others do not allow access to any outside researchers. The remaining states grant approval on a case-by-case basis. For this reason, I do not have access to data for all states; there

[23] Source: http://www.bls.gov/cew/cewbultn.htm, viewed Aug 23, 2006.

are currently 31 states in my sample.[24] This number could grow as additional state-level agreements are reached.[25]

The UI data are organized by 6-digit NAICS industry codes. In theory, this means that establishments are classified at the level of generation type in the BLS data.[26] However, examining the microdata reveals that establishments frequently misreport their NAICS codes. For example, an establishment called "John Doe Nuclear Plant" might appear in the data under a NAICS code that designates it as a hydroelectric plant. If there is indeed a nuclear plant with that name in the EIA dataset, I assume that this is an establishment that is incorrectly classified and that it is actually a nuclear plant. To deal with these misclassifications on a formal basis, I use a manual technique to match the plants in the BLS dataset to the plants in the EIA database. Plants are matched using BLS data that detail company name, trade name, address, NAICS code, number of employees and aggregated payroll.[27]

Ultimately, I was able to identify 273 gas-fired[28] plants in the sample, out of the universe of 1,443 plants of this type that existed in 2002. Based on the fact that the average capacity of the plants in my sample is larger than the average capacity of the universe of gas plants, the plants that I could not identify tend to be the smaller gas plants. Although the plants that I have matched do not represent a census of plants, I am confident that I have correctly identified the plants for this subset. Given the irregularity of the data, I am more comfortable with a relatively small number of confident matches than with a plant census that requires a great deal of assumptions. Based on my experience with the microdata, I do not believe matching every plant in the two databases is feasible.

b. Plant-Level Descriptive Data

Data from the EIA[29] provide information on the characteristics of individual plants, such as merchant status, capacity, the year the plant started operation and the type of fuel used by the plant. The *Electric Power Monthly*, published by the EIA, details changes in plant ownership for this time period. I consider a plant to be divested as of the year the change in ownership went into effect.

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[24] The states in the sample are; AK, AR, AZ, CA, DE, GA, IA, ID, IN, KS, KY, LA, MD, MN, MO, MS, MT, NC, ND, NE, NJ, NM, NV, OK, RI, SD, TN, TX, UT, VA, WI. See footnote 17 for the regulation status of these states.

[25] These data are housed at BLS headquarters in Washington, DC, where all data analysis was conducted.

[26] 221111, for example, corresponds to "Hydroelectric Power Generation."

[27] As the data collection processes are completely separate and the data are reported by individual establishments over a period of years, there is no guarantee that company names and addresses will be represented the same way in both the BLS and EIA databases. As a result, I hand-matched the establishments in the UI data according to state, city, company or trade name and address. Often the match was straightforward – if the plant was called "ABC Power Plant" (either company name or trade name) in the BLS data I considered that a match to "ABC Power Plant" in the EIA data (assuming the city and state also matched), regardless of NAICS classification in the BLS data.

[28] For reasons discussed below I focus on gas plants for this analysis.

[29] EIA Form 860a and 860b, obtained through Platts POWERdat, version 8.1.0804.

Power plants can be fueled by a number of different sources. The categories of fuels used in generation are nuclear, coal, gas, water and other.[30] For the present analysis, I consider only gas-fired plants. Nuclear, hydro and "other" plants have clearly different operations patterns from fossil fuel plants. Nuclear plants have extensive safety regulations that affect employment. On a very practical note, my sample only contains one divested nuclear plant and so this is not currently a feasible area of research. Hydro plants tend to be very small and have traditionally been sparsely staffed. Plants that fall in the "other" category cover a wide range of plants and tend to rely on less mature technology.

Because state utilities commissions tended to encourage the divestiture of fossil fuel plants, their numbers are more plentiful. For this analysis, I focus on natural gas-fired plants. These plants make up a significant portion of overall portfolio by capacity.[31] Moreover, merchants tended to build gas plants and it was the single largest category of divested plants on the basis of the percent of capacity divested, with 28% of the total capacity of natural gas-fired plants divested or slated for divestiture as of 1999.[32] Since these plants comprise a significant portion of the overall plant base and also of the divested plant base, are a relatively well-understood technology, and are less subject to continued regulatory oversight, they are a reasonable focus of research. The analysis was also conducted with coal plants, but there were not enough divested or native merchant coal plants in the sample to obtain significant results (although the sign of the results was broadly consistent with the sign of the results using natural gas plants).

For a subset of years, I have EIA data on the annual production of the plants, measured in megawatt-hours.[33] These data are available for both utility and merchant plants from 1995 through 2004. In theory, since production varies on an annual basis, this measure of output may be useful in addition to plant fixed effects. However, I do not find that accounting for fluctuations in plant usage over time changes the analysis in a substantive way. This is not surprising, as staffing decisions are likely made based on capacity and long-term production plans as much as on short-term output variation. For a normal range of operation (i.e., the plant is not shut down or on standby), employment is somewhat fixed. A plant operator needs to be present whether the plant is running at 50% of capacity or at 75% of capacity. Maintenance employment may differ somewhat if the plant is run particularly intensively, but again, looking at the issue empirically, when production data are included the results are essentially the same as when they are omitted. Furthermore, the plants in my study tend to be baseload plants, so their output does not vary dramatically.

I follow FRW (2006) in defining a dichotomous variable for the status of restructuring legislation. States chose whether or not to restructure their electricity industries beyond

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[30] The "other" category includes renewables, such as wind and solar power, and other less widely-used fuel sources.

[31] Energy Information Administration, Electric Power Annual 2004. Note that gas plants are 24.4% of installed capacity.

[32] Energy Information Administration, *The Changing Structure of the Electric Power Industry 1999: Mergers and other Corporate Combinations* (December 1999). For comparison, 15% of total coal capacity was divested.

[33] EIA Form 906, obtained through Platts POWERdat version 8.1.0804.

the federal efforts that paved the way for merchant entry, and each did so on their own timetable. States either chose to pass a law authorizing competitive markets or chose to maintain the status quo of centrally-set electricity rates. Since legislation was universally preceded by a formal state-level hearing, I take the start of formal hearings as the incipiency of state-level restructuring. The delay between hearings and the enactment of legislation was often quite lengthy, so it is useful to consider the time period between hearings and legislation as a time that the utilities were aware of impending changes and some actions taken in this period were undoubtedly anticipatory. Although this definition requires a level of foresight on the part of the utilities, they were active participants in restructuring hearings and it is reasonable to expect that they had a fair idea of the outcome of the process.

c. Potential Selection of Divested Plants

A natural question that arises is whether the plants that were divested suffer from a selection or pre-existing trend issue. That is, would the plants have reduced employment costs in the absence of divestiture? Were the plants that were divested non-random, e.g., chosen because they had the most potential for efficiency gains?

States approached the issue of divestiture in different ways. At a broad level, some states were very concerned about the potential for utilities to exercise market power. These states mandated divestiture, but did so in different ways. Some states mandated that all plants with certain characteristics be sold; others said that utilities must divest themselves of a certain proportion of their generation assets. Divestitures also occurred separately from restructuring, as firms or municipalities decided to exit the generation market entirely. It is also possible that some utilities divested selected plants strategically; this possibility is discussed further below.[34]

Between 1998 and 2002, 339 plants[35] were divested in 24 states plus the District of Columbia.[36] Most of these divestitures occurred in states that had enacted restructuring. However, there were some states that experienced divestiture even though no restructuring took place.[37] By contrast, of the 18 states, including DC, that restructured (and did not subsequently suspend or delay the process), utilities in 15 states ultimately divested at least some generation assets. The reasons for divesting were myriad – a mixture of mandated sale, “encouragement” to sell, strategic sales and disintegration of the supply chain.

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[34] For more discussion of reasons firms divested their generation assets see Energy Information Administration, *The Changing Structure of the Electric Power Industry 1999: Mergers and Other Corporate Combinations*, Section 6: “Divestiture of Generation Assets by Investor-Owned Electric Utilities,” December 1999.

[35] Excluding bulk hydro sales. Data are from the *Electric Power Monthly* released by the EIA over the period 1998 - 2003.

[36] The majority of divestitures that have taken place occurred during this time period. Although there were a few divestitures that took place in 2003 or 2004, these were not included in this analysis because of a lack of post-divestiture observations in the BLS dataset, which is available through 2004.

[37] States that had divestitures but did not restructure were: AK (1 plant), FL (1 plant), IN (2 plants), KY (5 plants), LA (2 plants) and WV (1 plant).

The concern of selection bias is greatest in those cases in which the utilities were allowed to choose which of their plants were to be sold to a merchant owner. If this were the case, the utilities could have chosen to divest only those plants that were already reducing employment, meaning that ownership transfer could have coincided with changes that were happening at the plant independently of divestiture. To begin to address this issue, it is useful to think about the incentives of the utility. Consider a plant that had leaner operating costs; it would be a more attractive investment for merchant firms and would therefore fetch a higher price upon sale. It is possible, then, that utilities did some cost cutting in advance of divestiture. These cost efficiencies would still be attributable to divestiture. On the other hand, it may be that utilities divested the plants that had the greatest potential for improvement, selling them as "fixer-uppers." Either way, it is important to consider which plants were ultimately divested to determine whether sample selection is a serious issue for this analysis.

Bushnell and Wolfram (2005) show that in practice the utilities that divested generation tended to divest all or nearly all of their assets rather than selectively retaining plants. For the set of states included in the present sample that had divestitures of at least 500 MW, the percent of coal and gas capacity owned by independent power producers is shown in Table 2. For three of the states in my sample with significant divestitures, 90% or more of the capacity is owned by merchants, supporting the "all or nothing" claim of non-selective divestiture. There are, however, a few exceptions that would benefit from some explanation. Indiana and Kentucky had divestitures that resulted from the sale of the portfolio of assets of utilities that primarily served another state. Louisiana's divestitures were the result of a single utility selling both of its power plants. Texas experienced two types of divestitures in this period. First, all of the assets controlled by Central Power and Light and West Texas Utilities Company were transferred to AEP (a merchant firm) as the result of a corporate merger. Second, Texas Utilities Electric Company transferred all of its generation assets to an unregulated subsidiary. Based on these facts, it is unlikely that strategic divestiture was widespread during this period.

Restructuring decisions were clearly correlated with electricity costs in the individual states. Since employment is a relatively small part of generation expenses, however, it is difficult to credibly claim that redundant or inefficient employment was a driver in state-level restructuring.

d. Plants in Sample vs. Plant Universe

It is possible that the plants in my sample differ systematically from the plant universe in a way that might bias the results of this analysis. Here, I present characteristics of the plants that are in my sample and compare them to the full sample of plants. Table 3 presents summary characteristics for the plants in my sample.

In the universe of U.S. power plants as of 2004, 18% (by count) were gas-fired. When considering the plants by capacity, however, gas plants comprise about 24.4% of total capacity, indicating that they tend to be larger by capacity in comparison to other fuel types.[38]

[38]Energy Information Administration, *Electric Power Annual*, 2004.

The observations that are included in the BLS data tend to describe plants that are both larger and older than typical.[39] It is sensible that larger plants are easier to spot in the data – they are much less likely to be reported under another establishment. It is possible that larger plants had more latitude for efficiency improvements, but this does not detract from the results of the study.

IV. Estimating the Effects of Legislation, Divestiture and Merchant Ownership

There are three main components to this analysis. First, I look at the effect of restructuring and merchant ownership on staffing levels, using end-of-year employment counts. Next, I divide annual establishment payroll by average employment over the year to evaluate the change in the annual payroll per employee by establishment.[40] Finally, I consider changes in total annual payroll by establishment. The basic approach is common across all three of these measures of the price or quantity of an establishment's labor inputs.

Note that I have two dependent variables that are directly reported in the data and I have constructed a third. I consider the three separately for two reasons. First, by looking at all three variables separately it is straightforward to assess the separate and combined effects of staffing and pay decisions. Second, the payroll variable contains annual establishment-level data. Thus, it would be inappropriate to divide payroll by end-of-year employment[41] to arrive at a measure of employee-level costs. While the three variables are clearly related, the payroll per employee measure is not precisely a transformation of the observations on employment and payroll. For these reasons, all three regression results are reported.

Each of the three measures of labor inputs is analyzed in two ways. The first set of regressions uses plant fixed effects to control for individual plant characteristics that are unobservable or idiosyncratic. While this is the best way to control for variation at the plant level, it is useful only for identifying a divestiture effect. Plants that were constructed by merchant firms and have always been merchant-owned cannot be analyzed in this way, because the plant fixed effects incorporate the merchant component. As a result, the second set of regressions for each labor decision attempts to identify an overall merchant effect separately from the divestiture effect; to do this, I use plant characteristics in lieu of plant fixed effects to analyze the choices of plants that are either divested or native merchant establishments in relation to utility plants.

The basic approach is to use a log-linear model of the following form:

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[39] In 2004, the average nameplate capacity for gas plants in the EIA database (plant universe) was 283 MW. This is smaller than the average size of 361 MW for gas plants in the BLS sample for that year. Mean plant age in the BLS sample is 27 years, while it is 23 years for the EIA gas plants.

[40] I also ran a regression that regressed (log) payroll on (log) employment (plus other variables). The coefficient on employment was consistently very close to one, indicating that using the payroll per employee as the dependent variable is not an unreasonable approach.

[41] Reasons for evaluating end-of-year rather than average employment are detailed below. Because of concerns about the potential peculiarities of December payroll, I consider annual payroll instead.

$$(1)\ \ln(L_{it}) = C + \beta_1 legislation_{st} + \beta_2 divest_{it} + \phi_i ORISPL_i + \alpha_t Year_t + e_{it}$$

In this equation, L_{it} is one of the three labor decisions I am analyzing – end-of-year employment at the plant level, annual payroll at the plant level or annual payroll per employee at the plant level. *Legislation* is a dummy variable that equals one for states that ultimately enacted their own restructuring legislation, beginning the year that the state started formal hearings and *divest* is a dummy variable that equals one for plants that were divested, beginning the year that ownership transferred. Also included in the regression are plant (designated by *ORISPL,* industry jargon for the unique plant identification numbers assigned by the EIA) and *Year* fixed effects.

For the employment analysis, I focus on end-of-year employment. The alternative is to use annual average employment, which overstates employment if there is a downward trend in staffing over the year. Conversely, if an establishment adds employees over the year, employment would be overstated by this measure. Since I am looking at the shift in employment over time, I have chosen to use December employment as the measure of employment for the year so that the trend does not obscure the analysis. This also allows me to use fully the information contained in the most recent data available. Additionally, I have excluded plants that have an end-of-year employment of zero from the sample in the year that the employment was reduced to this level. This eliminates employment fluctuations that result from closing the plant either permanently or temporarily.

The data in this analysis are clearly autocorrelated. For the employment equation, the estimated *rho* is 0.642, indicating a high level of correlation. Total payroll has an estimated *rho* of 0.547. Average pay per employee is much less persistent, with an estimate *rho* of 0.192. In all three cases, the Durbin-Watson statistic supports the rejection of the hypothesis of no autocorrelation at the 1% confidence level.

To account for the serial correlation, each regression is run using OLS, with a variance correction using errors clustered at the plant level.[42] The regressions are also run using the Prais-Winsten GLS correction. Although specific coefficient estimates change somewhat under GLS, the overall conclusions of the analysis do not change when this correction is implemented.

Using OLS requires that changes in state-level restructuring legislation and plant-level ownership status be exogenous to changes in plant-level employment decisions. Looking at industry and regulatory documents as well as press accounts from the period that states were considering legislation, there is no cause to believe that high employment costs (either employee counts or payroll costs) were a primary driver of industry reform. Employment expenses are a relatively small share of the total cost of generating electricity, dwarfed by fuel and other costs.[43] Because of this, I do not have reason to believe that employment was a target of restructuring legislation and so the exogeneity assumption is justified for this variable. As discussed above and demonstrated in Table 2,

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[42] I use the cluster command in Stata, which is described in Arellano (1987).

[43] For 2004, I estimate labor expenses of $3.62 per MWh of net generation output. The average wholesale price for that year was about $39.40 per MWh (see Footnote 11).

divestitures were also exogenous to plant-level employment and payroll expenses for this time period. Utilities tended to divest either all or none of their capacity. Those that partially divested generation assets did so for reasons other than employment costs.

The model is specified as log-linear, implying that there is a multiplicative effect of the independent variables. This is a reasonable assumption as we would expect the dummy variables to have a proportional effect on employment, payroll or average wage. We would expect a merchant generator to staff at some fraction of a utility generator, rather than that all merchants employ, say, 5 fewer people. This specification also leads to a straightforward interpretation of the coefficients in the model. Coefficients on indicator variables, as we have in equation (1), can be easily transformed to reflect the percent differential for plants that exhibit the characteristic marked by the variable. To arrive at the percent effect of a given characteristic, exponentiate the coefficient and subtract 1. To be concrete, the divested plants have, on average, $(e^{\beta_2} - 1)$*100% more (or fewer) employees than nondivested plants. The percent effects, calculated in this way, are presented along with the regression results in the output tables.

The above technique sets forth the preferred approach to analyzing this type of data. Plant fixed effects are a useful way to control for the unobserved and idiosyncratic variables at the plant level. However, it is not wholly satisfactory as it fails to exploit a significant source of information. Since plants that were built by merchant companies were never anything other than merchant companies, using fixed effects leads to a failure to identify the effect of being a merchant plant unless the plant arrived at that state via divestiture. In an attempt to utilize the data of native merchant plants, I also use observable plant characteristics in place of plant fixed effects. Although this does not control for plant-level differences as completely, it is not an unreasonable approach. Power plants are relatively homogeneous as compared to other types of production facilities. A few general plant characteristics can account for much of the plant-level variation.

To formulate a specification that can mimic plant fixed effects, it is necessary to determine the important characteristics of a plant vis-à-vis employment decisions. From a theoretical perspective, plant capacity in megawatts (MW), age of the plant,[44] a measure of plant efficiency, or heat rate, and the prime mover[45] the plant uses are clearly the primary characteristics that should have a significant effect on labor decisions. Since I am not certain precisely how these characteristics contribute to the determination of operating decisions, I consider a specification that is flexible regarding the roles played by the various characteristics. Specifically, capacity, heat rate and plant age also enter the equation as higher order terms. State fixed effects are included as well.

The regression that uses plant characteristics in lieu of plant fixed effects is:

[44] *Age* is calculated using the year the oldest unit at the plant initially went online.
[45] The prime mover is the particular generation technology used by the plant. Gas plants can be single-cycle or combined cycle, which may affect plant operating decisions.

$$\ln(L_{it}) = C + \beta_1 legislation_{st} + \beta_2 divest_{it} + \beta_3 merchant_{it} + \sum_{j=1}^{4}\omega_j[\ln(\min\_hr_{it})]^j + \sum_{j=1}^{4}\eta_j[\ln(\max\_hr_{it})]^j + \sum_{j=1}^{4}\lambda_j[\ln(capacity_{it})]^j + \sum_{j=1}^{4}\gamma_j[\ln(age_{it})]^j + \theta_p Prime_{it} + \phi_s State_i + \alpha_t Year_t + e_{it} \quad (2)$$

The variables in equation (2) that are common with equation (1) are as defined above. The variables that replace the plant fixed effects of equation (1) are the log of the minimum heat rate (min_*hr*) at the plant, the log of the maximum heat rate (max_*hr*) at the plant[46], the log of plant nameplate capacity (*capacity*), the log of the time elapsed since plant online date (*age*), dummies for the plant's prime mover (*Prime*), a set of state fixed effects and a set of year fixed effects. Additionally, I include squares, cubes and quartics of the heat rate, *capacity* and *age* variables.

Equation (2) uses the log-linear specification for the same reasons given for its use in equation (1). The only difference is that here there are four continuous variables – minimum heat rate, maximum heat rate, capacity and age of the plant. While the interpretation of the dichotomous variables is unchanged, the interpretation of the log-linear coefficient of a continuous variable is simply the elasticity of the independent variable with respect to the dependent variable. That is, β*100 is the percent change in plant employment (payroll or average wage) that follows a 1% change in (for example) megawatt capacity.

Finally, I estimate the equations with a time trend variable in lieu of the divestiture variable. It is possible that divested plants were on a different employment path over time that was simply continued in the post-divestiture era. To evaluate the extent to which this is happening, I add a set of dummy variables that indicate where the plant is chronologically in the divestiture process. These variables are always equal to zero for plants that were never divested or are native merchant plants. For divested plants, they are separate dummy variables for each year before and after divestiture, starting with 5 years prior to divestiture and ending with 6 years after divestiture. For example, consider a plant that was divested in 1998. For this plant, the variable indicating 5 years pre-divestiture would correspond to the calendar year 1993, and 2004 would be 6 years post-divestiture. The equation estimated is as follows:

$$\ln(L_{it}) = C + \beta_1 legislation_{st} + \delta_y YrDiv_{it} + \phi_i ORISPL_i + \alpha_t Year_t + e_{it} \quad (3)$$

This is a modification of equation (1); variables that are common to the equations are as defined above. The new component of this equation is represented by *YrDiv*, which should be interpreted as the set of annual dummy variables that describe the chronological position of the plant in the divestiture cycle.

[46] Heat rate is a measure of how efficiently the plant can turn fuel into electricity. It is reported annually by unit, so when I aggregate to the plant level for this analysis I retain the heat rates of both the most-efficient and the least-efficient unit at the plant.

This equation is also estimated as a merchant-effect regression with plant characteristics replacing plant fixed effects. That equation is:

$$(4)\quad \ln(L_{it}) = C + \beta_1 legislation_{st} + \beta_3 merchant_{it} + \delta_y YrDiv_{it} + \sum_{j=1}^{4}\omega_j[\ln(\min\_hr_{it})]^j + \sum_{j=1}^{4}\eta_j[\ln(\max\_hr_{it})]^j + \sum_{j=1}^{4}\lambda_j[\ln(capacity_{it})]^j + \sum_{j=1}^{4}\gamma_j[\ln(age_{it})]^j + \theta_p Prime_{it} + \phi_s State + \alpha_t Year_t + e_{it}$$

Again, all of the variables in this equation have been defined above. I did not estimate the equations with a separate merchant time trend, as there is no reason to expect that the pattern of merchant plants differed from the pattern exhibited by non-merchant plants. Indeed, statistical tests indicate that a set of merchant time effects is not significant when estimated in conjunction with a set of overall time effects.

V. Results

a. Employment

The first analysis I consider is that of employment, estimated using plant-level fixed effects. I find that there is a large and significant effect of divestiture on employment. Data are clustered at the plant level in these regressions.

Table 4 shows the results of the employment regressions. The first two columns (regressions I and II) show the employment regression as it is estimated with plant-level fixed effects, as in equation (1). Divestiture is the effect that can be estimated in these equations. Regression I illustrates OLS regressions that have been corrected for serial correlation by clustering observations at the plant level. Regression II is the GLS regression, which is estimated using the Prais-Winsten technique. According to the OLS estimates, divested plants in the sample have approximately 42.4% fewer employees than non-divested plants, even after accounting for the industry-wide decline in employment over this time period using year fixed effects. The effect estimated by the Prais-Winsten approach is somewhat more modest, although it still calculates a 28.2% percent reduction in employment at divested plants. Note that although the point estimates of the two approaches are different, there is significant overlap in the 95% confidence intervals of the estimates. Both estimates are significant at the 5% level or better; the effect is clearly negative and of substantial magnitude.[47]

Regressions III and IV shown in Table 4 are the OLS and GLS estimates of the employment regression specified in equation (2), which uses plant characteristics and state fixed effects in place of plant fixed effects. Although, as explained above, plant characteristics combined with state fixed effects are not perfect predictors of the plant-level effects, using this technique I can look at the experience of native merchant plants in addition to the plants that became merchants through divestiture.

[47] When the average of monthly employment over the year is used as the dependent variable rather than end of year employment, the coefficient on *divest* is closer to zero and still significantly different from zero. This is consistent with the downward trend in the data, which would result in an average employment that is larger than the end of year employment.

For the clustered OLS regressions, the conclusions of the plant characteristics regression are qualitatively similar to those of the divestiture-only regressions, though the effect is of a much larger magnitude. Merchant plants are estimated to have approximately 72.2% fewer employees, significant at the 5% level. This is a very large number. Notice that the standard error is relatively large as well, so the estimate should be interpreted cautiously. The estimate for *divest* in this equation is positive, although not significant. Since the two coefficients should be summed for the total effect on divested plants, these regressions suggest that the bulk of the decline in employment estimated in regressions I and II is due to the fact that the plants are owned and operated by merchants rather than that divestiture provided an incentive apart from this ownership incentive.

The GLS regression estimates a slightly smaller merchant effect of -65.4%, which is significant at the 10% level. The effect of divestiture in this regression is positive, very large in magnitude and significant at the 10% level. Taking into account standard errors, there is significant overlap in the 95% confidence intervals for the OLS and GLS estimates, so the results are not inconsistent.

The lack of significance (regression III) or borderline significance (regression IV) of the *divest* coefficient suggests that other utility-owned plants would likely experience a similar magnitude of employment reductions if they were divested to merchant firms. Note that since all divested plants are also merchant plants, the total effect of divestiture is the sum of the *divest* coefficient and the *merchant* coefficient. It is tempting to conclude from the large and positive coefficient on *divest* that it is not likely that divested plants will achieve the labor reductions of native merchant plants. However, the fact that the *divest* coefficient is barely or not at all significantly different from zero implies that native merchant plants do not have significantly greater potential for efficiency gains with respect to labor than utility-built plants, over the approximately five-year time horizon of this study.

Table 5 shows the results of employment equations (3) and (4), which use a set of annual divestiture fixed effects in place of the single time trend and the divest dummy. These regressions indicate the evolution of the effect of divestiture on staffing decisions, rather than simply comparing the pre-divestiture average to the post-divestiture average employment. F statistics of the joint significance of the set of pre-divestiture dummies (5 years prior to divestiture through the year before divestiture) and the post-divestiture dummies (year of divestiture through 6 years after divestiture) are given below the list of coefficient estimates. These regressions also include generic year effects, which are not reported in this table, meaning that the yearly divestiture effects are in addition to the secular time trend.

In the divestiture-effect regressions (regressions I and II of Table 5), it is clear by inspection that overall the pre-divestiture set of dummies is smaller in absolute magnitude than the post-divestiture variables. None of the years in the pre-divestiture era have a trend coefficient that is significantly different from zero. By contrast, plants had reduced employment by approximately 80% in the third year after divestiture, significant at the

1% level. Additionally, the F statistic shows that as a group the post-divestiture dummies have a higher level of significance than the pre-divestiture dummies. This is evidence that the significance of the divest variable in the previous set of regressions is not due solely to the continuation of an existing trend. While the estimates for years 5 and 6 post-divestiture could indicate the reversal of the trend, I hesitate to conclude too much from these estimates. They are based on a relatively small number of plants due to the fact that relatively few of the plants in the sample were divested early enough to generate these time effects. However, it may be worthwhile to revisit this issue as more data become available; it is possible that the new owners underestimated the minimum number of employees required to staff a plant and there was a period of correction after the initial drop in employment. This would be consistent with what I was told by a union representative in 2004, who said that the merchant plants, after a period of broadening job titles and responsibilities were beginning to see the "wisdom" of narrower job titles and the higher staffing levels that implies.

The merchant-effect regressions that include divestiture time effects (regressions III and IV in Table 5) again indicate that merchant ownership rather than divestiture is the key factor at work in the observed employment reduction. The effect of merchant ownership (which is additive to the divestiture effects) is estimated to be approximately -79.4% and is significant at the 1% level. As in the previous regressions, the effect of divestiture, when separated from the merchant component is positive and insignificant in the post-divestiture era. Note that some of these estimates imply extraordinarily large effects; before drawing a conclusion about this recall that the standard errors are again quite large, so the 95% confidence interval includes a reasonable range of values.

Because of data limitations, this paper does not distinguish between a reduction in the total labor force and a shift of employment from in-house employees to contractors. While I do not have contracting data at the plant level, I do have some information on this point from the quinquennial Economic Census of Utilities and Transportation, albeit at the national level. In 1992, the percent of Maintenance and Repair expenses that was incurred by direct employees was 58.3%. By 1997, this number had grown to 60.4% and in 2002 it was back down to 54.2%. In real dollar terms, the amount spent on outside work was 7.3% lower in 2002, relative to 1997.[48] While this does not tell us the changes in the populations of interest (either by state/restructuring status or by merchant/utility ownership), it does indicate that there were not drastic industry-wide shifts in contracting practices over this time period.

Although we should keep the above in mind, the analysis clearly shows that significant staffing reductions have occurred. Given the magnitude of the shift and the limited information that can be gleaned from the national data, this is unlikely to be solely the result of an outsourcing of labor. However, even if the difference shown here were completely attributable to contracting, it would be significant that the utility and merchant firms are behaving differentially. Presumably, merchant firms would not be contracting with outside labor sources if they could provide a permanent in-house labor force more cheaply. Thus, to conclude there is no difference in behavior requires that

[48] Economic Census (Utilities), 1992, 1997, 2002.

merchants are not able to hire workers as cheaply as utilities while the sources of contract labor *can* hire labor at those rates. This does not seem to be a plausible scenario, especially relative to the alternative hypothesis of differential incentives to cost-minimize.

Correcting the parameter estimates in both sets of equations for autocorrelation using Prais-Winsten GLS correction does not change the primary conclusion of the analysis – divestiture has an economically and statistically significant effect on employee counts at these plants.

I was not able to identify an employment effect that was significantly correlated with state-level legislation in either the regressions with plant fixed effects or state fixed effects. Checks on the analysis that looked at divestitures and legislation separately did not indicate that this is a result of collinear variables – including *legislation* did not have much effect on the estimated *merchant* coefficient and vice versa. Further, omitting *merchant* entirely did not have an appreciable effect on the estimated *legislation* coefficient; the reverse was also true. It is possible that because the pre-period of the sample with respect to legislation is relatively short,[49] the legislation effect is incorporated into the state or plant fixed effects. Fabrizio, Rose and Wolfram (2006) identify a legislation efficiency effect for employee counts in the neighborhood of three percent. The period examined by FRW, 1981 – 1999, is quite a bit earlier than my period, resulting in a much larger number of pre-restructuring observations. Additional factors for the difference could be that FRW covers all states, while this analysis covers a subset of states.

These regressions were also run on coal plants. Results were qualitatively similar, although there were relatively few coal plants in the sample, which resulted in a lack of significance in the findings. Gas plants are a reasonable focus of the analysis as a higher share of gas plants was divested. Moreover, because of environmental and other concerns merchants tended to build gas plants over this time period. Because of relative fuel prices (and perhaps because of a decrease in the likelihood of opposition from environmental regulatory bodies, either because of political clout or improved environmental efficiency of the plants), however, there is currently a resurgence in the construction of coal-fired plants,[50] so it may be worthwhile to extend the analysis to these plants in the future.

b. Payroll per Employee

From a broad perspective, the average wage in the generation industry increased dramatically during this period. While the CPI for this time period indicates a 45% overall increase in prices, workers in this industry saw their nominal wages increase by 85% between 1990 and 2004. Table 6 considers the relative changes in payroll per employee for ownership and restructuring groups within the industry. Regressions I and II of Table 6, which are based on equation (1), indicate that the effect of divestiture on

[49] Recall that restructuring is defined by the beginning of formal hearings in the state. The first state, NY, began hearings in 1993 and the bulk of restructured states began hearings by 1995.

[50] See, for example, the proposal by the unregulated generation affiliate of TXU to build 11 new coal-fired plants in Texas.

payroll per employee, when controlling for plant-level fixed effects, is modestly positive, though it is not significantly different from zero in either regression. As in the employment table, the first regression presents standard errors that are robust to serial correlation within plants. The second regression corrects both the standard error and the parameter estimate for first-order autocorrelation.

Regressions III and IV of Table 6 estimate equation (2) and attempt to identify an effect for merchant plants that is separate from the divestiture effect of being a former-utility plant. The estimated merchant effect is much larger than the effect that was estimated for divested plants – OLS estimates that merchant plants pay employees approximately 50.4% more than non-merchant plants when controlling for state effects and basic plant characteristics at the 5% significance level. The GLS correction yields a modestly smaller estimate of the effect of merchant ownership of 46.6%, significant at the 1% level. When identifying a general merchant effect, the coefficient on *divest* is negative and significant in both regressions, indicating that divested plants have lower payroll per employee than comparable native merchant plants. Adding the *divest* and *merchant* coefficients results in an estimate that is roughly in line with the *divest* coefficients of regressions I and II.

One explanation for the relatively higher payroll per employee at merchant plants is that merchant owners have disproportionately reduced employment in lower-skill jobs. This is consistent with what I learned from union and industry managers, who told me that wages did not change much for the workers that remained in the industry, controlling for job title. An explanation was suggested by a manager at a merchant power plant, who told me that her firm has virtually eliminated apprenticeship programs. She stated that since training is no longer in her budget she is now looking to hire fully trained personnel, a departure from utility practices. This assertion is corroborated by recent press reports, which state that generation companies have begun encouraging technical schools and colleges to offer degree programs to train power plant operations staff.[51]

As the BLS data are aggregated at the establishment level, it is not possible to explore further the issue of the changing composition of this labor force using this data source. However, this analysis can be expanded in the future using Longitudinal Employer-Household Dynamics (LEHD) data from the U.S. Census Bureau that are available on a confidential basis through a separate proposal process. The LEHD data allow the researcher information on the wage distribution within establishments. As its name suggests, the database also synthesizes payroll and employment data obtained through employer filings with employee demographic data that is obtained through Census surveys.

The regressions in Table 7 of equations (3) and (4) that trace the evolution of payroll per employee at divested plants tell a similar story. Post-divestiture annual effects are positive and large in magnitude, though not generally significantly different from zero. Again, when decomposing the effect into a merchant effect and a divestiture effect, the merchant effect is estimated to be large and positive, exceeding 50%. In both the OLS and GLS regressions, the estimate is significant at the 5% level. At the same time,

[51] "Power Firms Look to Stem Labor Shortage," *New York Times*, October 30, 2006.

looking at the yearly divestiture effects in the estimate of equation (4), which is shown in columns III and IV, payroll per employee at divested plants fell significantly in the year of divestiture and recovered modestly, if at all, in subsequent years. There is a jump up in payroll per employee between years 5 and 6 after divestiture, but because of the thinness of the sample in that range I hesitate to conclude too much from that estimate. The test of joint significance reveals that the post-divestiture set of effects is significant as a group. The pre-divestiture effects are of borderline significance, to the extent that they are significant at all, indicating that the post-divestiture estimates are not simply the continuation of an existing trend. These results are particularly striking in the merchant-effect regressions.

As with the employment equations, I do not find a significant relationship between the payroll per employee and whether the state in which the plant is located has enacted restructuring legislation. The estimate of the effect of restructuring is small, negative and statistically insignificant. Again, this may be because of the limited observations for the pre-restructuring period in these data.

c. Payroll

Aggregating the effect of merchant ownership on employment and payroll per employee, the establishment-level payroll regressions show that divested and merchant plants have significantly lower payroll expenses than utility plants. On a percentage basis, the reduction in payroll observed at these plants is generally somewhat less than the reduction in employment. This is consistent with the above observation that a decrease in employment based on employee counts is correlated with divestiture and merchant ownership, while the payroll per employee was unchanged or increased at these plants.

The first two columns of Table 8 show the results of the estimation of equation (1) and indicate a large and significant decrease in total payroll costs per establishment. OLS estimates a decrease in payroll costs of about 32.3%, while the GLS estimate is -25.3%. As in the previous analyses, these regressions use plant fixed effects to control for plant characteristics that do not vary across time.

When looking at the overall effect of merchant ownership using the specification of equation (2), shown in the third and fourth regressions of Table 8, the relationship between payroll and merchant ownership is slightly less clear. Although the coefficient on *merchant* is large and negative in both regressions, as was the coefficient on *divested* in the regressions controlling for plant fixed effects, the standard deviation is much larger in the *merchant* regressions; as a result, the estimate is borderline statistically significant in regression III. The *merchant* estimate of regression IV is negative and strongly significant. Again, in these regressions, the bulk of the effect of divestiture effect appears to be derived from the fact that these plants are run by merchant firms. In regression III, which decomposes merchant ownership and divestiture, it does not appear that divestiture has a differential effect apart from merchant ownership. However, regression IV shows that divestiture has a very large and significant additive effect to merchant payrolls. That is, divested merchant plants have higher payrolls than native merchant plants. The magnitude of the effect is quite large, although the large standard error indicates the magnitude of the effect may well be overstated.

As with the employment and wage regressions, I evaluated equations (3) and (4) with establishment payroll as the dependent variable, using a separate time trend for divested plants. The results are reported in Table 9. The post-divestiture effects reported here are clearly different from the pre-divestiture effects in these regressions, with their effects peaking in the fourth year after divestiture. They are, as a group, of greater magnitude than the pre-period estimates. As in the previous regressions, it is difficult to know whether the reversal of trend in years 5 and 6 is a result of a new strategy or if it is an artifact of the relatively small sample in later years. As was the case with both employment and payroll per employee, the regressions that use the plant characteristics instead of plant fixed effects demonstrate that the effects that I observe are largely due to the merchant aspect of divested plants, rather than due to the fact that divested plants have a greater potential for cost savings. In fact, it appears that divested plants have generally not been able to achieve the lower cost levels exhibited by other merchant plants. This may be because of legacy employment arrangements.

VI. Conclusion

From the results presented in this paper, it is clear that restructuring defined as the encouragement of new types of plant ownership had a large effect on labor costs in this industry. Merchant firms in the electricity generation industry responded to the stronger incentives provided by this type of ownership. Specifically, merchant firms have smaller staffs and lower overall payroll costs. There is also some evidence that payroll per employee is higher at merchant plants. This may reflect a change in the skill mix used at these plants.

Divested plants follow a similar pattern, but when both a merchant and a divestiture effect are estimated, the merchant effect is the primary driver of the results. Plants that were divested from utilities and those that were built by merchant firms from the ground up exhibited large but only mildly significant differences in their abilities to reduce labor costs. This suggests that plants that were conceived, built and operated as merchant plants can achieve modestly better cost savings than plants that were built by utilities and then divested to merchant ownership.

In this analysis, I do not find that restructuring defined as the passage of state-level restructuring legislation had a significant effect on plant employment or payroll costs. It is possible that using a time period with more data in the pre-legislation period could affect this conclusion.

This analysis suggests that the movement toward liberalization and the use of market incentives can result in significant gains in productive efficiency. Over the 1990s, this industry was able to drastically reduce its labor force while expanding total output. This is broadly consistent with other findings in the literature. While my analysis does not consider the performance of regulation in enhancing market competitiveness, it is clear that firms are responding to the opportunity to improve their profits by economizing when there is a reward for these efforts. From a productive efficiency perspective, these incentives appear to be working.

This paper does not explore the specific mechanisms by which employment and payroll costs were reduced at the merchant power plants. It also does not consider the long-run implication of these decisions, such as whether the plants that have reduced employment are engaging in a sustainable business strategy. These are issues that I will address in future work, as detailed below.

With respect to the mechanism by which efficiencies are achieved, there are a number of reasons that generators might have behaved in the manner I observe. One possibility is that training programs have been eliminated. The results presented here suggest that merchant firms may utilize a more highly-skilled labor force. The observed differences could indicate outsourcing of low-skill functions, such as janitorial services, or it could be the result of the elimination of training programs. It is also possible that some jobs have been eliminated entirely.

Another way to reduce the labor force is to combine job functions, thereby eliminating some underutilized labor. Anecdotal evidence indicates that job descriptions were broadened considerably during this time period. This would be an indication of this type of streamlining of resources. Firms might also simply be reducing employment through a movement toward a more spartan work environment. For example, landscaping efforts might be scaled back or trashcans might be emptied less frequently.

The above mechanisms for employment reduction could be assessed using data from the Census Bureau’s Longitudinal Employer-Household Dynamics (LEHD) dataset. The LEHD dataset contains data that are similar to the BLS data, but it has the advantage of being reported at a finer level of detail. It contains information on the wage profile of establishments as well as a gender profile, age profile and a human capital estimate. The latter data are collected from Census surveys and merged to match the individuals’ wage data that are collected from employers. This dataset will provide a great deal of insight into the operating decisions of competitive and utility firms. The LEHD dataset will provide a way to assess to what extent job descriptions are being broadened or eliminated. That is, a way to reduce employment would be to eliminate nonessential tasks or to combine job functions. The LEHD would help me to determine the extent to which these strategies are taking place.

On a separate but related note, the issue of contracting trends can be analyzed either through the LEHD or more directly through the Economic Census of Utilities and Transportation, which asks utilities to report contracting activities as a proportion of operations and maintenance expenditures. National data are available publicly, but such a high level of aggregation is of limited use in this context. Establishment-level data are available through the Census data centers on a proposal basis. I will submit this proposal, along with the LEHD proposal in the near future.

Finally, I will analyze the long-run sustainability of the cost-cutting strategies employed by merchants. It has been suggested that the strategies I observe at the power plants are optimal given a short-term horizon. It is possible, therefore, that plants are maximizing short-run returns at the expense of the long-run survival of the plants. This may be because of uncertainty of future regulatory decisions or because of an inability to compete with regulated utilities in the long run. I will use data on operating efficiency, planned outages, unplanned ("forced") outages and output decisions to assess whether merchant plants are being run more intensively than utility plants.

A short-term strategy would indicate that revenue in future periods is highly discounted relative to near-term revenue, perhaps because of pessimism about the long-term prospects of the firm. This pessimism may be the result of regulatory uncertainty or a persistent competitive disadvantage relative to incumbent generators. Operators with a long-term decision horizon engage in ongoing plant maintenance and tend to run the plant within a moderate range of output. Excessive plant starts and prolonged operation of the plant outside a normal range of output contribute to early deterioration of plant equipment. As a result, plants that are being run to maximize short-term gains may exhibit fewer planned maintenance outages and more forced outages. They may also be run more frequently at suboptimal heat rates (a measure of plant efficiency) and may be stopped and started more frequently.

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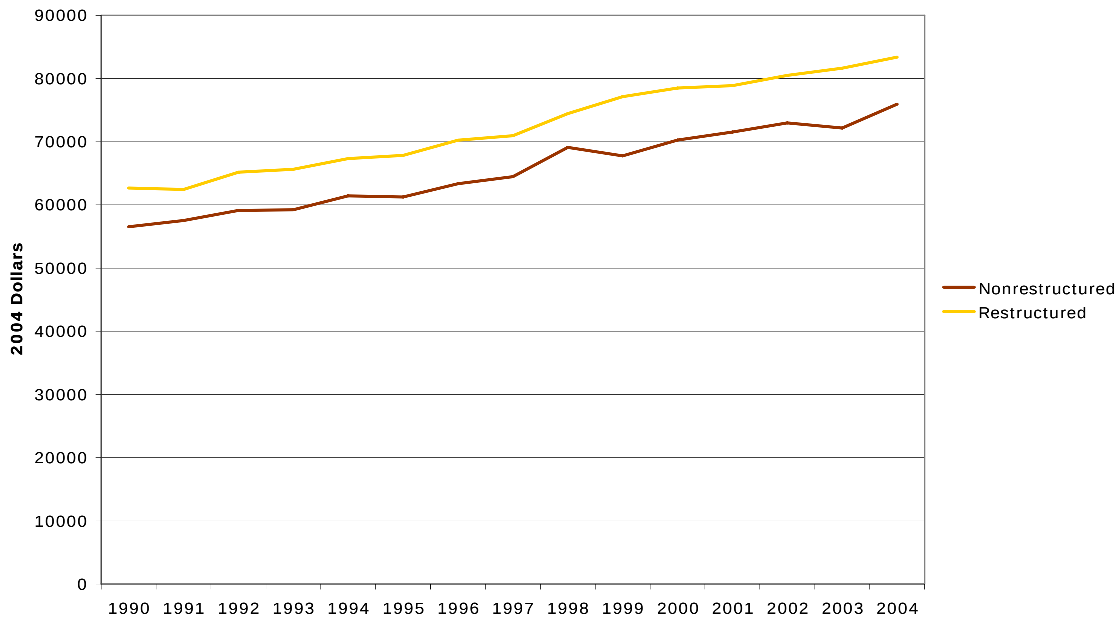
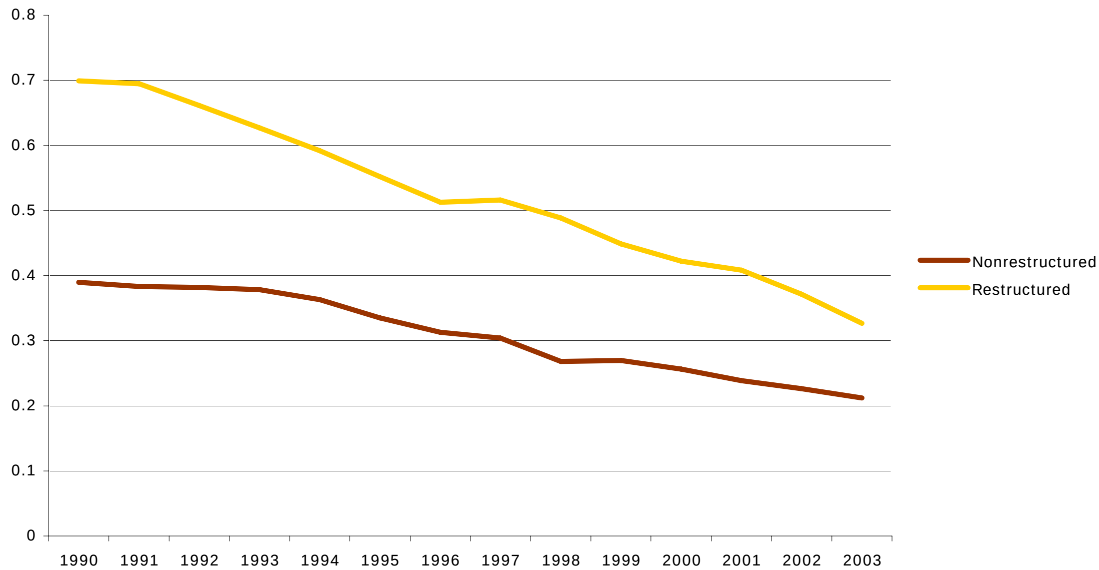
Figure 1. Average Annual Wage, Electricity Generation Industry (Deflated, Balanced Panel of State-Level Data)



Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics (Public Data)

Figure 2. Employees per MW Capacity (Balanced Panel of State-Level Data)



Sources: Quarterly Census of Employment and Wages, Bureau of Labor Statistics;
Electric Power Annual 2003 – Spreadsheets, Energy Information Administration

Table 1. Generation (MWh) and Capacity (MW) of Merchant and Utility Generators, 1990-2003

	Generation (MWh)		Capacity (MW)	
	Merchant	*Utility*	*Merchant*	*Utility*
1990	7.5%	92.5%	5.9%	94.1%
1991	8.0%	92.0%	6.3%	93.7%
1992	9.2%	90.8%	6.8%	93.2%
1993	9.7%	90.3%	7.3%	92.7%
1994	10.3%	89.7%	8.2%	91.8%
1995	10.6%	89.4%	8.3%	91.7%
1996	10.5%	89.5%	8.5%	91.5%
1997	10.5%	89.5%	8.7%	91.3%
1998	11.2%	88.8%	11.6%	88.4%
1999	14.0%	86.0%	19.0%	81.0%
2000	20.6%	79.4%	26.1%	73.9%
2001	29.6%	70.4%	36.0%	64.0%
2002	33.9%	66.1%	39.0%	61.0%
2003	36.6%	63.4%	43.4%	56.6%

Source: EIA State Generation and State Existing Capacity Databases

Table 2: Merchant Capacity (Gas), by State (2002)[1]

STATE	YEAR	Utility (MW)	Merchant (MW)	Pct Merchant
CA	2002	1,772	19,379	92%
IN[1]	2002	1,257	2,281	64%
KY[1]	2002	761	1,774	70%
LA[2]	2002	1,930	5,001	72%
MD	2002	-	338	100%
NJ	2002	-	2,264	100%
TX[3]	2002	11,666	14,386	55%

Source: EIA Capacity Tables (Gas Plants).
[1]States in sample that had divestitures over 500MW.
[2]IN, KY: Divestitures by companies with multi-state territories
[3]LA: Single utility sold 100% of its generation assets
[4]TX: Divestitures resulted from:
1) merger of AEP and CSW
2) transfer of Texas Utilities Electric Co assets to an unregulated subsidiary

Table 3. Summary Statistics

Period Plants	1990-2004 Gas	
	mean	std dev
employ	59.00	274.75
avg_pay	54,568.20	27,906.65
payroll	3,740,725.00	21,900,000.00
plant age	28.10	18.57
capacity (MW)	297.27	436.41
merchant	0.39	
legislation	0.45	
divest	0.05	
legislation		
merchant	0.27	
utility	0.19	
no legislation		
merchant	0.12	
utility	0.42	
observations	2,337	

Source: Bureau of Labor Statistics, confidential microdata

Table 4. Results of Employment Equations

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(employ)		ln(employ)		ln(employ)		ln(employ)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant		plant		state		state	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	-0.020 (0.074)	-2.0%	0.010 (0.036)	1.0%	0.048 (0.128)	4.9%	-0.004 (0.023)	-0.4%
divest	-0.552 ** (0.249)	-42.4%	-0.331 *** (0.126)	-28.2%	0.607 (0.641)	83.5%	1.010 * (0.597)	174.6%
merchant					-1.279 ** (0.622)	-72.2%	-1.062 * (0.605)	-65.4%
1991	0.049 (0.044)	5.0%	0.023 (0.030)	2.4%	-0.207 *** (0.087)	-18.7%	-0.011 (0.033)	-1.1%
1992	0.066 (0.054)	6.8%	0.031 (0.036)	3.2%	-0.154 * (0.082)	-14.3%	-0.005 (0.034)	-0.5%
1993	0.061 (0.061)	6.3%	0.041 (0.045)	4.2%	-0.130 (0.086)	-12.2%	0.003 (0.047)	0.3%
1994	0.045 (0.061)	4.6%	0.028 (0.052)	2.8%	-0.111 (0.088)	-10.5%	-0.029 (0.056)	-2.8%
1995	0.027 (0.066)	2.7%	-0.014 (0.062)	-1.4%	-0.134 (0.108)	-12.6%	-0.077 (0.067)	-7.4%
1996	-0.019 (0.071)	-1.9%	-0.056 (0.065)	-5.5%	-0.211 * (0.120)	-19.1%	-0.133 * (0.075)	-12.5%
1997	-0.040 (0.079)	-3.9%	-0.085 (0.075)	-8.2%	-0.224 * (0.135)	-20.1%	-0.159 * (0.084)	-14.7%
1998	0.010 (0.078)	1.0%	-0.047 (0.074)	-4.6%	-0.142 (0.145)	-13.2%	-0.146 (0.089)	-13.6%
1999	-0.005 (0.083)	-0.5%	-0.065 (0.079)	-6.3%	-0.153 (0.158)	-14.2%	-0.190 * (0.100)	-17.3%
2000	-0.051 (0.084)	-5.0%	-0.106 (0.081)	-10.1%	-0.144 (0.164)	-13.4%	-0.210 * (0.114)	-18.9%
2001	-0.084 (0.089)	-8.1%	-0.160 * (0.088)	-14.8%	-0.091 (0.171)	-8.7%	-0.272 * (0.149)	-23.8%
2002	-0.092 (0.091)	-8.8%	-0.201 ** (0.092)	-18.2%	0.038 (0.186)	3.9%	-0.357 ** (0.172)	-30.0%
2003	-0.044 (0.088)	-4.3%	-0.168 * (0.089)	-15.4%	0.162 (0.187)	17.6%	-0.360 ** (0.175)	-30.2%
2004	-0.024 (0.091)	-2.4%	-0.146 (0.090)	-13.6%	0.088 (0.202)	9.2%	-0.372 ** (0.181)	-31.1%
Constant	0.024 (0.091)		0.146 (0.090)		-580.352 (2400.948)		42.013 (26.287)	
R-Squared	0.90		0.79		0.62		0.38	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level.
Standard Errors in ( ) below coefficient estimates.

Table 5. Results of Employment Equations, Divestiture Time Trends

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(employ)		ln(employ)		ln(employ)		ln(employ)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant, year		plant, year		state, year		state, year	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	-0.001 (0.076)	-0.1%	0.023 (0.044)	2.3%	0.175 (0.136)	19.1%	0.029 (0.025)	3.0%
merchant					-1.580 *** (0.585)	-79.4%	-1.578 *** (0.522)	-79.4%
divest minus 5	-0.094 (0.151)	-9.0%	-0.039 (0.075)	-3.8%	-0.565 *** (0.216)	-43.2%	-0.114 ** (0.056)	-10.8%
divest minus 4	-0.128 (0.167)	-12.0%	-0.042 (0.112)	-4.1%	-0.564 *** (0.208)	-43.1%	-0.154 * (0.079)	-14.2%
divest minus 3	-0.071 (0.262)	-6.8%	-0.066 (0.210)	-6.3%	-0.444 * (0.225)	-35.9%	-0.060 (0.085)	-5.8%
divest minus 2	-0.179 (0.240)	-16.4%	-0.188 (0.193)	-17.1%	-0.628 ** (0.249)	-46.7%	-0.276 ** (0.118)	-24.1%
divest minus 1	-0.091 (0.244)	-8.7%	-0.093 (0.206)	-8.9%	-0.567 ** (0.247)	-43.3%	-0.164 (0.145)	-15.1%
divest	-0.178 (0.294)	-16.3%	-0.189 (0.242)	-17.2%	0.875 (0.616)	139.9%	1.352 ** (0.528)	286.5%
divest plus 1	-0.177 (0.307)	-16.2%	-0.173 (0.258)	-15.8%	0.960 (0.597)	161.1%	1.451 *** (0.520)	326.7%
divest plus 2	-0.764 ** (0.413)	-53.4%	-0.747 ** (0.370)	-52.6%	0.556 (0.622)	74.5%	1.141 ** (0.540)	212.9%
divest plus 3	-1.664 *** (0.574)	-81.1%	-1.509 *** (0.491)	-77.9%	-0.223 (0.783)	-20.0%	0.370 (0.697)	44.8%
divest plus 4	-2.150 *** (0.774)	-88.4%	-2.263 *** (0.669)	-89.6%	-0.076 (0.942)	-7.3%	-0.301 (0.851)	-26.0%
divest plus 5	-0.397 (0.470)	-32.8%	-0.865 (0.602)	-57.9%	1.184 (0.740)	226.7%	-0.193 (0.868)	-17.6%
divest plus 6	0.064 (0.466)	6.6%	-0.460 (0.481)	-36.9%	1.845 *** (0.659)	532.8%	2.157 *** (0.603)	764.2%
Constant	3.180 *** (0.111)		3.216 *** (0.091)		-1010.566 (2306.820)		32.560 (25.688)	
F-Stat, pre-divest	1.58		2.26 **		3.00 **		5.09 ***	
F-Stat, post-divest	4.02 ***		3.38 ***		3.93 ***		4.99 ***	
R-Squared	0.91		0.82		0.64		0.47	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level
Standard Errors in ( ) below coefficient estimates.

Table 6. Results of Payroll per Employee Equations

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(avg_pay)		ln(avg_pay)		ln(avg_pay)		ln(avg_pay)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant		plant		state		state	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	0.012 (0.028)	1.2%	0.011 (0.026)	1.1%	-0.029 (0.036)	-2.9%	-0.023 (0.022)	-2.3%
divest	0.047 (0.054)	4.8%	0.036 (0.052)	3.7%	-0.336 * (0.177)	-28.5%	-0.393 ** (0.163)	-32.5%
merchant					0.408 ** (0.171)	50.4%	0.382 *** (0.145)	46.6%
1991	0.021 (0.024)	2.2%	0.027 (0.020)	2.7%	0.032 (0.031)	3.2%	0.035 ** (0.016)	3.6%
1992	0.079 *** (0.018)	8.2%	0.083 *** (0.018)	8.7%	0.087 *** (0.022)	9.1%	0.067 *** (0.021)	7.0%
1993	0.102 *** (0.025)	10.8%	0.109 *** (0.024)	11.5%	0.106 *** (0.034)	11.1%	0.103 *** (0.027)	10.9%
1994	0.178 *** (0.027)	19.5%	0.184 *** (0.026)	20.2%	0.196 *** (0.034)	21.7%	0.193 *** (0.031)	21.2%
1995	0.189 *** (0.032)	20.8%	0.192 *** (0.030)	21.2%	0.215 *** (0.041)	24.0%	0.207 *** (0.037)	22.9%
1996	0.222 *** (0.035)	24.8%	0.227 *** (0.033)	25.5%	0.242 *** (0.045)	27.4%	0.235 *** (0.043)	26.5%
1997	0.257 *** (0.039)	29.3%	0.264 *** (0.038)	30.2%	0.268 *** (0.055)	30.7%	0.266 *** (0.049)	30.5%
1998	0.330 *** (0.039)	39.1%	0.335 *** (0.037)	39.7%	0.338 *** (0.054)	40.2%	0.343 *** (0.049)	40.9%
1999	0.323 *** (0.040)	38.1%	0.325 *** (0.038)	38.5%	0.345 *** (0.057)	41.2%	0.349 *** (0.051)	41.7%
2000	0.362 *** (0.040)	43.6%	0.364 *** (0.039)	43.9%	0.377 *** (0.058)	45.8%	0.397 *** (0.050)	48.7%
2001	0.396 *** (0.042)	48.6%	0.401 *** (0.041)	49.4%	0.432 *** (0.057)	54.1%	0.462 *** (0.050)	58.7%
2002	0.449 *** (0.046)	56.7%	0.461 *** (0.045)	58.6%	0.457 *** (0.060)	57.9%	0.513 *** (0.054)	67.0%
2003	0.509 *** (0.043)	66.3%	0.516 *** (0.041)	67.6%	0.506 *** (0.065)	65.9%	0.568 *** (0.061)	76.4%
2004	0.555 *** (0.042)	74.3%	0.567 *** (0.041)	76.2%	0.545 *** (0.065)	72.5%	0.598 *** (0.060)	81.8%
Constant	10.520 *** (0.042)		10.509 *** (0.041)		-318.002 (560.102)		23.205 *** (6.647)	
R-Squared	0.80		0.92		0.75		0.99	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level
Standard Errors in ( ) below coefficient estimates.

Table 7. Results of Payroll per Employee Equations, Divestiture Time Trends

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(avg_pay)		ln(avg_pay)		ln(avg_pay)		ln(avg_pay)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant, year		plant, year		state, year		state, year	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	0.004 (0.030)	0.4%	0.004 (0.028)	0.4%	-0.040 (0.037)	-3.9%	-0.025 (0.024)	-2.5%
merchant					0.439 ** (0.175)	55.2%	0.431 *** (0.152)	53.9%
divest minus 5	-0.002 (0.039)	-0.2%	-0.009 (0.034)	-0.9%	-0.004 (0.042)	-0.4%	-0.007 (0.020)	-0.7%
divest minus 4	0.052 (0.044)	5.4%	0.049 (0.043)	5.1%	0.054 (0.044)	5.6%	0.048 (0.031)	4.9%
divest minus 3	0.030 (0.042)	3.0%	0.031 (0.042)	3.2%	0.044 (0.038)	4.5%	0.026 (0.028)	2.6%
divest minus 2	0.075 (0.049)	7.8%	0.074 (0.049)	7.7%	0.075 * 0.041	7.8%	0.038 (0.033)	3.9%
divest minus 1	0.055 (0.051)	5.6%	0.040 (0.054)	4.1%	0.068 (0.047)	7.1%	-0.003 (0.042)	-0.3%
divest	-0.065 (0.110)	-6.3%	-0.062 (0.108)	-6.1%	-0.415 ** (0.171)	-34.0%	-0.495 *** (0.172)	-39.1%
divest plus 1	0.094 (0.065)	9.9%	0.091 (0.066)	9.5%	-0.273 (0.180)	-23.9%	-0.409 ** (0.198)	-33.5%
divest plus 2	0.158 * (0.094)	17.1%	0.163 * (0.092)	17.8%	-0.419 * (0.241)	-34.2%	-0.387 * (0.223)	-32.1%
divest plus 3	0.212 (0.221)	23.7%	0.215 (0.222)	24.0%	-0.135 (0.193)	-12.6%	-0.138 (0.190)	-12.9%
divest plus 4	0.172 (0.110)	18.8%	0.140 (0.124)	15.1%	-0.282 (0.182)	-24.6%	-0.209 (0.186)	-18.9%
divest plus 5	0.052 (0.223)	5.4%	0.047 (0.211)	4.8%	-0.495 *** (0.175)	-39.1%	-0.368 ** (0.180)	-30.8%
divest plus 6	-0.098 (0.091)	-9.3%	-0.076 (0.099)	-7.3%	-0.112 (0.178)	-10.6%	-0.044 (0.185)	-4.3%
Constant	10.059 *** (0.030)		10.050 *** (0.031)		-290.583 (574.355)		23.955 *** (7.187)	
F-Stat, pre-divest	1.90 *		2.35 **		1.29		1.21	
F-Stat, post-divest	5.77 ***		6.09 ***		9.97 ***		9.06 ***	
R-Squared	0.80		0.92		0.75		0.99	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level
Standard Errors in ( ) below coefficient estimates.

Table 8. Results of Payroll per Establishment Equations

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(payroll)		ln(payroll)		ln(payroll)		ln(payroll)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant		plant		state		state	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	0.003 (0.071)	0.3%	0.024 (0.045)	2.4%	0.014 (0.118)	1.4%	0.007 (0.028)	0.7%
divest	-0.389 ** (0.192)	-32.3%	-0.292 ** (0.126)	-25.3%	0.383 (0.611)	46.7%	1.245 *** (0.456)	247.4%
merchant					-0.961 * (0.575)	-61.8%	-1.347 *** (0.466)	-74.0%
1991	0.080 (0.057)	8.3%	0.080 ** (0.038)	8.3%	-0.172 * (0.094)	-15.8%	0.021 (0.027)	2.1%
1992	0.169 *** (0.054)	18.4%	0.157 *** (0.048)	17.0%	-0.078 (0.082)	-7.5%	0.038 (0.042)	3.8%
1993	0.190 *** (0.058)	20.9%	0.196 *** (0.052)	21.6%	-0.027 (0.084)	-2.7%	0.099 ** (0.044)	10.4%
1994	0.274 *** (0.060)	31.5%	0.276 *** (0.056)	31.8%	0.087 (0.080)	9.1%	0.163 *** (0.057)	17.7%
1995	0.269 *** (0.055)	30.9%	0.250 *** (0.057)	28.4%	0.080 (0.094)	8.3%	0.149 *** (0.064)	16.1%
1996	0.241 *** (0.063)	27.3%	0.237 *** (0.063)	26.8%	0.046 (0.108)	4.7%	0.153 ** (0.074)	16.6%
1997	0.244 *** (0.065)	27.7%	0.236 *** (0.065)	26.6%	0.035 (0.121)	3.5%	0.135 (0.088)	14.4%
1998	0.346 *** (0.065)	41.4%	0.321 *** (0.069)	37.8%	0.178 (0.125)	19.5%	0.225 ** (0.098)	25.3%
1999	0.334 *** (0.073)	39.7%	0.307 *** (0.077)	36.0%	0.190 (0.143)	21.0%	0.227 ** (0.110)	25.5%
2000	0.354 *** (0.077)	42.4%	0.335 *** (0.081)	39.8%	0.218 (0.166)	24.4%	0.276 ** (0.122)	31.8%
2001	0.388 *** (0.077)	47.4%	0.372 *** (0.082)	45.1%	0.389 *** (0.148)	47.6%	0.358 *** (0.134)	43.0%
2002	0.395 *** (0.091)	48.5%	0.381 *** (0.096)	46.4%	0.498 *** (0.174)	64.5%	0.365 ** (0.165)	44.0%
2003	0.517 *** (0.075)	67.8%	0.477 *** (0.086)	61.1%	0.656 *** (0.174)	92.8%	0.438 ** (0.172)	55.0%
2004	0.578 *** (0.081)	78.2%	0.549 *** (0.086)	73.2%	0.633 *** (0.191)	88.3%	0.477 *** (0.180)	61.1%
Constant	10.316 *** (0.081)		10.344 *** (0.086)		-1015.416 (2166.293)		42.412 (25.611)	
R-Squared	0.90		0.96		0.71		0.95	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level
Standard Errors in ( ) below coefficient estimates.

Table 9. Results of Payroll per Establishment Equations, Divestiture Time Trends

	(I)		(II)		(III)		(IV)	
Dependent Variable	ln(payroll)		ln(payroll)		ln(payroll)		ln(payroll)	
Correlation Correction	cluster(plant)		prais, cluster(plant)		cluster(plant)		prais, cluster(plant)	
Fixed Effects	plant, year		plant, year		state, year		state, year	
Fuel Type	gas		gas		gas		gas	
Plant Characteristics					yes		yes	
	estimate	% effect	estimate	% effect	estimate	% effect	estimate	% effect
legislation	0.023 (0.076)	2.3%	0.044 (0.052)	4.5%	0.137 (0.127)	14.7%	0.039 (0.034)	3.9%
merchant					-1.218 ** (0.539)	-70.4%	-1.512 *** (0.441)	-78.0%
divest minus 5	-0.129 (0.148)	-12.1%	-0.108 (0.074)	-10.2%	-0.554 *** (0.207)	-42.6%	-0.144 * (0.076)	-13.4%
divest minus 4	-0.109 (0.157)	-10.3%	-0.075 (0.107)	-7.2%	-0.526 ** (0.218)	-40.9%	-0.161 (0.112)	-14.9%
divest minus 3	-0.076 (0.196)	-7.3%	-0.075 (0.151)	-7.3%	-0.457 ** (0.221)	-36.7%	-0.132 (0.103)	-12.3%
divest minus 2	-0.103 (0.212)	-9.8%	-0.128 (0.169)	-12.0%	-0.462 ** (0.225)	-37.0%	-0.200 (0.128)	-18.1%
divest minus 1	-0.188 (0.220)	-17.1%	-0.236 (0.182)	-21.0%	-0.576 ** (0.245)	-43.8%	-0.298 * (0.164)	-25.8%
divest	-0.364 (0.257)	-30.5%	-0.373 * (0.216)	-31.1%	0.444 (0.605)	55.9%	1.108 ** (0.455)	202.9%
divest plus 1	-0.189 (0.266)	-17.2%	-0.199 (0.232)	-18.0%	0.639 (0.568)	89.4%	1.287 *** (0.463)	262.2%
divest plus 2	-0.357 (0.290)	-30.0%	-0.331 (0.256)	-28.2%	0.218 (0.664)	24.4%	1.260 *** (0.478)	252.4%
divest plus 3	-1.047 ** (0.520)	-64.9%	-0.957 ** (0.481)	-61.6%	0.261 (0.613)	29.8%	1.235 *** (0.470)	243.9%
divest plus 4	-1.648 ** (0.667)	-80.8%	-1.688 *** (0.628)	-81.5%	-0.143 (0.852)	-13.3%	0.637 (0.701)	89.1%
divest plus 5	-0.311 (0.296)	-26.7%	-0.658 (0.413)	-48.2%	0.743 (0.726)	110.3%	0.647 (0.704)	91.0%
divest plus 6	-0.012 (0.483)	-1.2%	-0.278 0.457	-24.2%	1.807 *** (0.660)	509.4%	2.702 *** (0.587)	1390.5%
Constant	13.189 *** (0.110)		13.168 *** (0.102)		-1452.052 (2060.577)		42.403 (26.811)	
F-Stat, pre-divest	1.16		2.94 **		2.12 *		1.70	
F-Stat, post-divest	7.81 ***		2.43 **		6.88 ***		3.75 ***	
R-Squared	0.91		0.96		0.72		0.95	
Observations	2,337		2,337		1,084		1,084	

Significant at 10% (*), 5%(**), 1%(***) level
Standard Errors in ( ) below coefficient estimates.