DO MERGERS IMPROVE EFFICIENCY? EVIDENCE FROM RESTRUCTURING THE U.S. ELECTRIC POWER SECTOR

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Abstract

This paper analyses the performance impact of the merger wave which took place in the US electricity industry during the period 1994-2003. It does so by analyzing the impact on operating and total cost in electricity distribution. While there are past studies of efficiency and productivity effects, as well as of prices, profits, and other outcomes, this study differs in several ways. First, the database consists of many merging and non-merging firms, rather than only a few on which to base inferences. Second, all of these mergers arise in a single industry, greatly facilitating controlled comparison. Third, we have data on the several years of pre-merger and post-merger efficiency of the specific merging units, unlike virtually all past studies. And finally, we employ a powerful nonparametric technique - data envelopment analysis - to measure the efficiency of each operating unit. The results indicate that electricity mergers are not consistent with improved cost performance.

Keywords: mergers, efficiency analysis, electricity distribution, data envelopment analysis

JEL Classification: L25, L43, L94

I. INTRODUCTION

Firm entry, exit, growth, and mergers are all signs of a vibrant market economy, but unlike the first three, mergers have long been deeply controversial. Both their motives and their effects remain in dispute. Advocates allude to the "market for corporate control," which views mergers and acquisitions as methods for efficiency-enhancing transfers of underperforming assets to firms that can utilize those assets better and thereby realize the value gain. Skeptics note that while many mergers may be benign or beneficial, others are motivated by market power, hubris, or simple mistakes, all of which result in societal costs. Evidence exists supporting each view. Stock market event studies routinely find shareholder gains from merger, at least in the short term, seemingly corroborating the efficient-merger hypothesis. Studies of actual operating effects, on the other hand, more often tend to show that gains from merger are the exception rather than the rule.

The present study addresses one central question about mergers—their efficiency effects—and does so in a manner that circumvents limitations of past studies. The distinctive features of this study are four. First, the database consists of many merging and non-merging firms, rather than only a few on which to base inferences. Second, all of these mergers arise in a single industry, greatly facilitating controlled comparison. Third, we have data on the several years of pre-merger and post-merger efficiency of the specific merging units, unlike virtually all past studies. And finally, we employ a powerful nonparametric technique–data envelopment analysis–to measure the efficiency of each operating unit.

This study focuses on the U.S. electricity industry and the large number of mergers that it has recently experienced. Beginning in the early 1990s a variety of federal and state restructuring

initiatives spawned a wave of mergers, particularly at the distribution stage. More than 75 mergers were consummated between 1994 and 2002, involving half of the electricity customers of all investor-owned electricity operating companies. Crucially for our purposes, reporting requirements imposed by the Federal Energy Regulatory Commission on all operating companies were unchanged by merger, creating a consistent set of data on costs and operations for the same units before and after the transaction. It is these data that are exploited in the present study.

From the entire set of merger experiences, we compile a panel of 73 operating companies over the 1994-2003 period. Data envelopment analysis is used to score each unit's production efficiency against best practice in each year. Production efficiency is measured in two different ways−as operating (variable) costs and also as total controllable costs, the latter including a measure of controllable capital expenditures.[1] Each measure results in 730 observations on relative efficiency. These scores are then related to the unit's merger experience−as a buyer, as a seller, or as a non-merging unit−and to the number of years before or after the merger. In this fashion it is possible to identify a progression of post-merger effects and also any trend in pre-merger performance.

We test the propositions that mergers are initiated by firms with superior efficiency and result in efficiency gains to one or both parties to the transaction. The evidence shows quite clearly the contrary. In the years prior to merger, acquiring companies are not superior performers in terms of operating costs, but rather are at best similar to non-merging firms. In fact, it is target firms−the sellers--that achieve higher efficiency than either acquiring companies or non-merging firms. After merger, however, sellers' measured efficiency moves toward the norm. In terms of total controllable costs, much the same pattern emerges, with buyers of rather

ordinary efficiency acquiring superior performing target firms. These results suggest that, in a rather remarkable inversion of the efficient-merger hypothesis, it is poor-performing companies that apparently search out and acquire better performers and that selling firms' efficiency declines rather than improves after merger.

We comment on some possible explanations for this result, as well as its implications, at the end of the paper. The remainder of the paper proceeds as follows: The next section sets out the foundation for this study in the literature on mergers and efficiency and in the recent history of the electricity industry. Section III outlines the framework and data used in the analysis. Section IV provides details on data envelopment analysis and the regression analysis of the resulting scores. Results are reported in Section V, and Section VI concludes.

II. MERGERS, EFFICIENCY, AND ELECTRICITY

1. Research on Mergers and Efficiency

The literature on the effects of mergers in general is vast and will not be reviewed here. Good summaries of empirical work and its varied findings can be found in a number of sources. For example, Andrade et al summarize and endorse the conclusions of event studies, which in their words find 'that mergers create value for stockholders of the combined firms, with the majority of gains accruing to the stockholders of the target' (Andrade et al, 2001, p. 116-117). In the industry of interest here–the electricity sector--there is event-study support for this favorable conclusion. Ray and Thompson (1990) examine four 1980s electricity mergers in detail and conclude that target firm shareholders benefit modestly, although regulation appears to transfer most of the gains to consumers. Leggio and Lien's (2000) study of share prices for 76 electric

mergers in 1983-96 finds qualitatively similar effects. Berry (2000) examines 21 electric-electric and electric-gas mergers in 1995-98 and reports benefits to target firm shareholders in both types of mergers, but none to acquiring firms.

By contrast, Scherer and Ross (1990) critique event study methodology and summarize evidence on the actual longer-term profit and productivity effects of mergers. From various studies, they conclude that mergers result in "widespread failure, considerable mediocrity, and occasional successes."[2] More recently, the Gugler et al study of the profit and sales consequences of mergers concludes that "a majority of the mergers taking place around the world over the last 15 years appear to be welfare reducing" (Gugler et al, p. 651), a finding that echoes earlier work by by Meeks (1977), Hughes (1989), and Hartmann (1996a).

Event studies and profit studies dominate the general literature on the effects of mergers, particularly for multi-industry studies. By contrast, a single industry focus permits analysis of productivity due to the better availability of necessary data at the industry level. Productivity studies of mergers come to more mixed conclusions. McGuckin and Nguyen (1995), for example, examine mergers in some 28,000 food plants and conclude that ownership changes are more frequent for plants with high labor productivity but also that ownership change improves productivity further. Peristani (1997) examines 2000 U.S. bank mergers for both scale efficiency and X efficiency (that is, cost efficiency). He finds that acquirers improved their scale efficiency but not their cost efficiency after merger.

In a study with methodological relevance to this inquiry, Cummins et al (1998) examine the efficiency performance of about 550 life-insurance firms in a five-year time period around the year of their merger. It uses the same measure of efficiency as in this study−data envelopment

analysis--as well as a similar method of allowing for time-dependent merger effects. Specifically, it takes the differences in the efficiency scores for all firms for two years before and two years after a merger, and explains those differences in a regression on firm characteristics. The results indicate significant improvement in target firm efficiency scores between those two points in time, but no significant difference between scores for acquiring firms and others not involved in any merger during this period.

There are few studies of the actual performance effects of mergers in electric power. Notable among these is the Hattori et al (2005) study of UK and Japanese electricity distribution companies that finds evidence of improved productivity growth in UK firms in the 1994-98 period following mergers and tougher regulation. Also of some relevance are studies by Domah and Pollitt (2001) of privatization of the electricity sector in the UK and by Markiewicz et al (2004) on divestiture and generation costs. Both find efficiency gains from ownership change.[3]

The present study draws on the above literature in several ways. It utilizes data envelopment analysis. It compares efficiency scores in the years before and after merger and compares both to non-merging firms. It examines the DEA scores for several years before and after a merger and tracks their efficiency over time.

2. The U.S. Electricity Industry

The U.S. electricity industry provides an exceptional opportunity to examine the efficiency effects of mergers. During the 1990s a variety of state and federal initiatives triggered a vast restructuring of the industry. The Energy Policy Act of 1992 signaled the federal interest in wider markets and was followed by FERC actions to require open access, more rational transmission pricing, and regional transmission planning. In 1996 FERC announced new merger

guidelines modeled after those employed by the Antitrust Division of the Department of Justice and the Federal Trade Commission. These were widely seen as limiting the role of some non-economic issues that had played a role in prior merger reviews. And various state actions such as vertical divestiture and performance-based pricing all seemed to herald freer markets with more opportunities for asset realignment.[4]

In most states traditional vertically integrated utilities were pressured to divest upstream assets and focus on distribution. The intent was to create a freestanding generation sector, comprised of divested assets together with new entrants, all in principle competing for downstream buyers. Transmission continued to be owned by the distribution companies, but operating control of transmission was increasingly governed by FERC rules and later handed over to Independent Service Operators and Regional Transmission Organizations.

Distribution companies operated much as they always had, except now they could more easily merge with or acquire other companies. Since they were franchised in specific geographical areas, mergers generally took the form of adding operating subsidiaries to an existing holding company. As shown in Table 1, these mergers were few in number during the mid-1990s but grew rapidly thereafter, peaking at twenty-three in 2000. Their total value (including gas assets) during this period exceeded $300 billion dollars, affecting more than half of all power sold and customers supplied in the country.

The nature of these mergers is readily illustrated by example. In 1999 Boston Edison, the major utility serving Boston completed a merger with Commonwealth Energy System which served customers in neighboring Cambridge (through its subsidiary Cambridge Electric) and in southern Massachusetts. The new entity, named NStar, focused on electricity distribution and

retailing. While part of a single corporate entity, its operating divisions continued to serve different territories, maintained separate identities, and submitted separate and unchanged reports to FERC and Massachusetts. Notably, in its filings with the state Department of Telecommunications and Energy, NStar promised that the merger would achieve cost reductions of around $660 million over 10 years (DTE, 1999, p.37), which would represent a 13.7 percent reduction in operating expenses.

The NStar merger was typical of those undertaken during this period. The separate reporting required of it and all operating companies permits construction of a detailed and consistent database on costs and operations for numerous distribution utilities during this period. This in turn affords a unique opportunity to track the effects of mergers on operating efficiency. Other reasons for examining distribution include the fact that it represents about 35 percent of value added in the industry, so it remains an important part of the business, and also the fact that by comparison to transmission and generation, the distribution function has undergone less substantial change, thereby permitting better comparison over time.

III. CONCEPTUAL FRAMEWORK AND DATA

1. Framework.

We are interested in examining five closely related questions concerning mergers in electric power distribution:

-Does the acquiring firm exhibit ex ante superior efficiency?

-Does the acquired firm exhibit ex ante poor performance?

-Does merger improve the operating efficiency of the target firm?

-How does merger affect the efficiency of the acquiring firm?

-What is the time path over which any such effects emerge?

To answer these questions, we measure the operating efficiency of each distribution utility over a period of time that brackets any merger or acquisition. The efficient-merger hypothesis implies that the target firm's pre-merger efficiency should be below the norm established by non-merging firms (and certainly below the acquiring firm's efficiency level), but that post-merger, the target firm should show improved efficiency. The buying firm should have pre-merger efficiency above the norm, as it seeks to exploit its superiority through merger or acquisition involving a relatively poor performing firm.

To capture these effects, we denote the measured efficiency of each operating unit that merges in some year t_0 by pre-merger years t-i and post-merger years t+i. Rather than simply comparing the values at some identical number of years before and after (e.g., t-2 vs. t+2, as done in Cummins et al), or comparing the average value for some number of years before and after merger, we examine all years' measured efficiency scores. That allows the data themselves to reveal the full nature and timing of any effects. That said, we do not necessarily expect much change at all in the year immediately following a merger, as the process of integration and improvement would scarcely have begun. Moreover, data in the immediate year before and perhaps after merger might be affected by firms' efforts to portray themselves in particularly favorable ways in order to induce merger or indicate its apparent success. For these reasons we expect clearer indications of actual effects in somewhat longer time spans.[5]

Buyers are distinguished from sellers, of course, and non-merging firms are also included in the sample. The latter permit investigation not only of whether target firms' efficiency is

below that of buyers before merger, but also whether it is below the benchmark set by non-merging firms for that year. If buyers are acquiring firms with lower efficiency than their own, but both are above the norm, then some reinterpretation of the results might be required.

2. Data

The basic data required for this study consist of outputs, inputs, and control variables for electric power distribution companies in the U.S. between 1994 and 2003. The initial data set consisted of 305 major investor owned utilities, including subsidiaries, compiled from Platts Data Disks and Form 1 filings, but three considerations reduce the number of observations in the final sample. First, a number of the utilities on the list are essentially generators and not appropriately part of this sample. Second, non-responses and unresolvable inconsistencies in the data result in the loss of many observations. Finally, in order to draw appropriate comparisons across years, we employ a balanced panel. The net effect of these factors is to reduce the number of utilities in our final data base to 73. It is nonetheless true that our sample covers approximately 57 percent of total customers and 51 percent of the total units distributed for year 2000−a fraction that holds fairly constant for all years in our sample period.

To perform the analysis, we need data on each operating utility's operations, costs, and other characteristics. Operations and financial data are extracted from Platts Data Disks, which are compiled from FERC Form 1 filings, and directly from Form 1 filings.[6] The remainder of the input and output data comes from Electrical World Directory of Electric Utilities.[7] Information on the identity of buyers and sellers and on merger timing is taken from the Edison Electric Institute website.[8]

One noteworthy data issue arises in states that have instituted retail competition. In such

cases, at least some consumers purchase energy from a supplier other than the local distribution utility, although the latter continues to provide distribution services to all consumers in its service territory. Distribution utilities thereafter began to report customer numbers and sales data only for their full-service customers, whereas costs included both full-service and distribution-only customers. Data from FERC and various state utility commissions on the omitted customers and sales were matched to each affected utility and year in the database and then added to the reported Form 1 data in order to ensure consistency over time.

Most definitions are straightforward, and so here we note only the following. Total operating expense is the sum of operation and maintenance (O&M) costs in distribution, plus customer support costs and administrative costs attributable to distribution. Customer support costs consist of customer accounts expense, customer service expense, and sales expense. Administrative costs attributable to distribution are a pro rata portion of total administrative costs, the share being the ratio of wages in distribution O&M and customer support to total wages in operations and maintenance for all activities. The result is total operating expense OPEX.

We would expect short-run operating efficiencies to manifest themselves in lower OPEX, cet. par. In the longer term other efficiencies may also arise through conservation of expenditure on capital investment. One method of measuring this latter effect would be to define a total expenditure variable that includes the imputed cost of invested capital, but this measure suffers from various limitations: It is very sensitive to assumptions about capital value and rate of return. In addition, the resulting imputed capital costs are often quite large relative to OPEX and so these assumption-driven imputations can dominate a total expenditure variable. Finally and

perhaps most importantly, because capital in this industry is so long-lived, it is not readily controlled by the utility, except in the very long run.

This last observation suggests an alternative measure of the effect of mergers on firm cost efficiency, namely, the sum of OPEX plus the current capital expenditure by the firm. The latter is an indisputably controllable expenditure, as well as obviously capital-related. It therefore does capture what the newly merged firm intends with respect to capital expenditures. This measure - total controllable expenditure TCEX - does, however, have one significant limitation: The decision about current capital expenditure may be subject to influences other than efficiency, and in addition for that or other reasons may be quite variable. Despite this caveat, we shall utilize TCEX, as well as OPEX, in the analysis below.[9]

IV. METHODS OF DATA ANALYSIS

1. Data Envelopment Analysis

This study uses data envelopment analysis (DEA) in its determination of each operating companies' efficiency. DEA is a non-parametric technique that uses observed inputs and outputs of decision-making units (firms) in the sample to construct a best practice frontier.[10] Each firm is then compared to a linear combination of best practice firms which can produce at least as much of each output as the less efficient firm but with the minimum amounts of inputs. Technical efficiency measures the degree to which each firm achieves that best practice, with frontier firms receiving a score of 1 and less efficient firms correspondingly lesser scores.[11] Thus, in Figure 1 the frontier is defined by actual operating utilities at points A, B, and C on isoquant Y. The firm at point R utilizes more of inputs x_1 and x_2 than best practice firms along the frontier. Firm R's

excess input utilization is measure by the distance DR/OR, where the point D is a linear combination of actual utilities at A and B. R's technical efficiency score is OD/OR, well short of the maximum value of 1 that would obtain for a frontier firm.

More formally, the linear program calculating the efficiency score of the i-th firm in a sample of N firms takes the following form:

$$\begin{aligned} &\text{Min}_{\theta,\lambda}\ \theta \text{ s.t.} \\ &\quad -y_i + Y\lambda \geq 0 \\ &\quad \theta x_{i,D} - X_D\lambda \geq 0 \\ &\quad X_{i,ND} - X_{ND}\lambda \geq 0 \end{aligned} \qquad (1)$$

Here θ is a scalar (equal to the efficiency score) and $\lambda \geq 0$ represents an Nx1 vector of constants. Assuming that the firms use K inputs and M outputs, X and Y represent KxN input and MxN output matrices respectively. The input and output column vectors for the i-th firm are represented by x_i and y_i, respectively. Non-discretionary or control variables can be introduced through additional constraints, as shown in the second and the third constraints in (1), where the subscripts D and ND refer to discretionary and non-discretionary variables, respectively. When non-discretionary variables are specified in this way, the DEA methodology ensures that the scores of inefficient firms are only calculated on the basis of reductions in their discretionary inputs, while controlling for non-discretionary variables for which reductions are not feasible.[12]

Relative to stochastic methods, DEA has several advantages. Important among them is the fact that it does not require specification of a functional form for the underlying technology. In addition, DEA does not require input prices, but instead physical inputs and outputs are used to evaluate input utilization..[13] On the other hand, efficiency scores can be sensitive to the choice

of input and output variables and also to the numbers of variables in the model and observations overall (Zhang and Bartels, 1998). Still, studies that have performed stochastic frontier analysis and DEA on the same data have generally found very similar results with respect to relative efficiency of individual units (Jamasb and Pollitt, 2001).

The DEA models used in this study have three outputs--total sales, number of customers, and network length. These are all cost-causative factors and have previously been used in analyses of distribution companies' operations (Jamasb and Pollitt). More numerous customers impose billing and service costs, while network length measures dispersion of output. As measures of input usage, we use OPEX in one set of analyses, and TCEX in the other. Financial measures of input usage are justifiable insofar as input tradeoffs are weak, as they clearly are in electricity distribution, and of course assuming financial costs are deflated appropriately such that they represent comparable amounts of real resources. Many studies of efficiency (such as Jamasb and Pollitt, 2003) have made use of such input measures.

These DEA models have been successfully run using the EMS program developed by Scheel (Sheel, 2000). We do not report all 730 individual DEA scores here, since it is not the raw score but rather their relationship to the merger experience of the utilities that is of interest.

2. Regression model and estimation issues

Having estimated these efficiency scores, we next undertake a regression analysis to determine the impact, if any, of mergers involving utilities in the data set at some point during the study period. We note first that the data comprise a balanced panel of DEA scores for 73 utilities over the 1994-2003 period. Moreover, in each year a few utilities have maximum DEA scores of 1. While this might suggest use of tobit analysis (as in Pollitt (1995)), the assumptions

of tobit–namely, that realizations in excess of the bound(s) are possible but not observed–do not apply, since no DEA scores in excess of 1 are logically possible.[14] Either generalized least squares and logit techniques might therefore be appropriate, but the nonlinearity of the logit model produces distinctly inferior overall fits. Consequently, we employ GLS, with random effects. Random effects are suggested by the fact that the 73 utilities are a subset with unknown properties of all utilities. Results of the Hausman test indicate the statistical equivalence of estimation using fixed effects, and indeed coefficient values scarcely change.

The regression model is specified with a focus on the efficiency outcomes for the buying and selling utilities at times before and after merger. For all such units, DEA scores are indexed according to that year's relationship to merger. There are as many as eight years prior to merger, denoted t-8, t-7, ...t-1, and as many as six years after merger, denoted t+1, t+2,...t+6. The year of a merger t_0 is omitted and becomes the convenient basis for comparing the estimated coefficients on the merger timing dummies–those before the merger which help identify characteristics of buyers and sellers, and those after which capture the effects of the merger. Non-merging utilities simply have zero values for all merger-timing dummy variables, but their scores are distinguished by calendar year.[15]

In addition to efficiency effects over time, we are also interested in two other questions concerning the merger experiences of these utilities. First, some efficiencies arise from physical proximity of the merging units, and so we would expect greater efficiency gains if the service territories of the utilities are adjacent. *ADJACENT* is a dummy variable that takes on a value of one for the 29 utilities in the data base (out of the 32 merging units) that are adjacent to their merger partners.

Second, eight of the merging utilities were involved in a second merger during the study period. Whatever their first-merger efficiency experience, it seems possible that a second merger might confer some learning economies and hence permit greater efficiency gains. Accordingly, *TWOMERGERS* is a dummy variable taking on a value of one for those years subsequent to a second merger for a given utility during this period.

We also include calendar year dummies (which will not be reported, since they are of little intrinsic interest) plus three other control variables that might affect the DEA score, as follows:

(1) *OUTPUT*, which denotes total MWH of distribution output to control for the scale of operation and its possible effect on DEA scores.

(1) *RESPCT,* the percent that residential sales represents of total sales. Relative to commercial and industrial sales, residential sales are more costly and likely to reduce efficiency due to the greater need for service and support, as well as added infrastructure costs.

(3) *GENPCT*, the percent of distribution output that the utility generates itself. This allows for possible efficiencies from vertical integration, as some have previously found.[16]

We now turn to the results of the estimation of this model.

V. REGRESSION RESULTS ON DEA SCORES

1. Preliminary Data Examination

Table 2 contains a preliminary examination of DEA score data for buyers' and sellers' operating expenses, without any of the controls noted above. Of the 73 utilities in the data base, twelve are buyers, 20 sellers, and the remaining 41 were not involved in a merger during the

1994-2003 study period.[17] The entries are score differences from the merger year, and while collinearity undermines statistical significance, some conclusions seem nonetheless clear. Buyers' DEA scores, shown in column (a), are not above the norm except for three years so far in advance of merger (t-8, t-7, and t-6) that they are unlikely to bear any relationship to the merger itself. For four of the five years immediately prior to merger, buyers' scores are actually below the norm, though not generally significantly so. Still, the contrast with the received hypothesis seems clear: Buyers do not appear to be high efficiency performers.

Seller score differences are reported in column (b) of Table 2. For all years prior to merger, sellers' efficiency scores are actually above the norm, in several years significantly so. For the likely most relevant years t-5,...t-2, the scores range from five to nine points higher. Equally notable is the fact that their post-merger scores revert to the norm. Of the four most likely relevant years t+2,...t+5, the first two imply a one point gain but those coefficients are completely insignificant, while the next two are increasingly negative, with that on t+5 carrying a t-value of 2.40. Thus, in contrast to the received hypothesis, sellers do not appear to be poor performers prior to merger, but rather to be significantly above the norm. Moreover, rather than benefitting from merger, they actually appear to suffer subsequent efficiency declines.

2. Regression Results on Operating Expenses

To test these preliminary observations more carefully, we employ the regression model described above, with controls for *ADJACENT*, *TWOMERGERS*, *OUTPUT*, *GENPCT*, *RESPCT*, and calendar year dummies. We begin with a data set consisting of all buyers and sellers, i.e, not including non-merging firms. We introduce two sets of merger timing dummies. The simple dummies t-8, ... t-1, t+1, ...t+6 capture buyers' pre- and post-merger efficiencies, whereas

versions of those dummies interacted with a dummy variable for sellers measure any difference in sellers' DEA scores along the same time line.

The results of this GLS regression are reported in column (a) of Table 3. We briefly note that the three pure control variables behave largely as expected. DEA scores are higher for larger utilities, for those which generate more of their own power, and for those with smaller percentages of residential sales. These results suggest positive economies from scale, vertical integration, and industrial sales−all propositions generally accepted in the literature. Since these effects emerge quite consistently in all regressions, we will not comment further upon them.

Our primary interest lies with the efficiency effects measured by merger timing dummies for buyers and, separately, for sellers. As shown in column (a) of Table 3, in all eight pre-merger years, buyers' efficiency scores are below the norm set by t_0 rather than above it. In the likely most relevant years t-5,...t-2, buyers' efficiency scores are seven to thirteen points lower, with t-values no less than 1.30 despite collinearity. In the post-merger period buyers' low scores are substantially reversed, with positive score differentials for the first four years. In the likely most relevant years t+2, ...t+5, the estimated differences range up to five points, although the coefficients are not statistically significant. We therefore conclude that buyers generally have low efficiency scores before merging, but those scores may actually improve to the norm in the years after merger.

Except for a near-zero value in t-1, seller DEA scores prior to merger are all above the norm. In the most relevant period t-5,...t-2, their scores are between six and 11 points higher, with three of the four values statistically significant at 10 percent or better. In the post-merger years, all values become negative, starting at 1.5 points lower in year t+2, increasing in absolute

value and becoming statistically more significant out through year t+5. It seems clear that sellers are indeed the more efficient producers, and are acquired by underperforming buyers. The result of acquisition is a decline in seller efficiency, perhaps partially offset by some improvement in buyer performance.

Before pursuing these results further, we should comment on two merger-related control variables included in these regressions. *ADJACENT* denotes those merging distribution companies whose service territories are geographically contiguous. The expectation is that adjacency permits the realization of efficiencies that might not be feasible for merging partners that do not share a border. The estimated effect of adjacency is negative in these results, but well short of statistical significance. We conclude that adjacency is essentially irrelevant to operating efficiency.

The other variable of interest, *TWOMERGER*, identifies those years after any particular utility is involved in its second merger. We have hypothesized that the efficiency effects of merger may be enhanced to the degree that a company learns from experience, whether favorable or disappointing. In column (a) the effect of *TWOMERGER* is both large (9 points) and statistically significant (t = 3.32). While the effect diminishes in both value and significance in all other regressions, there is a clear and persistent indication that prior merger experience is associated with more favorable efficiency outcomes.

The analysis thus far has focused on the head-to-head comparison of buyers and sellers. To more fully calibrate efficiency scores and score differences, we now compare buyers (and separately, sellers) to non-merging utilities during the study period. This comparison also serves to investigate the possibility that buyers and sellers might both have efficiency scores above (or

alternatively, below) those of non-merging firms, in which case the direct comparison between just buyers and sellers might require some re-interpretation. Column (b) of Table 3 reports the results of the same regression model on the set of all buyers plus non-merging firms, that is, excluding sellers. The merger timing dummies now test how buyers' DEA scores differ from those of utilities in the same year that were not involved in any mergers during the ten-year study period.

Buyers have higher DEA scores in years well before their merger, namely, years t-8, t-7, t-6, and t-5. Those scores decline steadily in magnitude and statistical significance, becoming essentially zero in year t-4 and for remaining pre-merger years. Buyers appear to be much like non-merging firms in their pre-merger efficiency scores. The same is true post-merger, with DEA score differentials in years t+2,...t+5 ranging from -3.2 to +2.0, but none approaching statistical significance. It seems clear that buyers strongly resemble non-merging firms both before and after their merger experience.

Since buyers are like non-merging firms but sellers achieve superior efficiency prior to merger, it should follow that sellers are more efficient than non-merging utilities. This inference is confirmed in Column (c) which examines a data set combining sellers and non-merging firms. Seller efficiency scores are significantly higher than for non-merging firms in all pre-merger years (again except for t-1). The differential in the most relevant time period is five to nearly 10 points, with t-statistics no less than 2.10. Quite clearly, sellers represent superior performers prior to acquisition. Also as before, seller efficiency in years t+2, ...t+5 declines to the norm of non-merging firms or even below it. The differential is positive but insignificant in the first two of those years, then negative and insignificant, and finally in year t+5 negative and

unambiguously significant (t = 2.76). In short, there is clear indication that sellers' post-merger efficiency declines not only relative to buyers, but also relative to the benchmark of non-merging firms.

The regression in column (d) provides further confirmation of these estimated effects. This model is an augmented version of the previous ones but now including all utilities, that is, buyers, sellers, and non-merging firms. For this specification, all merger timing dummies are interacted both with buyers and separately with sellers, so that both groups can be distinguished from non-merging utilities. The results indicate that buyers' efficiency is virtually identical to that of non-merging firms both before and after merger. Nothing here or in previous results suggests that buyers are superior performers. Rather, it is sellers that demonstrate superior pre-merger efficiency, with scores from six to eleven percent above non-merging firms, a differential that is statistically significant in all relevant years. After merger, however, sellers find themselves worse off. Their previously superior efficiency scores decline systematically, contrary to the hypothesis that mergers involve the takeover and improvement of poor performing units.

The results from this last model are illustrated in Figure 2. This shows the time line of differences in efficiency scores for buyers and separately for sellers relative to non-merging firms, over the most relevant period t-5,...t+5. Buyers' efficiency lies very close to the norm in pre-merger years, with some suggestion of a continuous decline. More importantly and starkly, seller efficiency begins well above that of non-merging firms in all years prior to merger except for t-1. In the five years after merger, seller efficiency declines continuously. This evidence, too, is contrary to the effect hypothesized by the theory of efficient mergers.[18]

3. Extension to Year Groups

As noted, there is considerable collinearity in the merger timing dummies, a fact that likely obscures the statistical significance of some results. To help clarify this issue, we replace some of the individual merger timing dummies with newly defined dummy variables for relevant groups of years prior to and post merger. This avoids proliferating dummy variables and instead tests for the persistent effect during certain years. We define the variable *PRE* as unity for years t-5,...t-2, zero otherwise, and similarly, *POST* for the corresponding post-merger years. The choice of these four years is based on earlier discussion of the likely timing of merger outcomes together with evidence already developed. Both of these new variables are interacted with buyer or seller dummies, as appropriate

We rerun all the regressions in Table 3 but with *PRE* and *POST* in place of the separate merger timing dummies for each year. Table 4 reports the estimated coefficients and t-values on those year-group variables only. All the other variables are still included in the regression model, but are not shown here since they are of lesser interest and in any case their results closely resemble those previously found. Column (a) tests DEA score differences for buyers vs. sellers in their respective second-through-fifth years before and after merger. As is evident, prior to merger, buyers' efficiency scores are nearly ten points below the norm, and significantly so, whereas their post-merger scores increase sharply to seven points above. The results for sellers are very nearly the opposite. Sellers represent good performers prior to merger, with scores a significant eight points higher, but after they are acquired, their scores sink below the norm, though not significantly so. We again conclude that mergers are not the cause of any performance improvement for sellers, but they may well benefit buying firms.

Column (b) reproduces the previous regression comparing buyers to non-merging firms. The estimated coefficients indicate that the two groups of utilities have indistinguishable efficiency levels in the years before and also after merger. Buyers are simply not superior performers. Column (c) confirms again that it is selling firms that display superior performance prior to merger. Their efficiency scores are approximately six points above those of non-merging firms before acquisition, but those scores decline to the level of non-merging firms in the relevant post-merger years.

The last of these regressions examines the efficiency of all utilities in the data base, with year-group variables defined so as to distinguish buyers and sellers from each other and also from non-merging firms. As reported in Column (d) of Table 4, buyers are again found to perform essentially the same as non-merging firms, both before and after merger. The estimated coefficients on sellers' pre-merger efficiency again confirm their superior performance, while their post-merger scores again show the adverse effect that merger has on their efficiency performance. These results confirm what has been previously found, namely, that mergers do not improve target firm performance.

4. Regression Results on Total Controllable Costs

All of the regression analysis to this point has focused on operating costs. We are also interested in the effects of merger on a more comprehensive measure of costs, which for reasons previously noted, we take to be total controllable costs. Controllable costs are defined as total operating expenses plus current capital expenditures. To test for the effects of merger on TCEX, we redo most of the analysis just described with respect to OPEX. Specifically, we calculate total controllable costs for all 730 data points, recalculate DEA scores for the entire panel based

on such costs, construct an entirely new data set consisting of those scores, augment that data set with all merger-related and other control variables, and rerun all previous regressions.

Table 5 reports the results of those regressions. As before, Column (a) represents a comparison of buyers vs. sellers, Column (b) buyers vs. non-merging firms, Column (c) sellers vs. non-merging firms, and Column (d) buyers and sellers vs. non-merging firms. Most results are similar but statistically somewhat weaker than for the analogous regressions on total operating costs. For example, Column (a) indicates that buyer efficiency in pre-merger years lies below the norm, often by a substantial margin, but improves in subsequent years. For sellers, pre-merger performance is above the norm, but the score differences are no longer strongly significant. Notably, there is some indication of increased efficiency scores in the years immediately after merger, although the familiar reversion to the efficiency norm for sellers sets in thereafter.

Column (b) largely confirms that buyers do not differ much from non-merging firms in the relevant pre- or post-merger years. Column (c) results offer some indication that sellers perform better than non-merging firms prior to merger, but the estimates do not achieve significance levels greater than 20 percent. Sellers' post-merger performance begins with scores above the norm in years t+1 and t+2, reverts essentially to the norm in the next two years, and falls significantly below it in year t+5. Very much the same pattern emerges in Column (d) results on all utilities: Buyers are much like non-merging firms throughout, while sellers have scores that are higher before merger but, with the exception of years t+1 and t+2, fall steadily after the merger.

Despite previously expressed misgivings about the reliability of DEA scores for the years

immediately before and after a merger (i.e., t-1 and t+1), the persistent finding of higher scores for total controllable costs for the first two post-merger years piques our interest. Since there is little indication of such an improvement with respect to operating expenses,[19] the apparent efficiency gain must arise from the difference between the two measures, namely, current capital expenditures. Reductions in capital expenditures required for a given output level can represent true efficiencies, of course, but in this case the reductions are entirely transient. The buying firm reduces the sellers' capital expenditures in the first and second post-merger years, immediately thereafter such expenditures revert back to normal and indeed by the year t+5, may exceed past levels. Rather than suggesting true and persistent efficiencies, this pattern is more consistent with an immediate effort to extract cash from a merger by reducing capital outlays, conveying an initially favorable appearance to the merger, even though in the medium and longer term such outlays are unchanged.

It can therefore be concluded that DEA efficiency scores on total controllable costs broadly confirm what has been established for total operating expenses, though generally at somewhat lower levels of statistical significance. Buyers are indistinguishable from non-merging firms. Sellers are superior performers prior to merger, and quite clearly not the beneficiaries of efficiency gains thereafter.

VI. CONCLUSIONS

Mergers are both common and influential in modern market economies. One source counts 70,000 mergers worldwide with a value in excess of one million US dollars between 1980 and 1997.[20] Over the past twenty-five years, between two and three percent of all companies

listed on the US stock exchanges (and a similar percent of total market capitalization) have undergone merger or acquisition in each year (Andrade et al, 2001). In the single year 2000, nearly 5000 domestic mergers were reported to the Federal Trade Commission and Antitrust Division of the Justice Department, with many more falling below the reporting threshold.[21] The size of individual mergers has reached enormous proportions, with several recent transactions valued around $100 billion, and one−AOL-TimeWarner−initially valued at about $180 billion, before, of course, its value fell spectacularly.

This paper probes the issue of the efficiency effects of mergers that took place in the U.S. electric power distribution sector in the 1994-2003 period. We find clear evidence that acquiring firms do not exhibit superior efficiency prior to merger, nor are acquired firms underperformers. Indeed, much the reverse appears to be the case. Buying firms have poor performance records prior to merger, and appear to seek out and acquire better performing target firms. Even more notably, target firms' post-merger efficiency is not merely not improved, but it actually declines. Acquiring firms record little or no gain to offset these efficiency losses by the acquired firms. As for timing, these effects are fairly consistent except for the years immediately before and immediately after the merger.

Because of the methodology employed in this study, it would seem to represent some of the strongest evidence against the theory of efficient mergers and the market for corporate control. There are several possible reasons for this anomalous result. These include managerial motives (Harris, 1994), mistakes prompted by restructuring, and defensive mergers intended to prevent takeover. While these cannot be tested with this data base, they represent fruitful avenues for further research.

From a policy perspective, this study suggests that at least for this industry, country, and time period, considerably more skepticism toward mergers is warranted. In addition, any expectation that firms in an industry undergoing deregulation would make efficiency-improving decisions about asset deployment does not appear to have been borne out in the U.S. electricity sector. The broad results of this study contrast rather sharply both to views of mergers and to expectations for deregulation.

FOOTNOTES

[1] More precise definitions of and the reasons for these choices will be discussed in Section III below.

[2] Scherer and Ross (1990, p. 173), summarizing primarily Ravenscraft and Scherer (1987).

[3] Other sources of some relevance include Anderson (1999, p. 49) who concludes that "only 15 percent of mergers and acquisitions [in electricity] have achieved the financial objectives that were expected prior to the deal," Stoner (1994), Hartmann (1996b), and Kwoka (2005) all examine scale and other characteristics of utilities, without finding economies large enough to justify major mergers.

[4] Another dramatic policy shift was embodied in 2005 repeal of the Public Utilities Holding Company Act, which lifted various restraints on the nature of mergers and acquisitions. Its effect postdates this study, however.

[5] A further reason that data for years t-1 and t+1 may not be reliable is that a merger that takes place in some calendar year might take place either at the very beginning or very end of that year. In such cases the adjacent years' data may be more similar to data for t_0 than to t-1 or t+1.

[6] All cost variables are deflated by GDP Deflator and expressed in year 2000 dollars. Further information on data definitions and sources is provided in the Data Appendix to this paper.

[7] Determination of geographic adjacency was based on information from the Electrical World Directory together with other sources. Ultimately, this required examination of each utility and merger. Gratitude is expressed to Evgenia Shulmikina for her research assistance on this issue.

[8] Although many of the transactions examined in this paper were nominally mergers rather than acquisitions, EEI recognizes the dominant partner and initiator of the transaction as the buyer. We adhere to that procedure and the resulting designations. Gratitude is expressed to EEI personnel for updates and clarification of their database.

[9] It has also been pointed out to us that TCEX helps to capture certain line item expenditures that might be shifted between OPEX and TCEX at the time of the merger.

[10] DEA was developed by Farrell (1957), Charnes et al. (1978), Banker, et al. (1984), and Färe et al. (1985)

[11] This describes input-oriented DEA, which is more appropriate when output is largely exogenous to the DMU. This is the case for electricity distribution utilities, as demand for distribution services is a derived demand and beyond the control of utilities. Output-oriented DEA would measure the degree to which a DMU achieves maximum output from given inputs. See Coelli et al (1998) and Cooper et al (2000).

[12] In variable returns to scale DEA, there is an additional constraint that ensures each firm is compared against other firms with similar size. This study makes use of constant-returns-to-scale DEA, a reasonable assumption in the context of merger analysis since firm size is likely to be adjusted optimally through the process of merger itself. The alternative assumption of variable returns would obscure the potential for merger gains through changing scale.

[13] Input price data would allow for calculation of allocative or input price efficiency and also overall productive efficiency, which is the combination of allocative and technical efficiency. These measures are beyond the scope of this study.

[14] One exception to this might be so-called super-efficiency (Scheel (2000)).

[15] While this specification allows us to retain data for all years for all DMUs, there is considerable collinearity among the merger timing variables, potentially limiting the inferences that can be supported by statistical testing. We shall subsequently combine various years before and after the merger into groups that appropriately summarize the DEA scores

[16] See Kaserman and Mayo (1991), Gilsdorf (1994), and Kwoka (2002)

[17] The number of buyers and sellers are not identical since it was not possible to include both sides to the same transaction in all cases. We also note that as a consequence of the previously described FERC reporting, the entities in the data base are generally subsidiaries of larger acquiring or acquired utilities.

[18] The important time dimension to the efficiency effects of merger found in this study may help explain an apparent paradox previously noted in the literature. Stock market event studies are typically single-period comparisons shortly before and after merger and show favorable effects, while studies based on operating results of mergers tend to measure effects over longer periods and are less positive. The complete set of time-indexed efficiency scores reveal that initial post-merger effects are often not unfavorable, but that within two years almost invariably seller efficiency scores begin a steady and significant decline.

[19] Two of the regressions in Table 2 suggest a score increase in year t+1, but we have already noted that the data for t+1 may not be altogether free of merger-accounting effects. In addition, there is no favorable second-year effect in any of those models.

[20] Global Mergers and Acquisitions Database of Thompson Financial Securities Data, cited in Gugler et al (2003), p. 631-2.

[21] Department of Justice Antitrust Division Workload Statistics, www.usdoj.gov/atr/public/workstats.htm, accessed 24 August 2006.

Figure 1

Input Oriented DEA

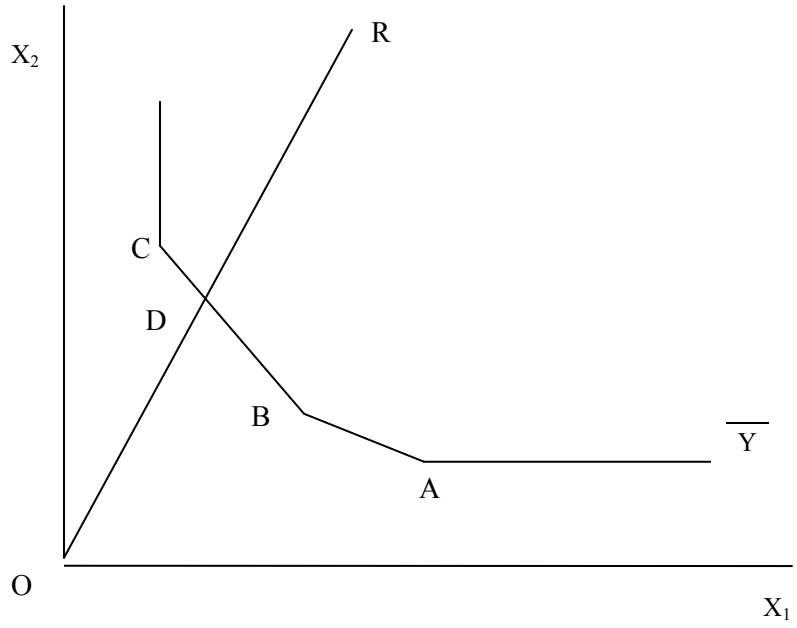

Figure 2

DEA Score Differences, Pre and Post Merger

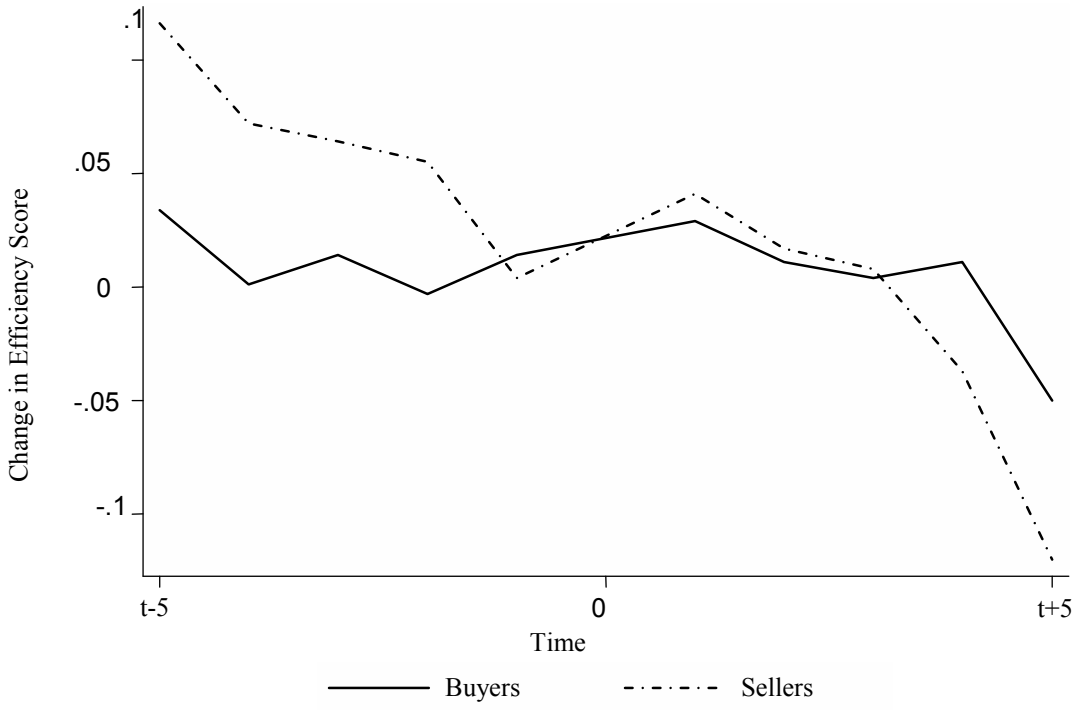

TABLE 1

Electric Utility Mergers

Year	Number of Completed Mergers
1994	1
1995	2
1996	1
1997	13
1998	9
1999	10
2000	23
2001	6
2002	5
2003	1

TABLE 2
DEA Score Differences, Years Before and After Merger
Operating Expenses (t-values in parentheses)

	(a) Buyers	(b) Sellers
t-8	.072 (1.13)	
t-7	.072 (1.13)	.157 (2.17)
t-6	.017 (.41)	.049 (1.21)
t-5	-.021 (.58)	.092 (2.73)
t-4	-.064 (1.87)	.053 (1.69)
t-3	.030 (.90)	.057 (1.93)
t-2	-.023 (.71)	.068 (2.29)
t-1	-.007 (.21)	.020 (.67)
t+1	.016 (.47)	.056 (1.88)
t+2	-.008 (.24)	.016 (.55)
t+3	-.009 (.26)	.008 (.27)
t+4	-.006 (.15)	-.027 (.78)
t+5	-.037 (.77)	-.103 (2.44)
t+6	-.087 1.37	.028 (.52)

TABLE 3
Regressions On DEA Scores for Operating Expenses
(t-values in parentheses)

	(a) Buyers vs. Sellers	(b) Buyers vs. Non-merging firms	(c) Sellers vs. Non-merging firms	(d) Buyers, Sellers vs.Non-merging firms
Output (10^8)	17.1	16.5	13.2	14.9
	(2.01	(2.40)	(2.27)	(2.59)
GenPct	.144	-.040	.019	.017
	(4.86)	(2.00)	(.90)	(.93)
ResPct	-.198	-.094	-.165	-.140
	(1.39)	(1.21)	(2.03)	(1.86)
Buyer t-8	-.025	.143		.143
	(.20)	(2.56)		(2.34)
Buyer t-7	-.059	.137		.136
	(.52)	(2.96)		(2.70)
Buyer t-6	-.050	.082		.083
	(.56)	(2.91)		(2.73)
Buyer t-5	-.098	.035		.034
	(1.30)	(1.41)		(1.27)
Buyer t-4	-.137	.000		.001
	(2.17)	(.02)		(.06)
Buyer t-3	-.071	.011		.014
	(1.39)	(.52)		(.64)
Buyer t-2	-.076	-.005		-.003
	(1.82)	(.25)		(.15)
Buyer t-1	-.013	.005		.014
	(.36)	(.27)		(.65)
Buyer t+1	.066	.022		.029
	(1.73)	(1.11)		(1.39)
Buyer t+2	.051	.009		.011
	(1.07)	(.45)		(.53)
Buyer t+3	.037	.011		.004
	(.63)	(.53)		(.19)
Buyer t+4	.035	.020		.011
	(.46)	(.79)		(.40)
Buyer t+5	-.007	-.032		-.050
	(.08)	(1.10)		(1.59)
Buyer t+6	-.032	-.042		.056
	(.28)	(1.18)		(1.48)

TABLE 3 continued

	(a)	(b)	(c)	(d)
Seller t-7	.141 (1.43)		.173 (2.80)	.204 (3.36)
Seller t-6	.004 (.08)		.061 (1.84)	.088 (2.68)
Seller t-5	.091 (1.88)		.095 (3.40)	.116 (4.19)
Seller t-4	.110 (2.46)		.056 (2.19)	.072 (2.84)
Seller t-3	.064 (1.52)		.054 (2.27)	.064 (2.76)
Seller t-2	.076 (1.83)		.049 (2.10)	.055 (2.39)
Seller t-1	-.013 (.31)		.001 (.06)	.004 (.16)
Seller t+1	-.005 (.12)		.041 (1.78)	.041 (1.81)
Seller t+2	-.015 (.35)		.019 (.80)	.017 (.72)
Seller t+3	-.017 (.40)		.014 (.56)	.008 (.35)
Seller t+4	-.062 (1.20)		-.028 (.91)	-.037 (1.25)
Seller t+5	-.096 (1.55)		-.105 (2.76)	-.120 (3.20)
Seller t+6	.075 (.91)		.024 (.51)	.006 (.14)
Adjacent	-.019 (.42)	-.014 (.33)	-.039 (1.10)	-.030 (.92)
TwoMergers	.089 (3.32)	.031 (1.40)	.035 (1.71)	.047 (2.55)
Constant	.652 (6.34)	.690 (15.99)	.677 (17.47)	.649 (16.89)
Number	320	530	610	730
Chi-square	114.8	136.9	126.2	175.89

TABLE 4

Year Group Regressions on DEA Scores for Operating Expenses
(t-values in parentheses)

	(a) Buyers vs. Sellers	(b) Buyers vs. Non-merging firms	(c) Sellers vs. Non-merging firms	(d) Buyers, Sellers vs. Non-merging firms
Buyers				
t-5432	-.097	.005		.004
	(2.91)	(.31)		(.23)
t+2345	.071	.009		.012
	(2.03)	(.50)		(.64)
Sellers				
t-5432	.079		.059	.067
	(2.49)		(3.11)	(3.58)
t+2345	-.036		.003	.001
	(1.09)		(.16)	(.05)
Number	320	530	610	730

TABLE 5

Regressions on DEA Scores for Total Controllable Costs
(t-values in parentheses)

	(a) Buyers vs. Sellers	(b) Buyers vs. Non-merging firms	(c) Sellers vs. Non-merging firms	(d) Buyers, Sellers vs. Non-merging firms
Output (10^8)	33.9	18.8	23.3	22.5
	(3.26)	(2.59)	(4.05)	(3.82)
GenPct	-.019	-.067	-.076	-.062
	(.58)	(2.51)	(3.05)	(2.77)
ResPct	.087	-.133	-.126	-.092
	(.53)	(1.32)	(1.32)	(1.03)
Buyer t-8	-.189	.051		.037
	(1.26)	(.65)		(.48)
Buyer t-7	-.129	.095		.083
	(.95)	(1.48)		(1.31)
Buyer t-6	-.138	.078		.066
	(1.27)	(2.01)		(1.75)
Buyer t-5	-.128	.041		.033
	(1.40)	(1.21)		(1.00)
Buyer t-4	-.152	.019		.010
	(2.01)	(.60)		(.33)
Buyer t-3	-.085	.005		.003
	(1.40)	(.19)		(.10)
Buyer t-2	-.067	.015		.013
	(1.38)	(.54)		(.47)
Buyer t-1	-.059	.004		.007
	(1.47)	(.15)		(.27)
Buyer t+1	.034	.042		.042
	(.79)	(1.55)		(1.60)
Buyer t+2	-.021	-.026		-.026
	(.39)	(.94)		(.95)
Buyer t+3	-.001	-.024		-.030
	(.01)	(.83)		(1.08)
Buyer t+4	.136	.031		.026
	(1.55)	(.86)		(.76)
Buyer t+5	.069	.005		-.003
	(.64)	(.12)		(.08)

TABLE 5 continued

	(a)	(b)	(c)	(d)
Buyer t+6	-.020	-.000		-.011
	(.15)	(.01)		(.23)
Seller t-7	-.007		.019	.040
	(.06)		(.25)	(.52)
Seller t-6	.017		.009	.027
	(.27)		(.23)	(.67)
Seller t-5	.052		.040	.056
	(.97)		(1.20)	(1.65)
Seller t-4	.061		-.004	.008
	(1.23)		(.15)	(.26)
Seller t-3	.054		.040	.048
	(1.15)		(1.40)	(1.66)
Seller t-2	.056		.039	.043
	(1.20)		(1.40)	(1.52)
Seller t-1	.035		-.002	-.001
	(.76)		(.07)	(.04)
Seller t+1	.057		.073	.070
	(1.24)		(2.62)	(2.51)
Seller t+2	.124		.074	.072
	(2.60)		(2.62)	(2.56)
Seller t+3	.075		.026	.024
	(1.54)		(.86)	(.79)
Seller t+4	-.097		-.027	-.029
	(1.69)		(.73)	(.78)
Seller t+5	-.082		-.108	-.108
	(1.19)		(2.32)	(2.31)
Seller t+6	.094		-.027	-.029
	(1.04)		(.46)	(.50)
Adjacent	.026	-.016	-.022	-.010
	(.47)	(.39)	(.68)	(.33)
TwoMergers	.032	.038	.043	.039
	(1.06)	(1.27)	(1.68)	(1.68)
Constant	.773	.771	.783	.749
	(6.20)	(16.23)	(18.96)	(18.05)
Number	320	530	610	730
Chi-square	133.17	124.37	174.07	206.92

Data Appendix: Variable Sources and Definitions

Variable	Definition	FERC Pages[1]	FERC Account Name / Notes
D	Total Distribution Costs (US$)	322-126b	TOTAL Distribution Expenses
A	Total Administration Costs (US$)	322-168b	TOTAL Administration & General Expenses
Cu	Total Customer Service Costs (US$)	322-134b	TOTAL Customer Accounts Expenses
	"322-134b" + "322-141b" + "322-148b"	322-141b	TOTAL Customer. Service and Information Expenses
		322-148b	TOTAL Sales Expenses
S1	Share of Distribution Business in Administration	S1(a) / S1 (b)	
S1 (a)	Numerator (wages of distribution and customer)		
	"354-20b"+ "354-21b" + "354-22b" + "354-23b"	354-20b	Distribution
		354-21b	Customer Accounts
		354-22b	Customer Service and Informational
		354-23b	Sales
S 1 (b)	Denominator (wages)		
	"354-25b"	354-25b	TOTAL Operations and Maintenance
DA	Distribution Assets (US$)	207-69g	TOTAL Distribution Plant
TA	Transmission Assets (US$)	207-53g	TOTAL Transmission Plant
PA	Production Assets (US$)	207-42g	TOTAL Production Plant
TOT	Total Assets (US$)	207-88g	TOTAL Plant in Service

[1] The FERC numbers refer to FERC FORM No.1 (REV.12-98).

Variable	Definition	FERC Pages	FERC Account Name / Notes
D_CAPEX	Distribution Plant Capital Expenses	206_69c	ADD Distribution Plant
G_CAPEX	General Plant Capital Expenses	206_83c	ADD General Plant
CC_Share	Share of General Plant Expenses attributed to Distribution Plant.	DA/TOT	
Sales	Total Units Delivered (MWh)	301-12d	TOTAL Unit Sales (MWH)
	Units Residential	301-2d	Unit Sales to Residential Consumers (MWH)
	Units Non-Residential	"301-12d" - "301-2d"	
Customers			
	Total Customers (#)	301-12f	
	Customers Residential	301-10f	TOTAL Sales to Consumers (#)
	Customers Non-Residential	"301-12f" - "301-2f"	Unit sales to Residential Consumer (#)
NL			
	Distribution Line Length	Platts	TOTAL Network Length (Miles)
OPEX			
	Non-Capital Expenditures	D + Cu + S1 * A	O& M Costs of Distribution
CAPEX			
	Capital Expenditures	D_CAPEX+ (CC_Share*G_CAPEX)	Current Capital Expenditure
TCEX			
	Total Controllable Expenditures	OPEX+CAPEX	Total Controllable Expenditures

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