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University Dissertation Fellowship, Yale University, 2018
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Econometrics I (graduate, Prof. D. Andrews), Fall 2016
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Research Assistant to Prof. Philip A. Haile, Summer 2016
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"Nonparametric Analysis of Finite Mixtures," with Yuichi Kitamura (2018)

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Dissertation Abstract

A Correlated Random Coefficient Panel Model with Time-varying Endogeneity, [Job Market Paper]

In an application of panel data regression, one might suspect that the impact of a regressor on the outcome variable is heterogeneous across individuals, yet have no prior information on the conditional distribution of the unobserved heterogeneity given the regressor. In such situations, OLS (or 2SLS if the regressor is endogenous) will not yield consistent estimates of the average effect in general. Previous work in the panel data literature provides an estimator of the average effect that is consistent without restrictions on the unobserved heterogeneity. However, consistency of this estimator fails in the presence of "time-varying endogeneity," i.e, endogeneity that cannot be controlled for by a fixed effect, due for instance to correlation between the regressor and time-varying omitted variables. As an example, consider an assessment of the impact of maternal time input on child cognitive development. This effect may be heterogeneous due to variation in unobserved mother skills, and the time allocation of the mother may be correlated with time-varying unobservables, e.g., stress from the workplace, that also affect child development.

We consider this problem in a linear panel model with unrestricted unobserved heterogeneity and time-varying endogeneity. We prove identification and provide an estimator of the average effect. A key assumption of the identification result relates to the control of endogeneity. We require the existence of control variables such that the conditional mean of the time-varying disturbances given regressors and control variables is a nonparametric function of the control variables only, hence independent of the regressors. The identification argument then proceeds in two steps. In a first step, exploiting the time variation of the regressors for each individual, we "difference away" the individual unobserved heterogeneity and identify the nonparametric term. In a second step we use "between-group" variation, correcting for endogeneity using the first step, to identify the average effect.

The identification argument is constructive, and its structure suggests a natural multi-step estimator. Estimates of the control variables are constructed first, then the nonparametric component of the model is estimated using nonparametric sieve regressions. Finally, the average effect is estimated as a sample analog of the final identification step. We prove that the estimator is consistent and asymptotically normally distributed, the main challenge being the presence of nonparametric regression estimators using nonparametrically estimated regressors. This estimator is computationally easy to implement as it uses closed-form expressions. Monte Carlo simulations show favorable finite sample properties.

As an extension, we show that the validity of the identification argument using our two-step approach and control variables is not limited to endogeneity due to omitted variables. The same two-step method allows us to identify the average effect in models where the previous period outcome may impact the current value of the regressor, hence relaxing the strict exogeneity condition maintained in the literature. Our argument also applies to panel models with random

coefficients where sample selection is a source of endogeneity. As an empirical illustration, we estimate a labor supply model where the impact of the wage rate is treated as a random coefficient.

Nonparametric Analysis of Finite Mixtures, with Yuichi Kitamura

Finite mixture models are useful for modeling unobserved heterogeneity in a variety of settings arising in labor economics, industrial organization and other fields. Mixtures are also convenient in dealing with contaminated sampling models and models with multiple equilibria. This paper shows that finite mixture models are nonparametrically identified under weak assumptions that are plausible in many economic applications. We provide three identification results under distinct and non-nested sets of sufficient conditions and show that observable features of data inform us which of the three approaches is valid. These results apply to general nonparametric switching regression models as well as to structural econometric models, such as auction models with unobserved heterogeneity. We extend these results to the case of a mixture regression model where the mixing weights depend on the value of the regressors in an unrestricted manner. Thus, a finite mixture model with function-valued unobserved heterogeneity can be identified in a cross-section setting without restricting the dependence between the regressor and the unobserved heterogeneity. We propose a nonparametric estimation approach based on one of the new identification arguments, using sample analogues. This estimator is shown to possess a desirable polynomial rate of convergence as in a standard nonparametric estimation problem, despite nonregular features of the model.