

# Generalized Instrumental Variable Models\*

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## Abstract

In this paper we extend the application of instrumental variable (IV) methods to a wide class of problems in which multiple values of unobservable variables can be associated with particular combinations of observed endogenous and exogenous variables. That is, in contrast to traditional IV models, the mapping from unobservables to endogenous variables need not admit a unique inverse. This class of generalized instrumental variable (GIV) models allows for unobservables to be multivariate and to enter nonseparably into the determination of endogenous variables, thereby removing strong practical limitations on the role of unobserved heterogeneity. Important examples include models with discrete or mixed continuous/discrete outcomes and continuous unobservables, and models with excess heterogeneity where many combinations of different values of multiple unobserved variables, such as random coefficients, can deliver the same realizations of endogenous variables. We use tools from random set theory to study identification of such models and provide a sharp characterization of the identified set of structures admitted. We demonstrate the application of our analysis to a continuous outcome random coefficients model with endogeneity and a model with an interval-censored endogenous explanatory variable.

Keywords: instrumental variables, endogeneity, excess heterogeneity, limited information, set identification, partial identification, random sets, incomplete models.

JEL classification: C10, C14, C24, C26.

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