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The Triangular Model with Random Coefficients

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The triangular model is a very popular way to allow for causal inference in the presence of endogeneity. In this model, an outcome is determined by an endogenous regressor, which in turn is first caused by an instrument. We study the triangular model with random coefficients and additional exogenous regressors in both equations, and establish non-identification of the joint distribution of random coefficients. This implies that counterfactual outcomes are not identified either. Non-identification continues to hold if we confine ourselves to the joint distribution of coefficients in the outcome equation or indeed any marginal, except the one on the endogenous regressor. Nonidentification prevails as well, if we focus on means of random coefficients, implying that IV is asymptotically biased. Based on these insights, we derive bounds on the joint distribution of economically relevant functionals, e.g., counterfactual outcomes, and suggest an additional restriction that allows to point identify the distribution of random coefficients in the outcome equation. We extend the model to cover the case where the regressors and instruments have limited support, and analyze semi- and nonparametric sample counterpart estimators in finite and large samples, and we provide an application to consumer demand.

Keywords: Random Coefficients, Endogeneity, Nonparametric Estimation, Identification, Characteristic Function, Demand Analysis.

1. Introduction

The difference between causal effects and mere correlations is of crucial importance in microeconomics and is at the heart of the endogeneity issue. For instance, in consumer demand this type of difference arises naturally if unobservables like preferences over goods consumed today are correlated with factors like risk aversion that drive the level of overall total expenditure today. Heterogeneity is another common feature of microeconomic applications, meaning that causal effects vary widely across individuals. Staying in the consumer demand example, a small price change may result in a significant change in the behavior of some individuals while others leave their behavior largely unchanged. For many policy relevant questions, it is precisely this difference that is of interest. How causal effects in a heterogeneous

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