

Identification and Estimation of Production Function and Consumer Demand Function under Monopolistic Competition from Revenue Data

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Abstract

Commonly used methods for estimating production functions typically assume that firms' output quantities are observable, whereas most datasets contain only revenue. We study the nonparametric identification of production and consumer demand functions from firm-level revenue data when firms face a general nonparametric demand function under monopolistic competition. Under standard assumptions, we provide a constructive, nonparametric identification of several firm-level objects, including the gross production function, total factor productivity (TFP), price markups over marginal costs, output prices, output quantities, and the demand function. By considering the homothetic single-aggregator (HSA) demand system of Matsuyama and Ushchev (2017), we identify the demand system, the representative consumer's utility function, and consumer welfare changes in counterfactual analyses.

We then develop a semiparametric estimator that can be implemented using standard firm-level datasets. In simulations, the estimator performs well, whereas treating revenue as a proxy for output leads to substantial bias. Applying our estimator to Chilean manufacturing plant data, we estimate the HSA-CoPaTh demand system—which nests the CES system—and statistically reject the CES specification. Our counterfactual welfare analysis shows that assuming a standard CES demand system substantially understates welfare losses from firms' market power, relative to the more flexible HSA system, in Chilean manufacturing industries.

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