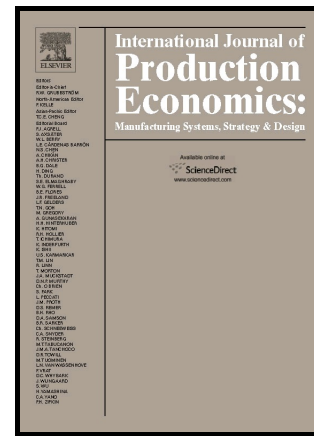# Author's Accepted Manuscript

Facility Location and Capacity Acquisition under Carbon Tax and Emissions Limits: To Centralize or To Decentralize?

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Facility Location and Capacity Acquisition under Carbon Tax and Emissions Limits: To Centralize or To Decentralize?

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Abstract

We investigate the effect of environmental regulations in the form of a carbon tax and command-and-control legislation on plant capacity and location decisions of a firm. In this context, command-and-control involves a limit on the total emissions and penalties for any polluter exceeding this environmental limit, while carbon tax involves a variable cost for emissions. We also propose two novel policy options that should be considered by policy makers for transportation emissions: (1) a per unit per mile transportation penalty, and (2) a collective transportation emissions policy with a limit on total transportation emissions that encourages emission and cost efficient facility networks. We devise an exact algorithm to solve the arising discontinuous nonlinear integer problem. We also consider simplified versions of the problem to gain analytical insights on factors driving the solutions for the more accurate yet complex scenarios. We develop a realistic dataset from the auto industry gleaned from publicly available sources to highlight key results of the model. Through analysis of this representative data, we identify the environmental limits and penalties that would drive the company to compliance. We find that stricter regulations without high penalties would not assure compliance as the benefits of increased scale associated with a centralized plant frequently outweigh the regulatory penalties. At the strategic level, a production emissions tax does not encourage companies to reduce production emissions. However, high lump sum penalties with intermediate limits reduce both regional production and total transportation emissions. We find that for regional production emissions, while a command and control scheme with a

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