

Vertical Separation of Transmission Control and Regional Production Efficiency in the Electricity Industry

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Deregulation in the electricity industry has been one of the major market restructuring transformations in the U.S. over the past few decades. Before deregulation, the U.S. electricity industry was comprised of many local natural monopolies that are vertically integrated from transmission control, generation to retail distribution. Typically, deregulation activities may consist of a combination of multiple aspects. In order to evaluate the impacts of restructuring for policy recommendations, researchers must disentangle these channels, which is generally a difficult task.

Exploiting a unique electricity market, the Southwest Power Pool (SPP), this study examines the welfare implication of one specific aspect of restructuring overlooked by previous literature: vertical separation of transmission control. The necessity of separating transmission function from other activities is largely grounded on the principle that an electricity market functions effectively only under the condition of non-discriminatory transmission access. A vertically integrated firm who operates both power plants and transmission facilities would have the incentive to discriminate against generators of their non-integrated competitors when providing the transmission services. Despite the extensive theoretical analyses and great policy relevance, there have been relatively few empirical studies on the efficiency impacts of the vertical separation. This study represents an intellectual endeavor to fill this gap.

In this paper, I investigate the impact of vertical separation of transmission control on regional production efficiency. If it is the case that vertically integrated utility producers engage in transmission discrimination and over-utilize their own generating assets, outside lower-cost options would be potentially underutilized. This would lead to an inefficient allocation of regional production resources. Thus, the divestiture of transmission control, which is handed over to a third, impartial party (called Regional Transmission Operator), could potentially enhance wholesale competition, incentivize under-utilized cost-efficient generators to produce more, and improve regional production efficiency accordingly.

I measure regional production efficiency through the sensitivity of unit utilization with respect to average costs. The implicit logic is that the utilization of generators in a market where units are dispatched more efficiently should be more responsive to their own average costs. I employ the difference-in-difference strategy and compare the average cost sensitivity of unit utilization in SPP with that in a control region, where no market restructuring activities ever took place. If the utilization of generators in SPP becomes on average more cost responsive, it would provide evidence of efficiency gains in regional production. I utilize an 8-year monthly panel of detailed micro-data at the generating unit level in the empirical work.

Based on robust results, I fail to find significant market wide evidence of improvement in regional production efficiency associated with the vertical separation of transmission control. However, looking into subgroups of generators, I find mixed evidence of cost savings via reallocation of production resources: (1) coal units are dispatched more efficiently after the restructuring, indicated by an increase in the cost sensitivity of unit utilization by 8%-11%; (2) such efficiency gains are not found for two types of gas units with different combustion technologies and cost efficiency.

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This study offers useful information for policy makers. First, it helps to better understand how to choose the optimal package of deregulation policies in electricity markets. Due to high implementation costs of deregulation, policy makers of traditionally regulated markets may favor a minor level of restructuring such as the vertical separation of transmission control. This study suggests that the efficiency improvement associated with it is limited. To achieve sufficient efficiency gains, restructuring needs to go beyond it and incorporate more aspects such as establishing market-oriented mechanisms to facilitate information revelation. Second, this study is also informative on the cost-and-benefit debates about vertical integration and separation in other network industries. The evidence of improvement in regional production efficiency indicates pre-existing discriminatory use of electricity network, which is also a major concern in other network sectors such as gas, telecommunications, etc. I find that the benefits associated with enhanced competition are at most moderate. Therefore, if the separation of the network is costly to implement, then improvement in regional production efficiency alone may not justify the policy change.