

# Market-Efficiency Impact of Vertical Integration Between Natural-Gas and Electricity Markets

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## Overview

*In a simple energy-market structure with natural gas and electricity suppliers, suppliers exercise market power by adjusting their production levels to influence the market price. This is done with the aim of maximizing their individual profits. Equilibrium occurs when all firms reach a point at which no further manipulation of the market will result in an increase in profits. This work examines the impact of vertical integration, whereby firms supply both natural gas and electricity. Because natural gas is an upstream input to the production of electricity, we conjecture that vertical integration can affect the firms' incentives to exercise market power. This is because the cost of natural gas, which impacts revenues from the sale of natural gas, impacts also the costs of (some) firms supplying electricity (depending upon the generating technologies that are used).*

## Methods

*We model market equilibria using a computational approach. Specifically, we examine stylized profit-maximization problems with vertically integrated and dis-integrated firms using a quantity-setting Nash-Cournot framework. Karush-Kuhn-Tucker (KKT) conditions are used to characterize optimal solutions to the firms' profit-maximization problems. Combining the KKT conditions of all of the firms allows us to compute market equilibria efficiently.*

## Results

*The complementarity framework is used to examine the incentives of integrated and dis-integrated firms to exercise market power in one or both of the markets. By examining comprehensive case studies that are reflective of real-world energy systems, we analyze the impacts of potential mergers between natural gas and electric firms on market efficiency.*

## Conclusions

*This work can inform policy makers and regulators in determining how markets should be structured to ensure increased efficiency. Policy makers and regulators could employ a modeling technique, such as the one that we develop, to screen potential vertical mergers in energy and other market settings.*

## References

- Allaz, B. and Vila, J.-L. (1993). Cournot Competition, Forward Markets and Efficiency. *Journal of Economic Theory*, 59:1–16.
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