# Research Synopsis

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My research interests lie primarily in the areas of industrial organization and econometrics and focus on identification, computation, estimation, and inference in dynamic microeconomic models. My current research falls primarily into three categories: computation and estimation of dynamic games, estimation and inference in partially identified econometric models, and identification and estimation of dynamic discrete choice models with serially correlated unobserved state variables. I study these models under conditions that are likely to arise in practice but which render analysis with existing methods difficult or impossible.

The three papers described below are representative of my work in these areas. In particular, the first paper develops methods to solve and estimate dynamic games with many firms by building on an underlying continuous-time model. This is a computationally challenging problem that commonly arises in empirical industrial organization. The second paper focuses on dynamic binary choice and duration panel data models in which the explanatory variables are either discrete or bounded. This leads to partial identification without a parametric assumption on the distribution of the disturbances. Another line of research considers estimation of dynamic discrete choice models in the presence of serially correlated unobserved state variables. Such models cannot be estimated using traditional methods.

*Job Market Paper 1: Estimation of Dynamic Discrete Choice Models in Continuous Time (with Peter Arcidiacono, Patrick Bayer, and Paul B. Ellickson)*

This paper provides a method of estimating dynamic discrete choice models (in both single- and multi-agent settings) in which time is a continuous process. The advantage of working in continuous time is that state changes occur sequentially, rather than simultaneously, eliminating a substantial curse of dimensionality that arises in multi-agent settings. Eliminating this computational bottleneck is the key to providing a seamless link between estimating the model and performing post-estimation counterfactuals. In the case of complex discrete games, the models that applied researchers typically estimate (where the curse of dimensionality is broken by using two-step approaches in which agent's beliefs—conditional choice probabilities (CCPs)—are estimated in a first stage) often do not match the models that are then used to perform counterfactuals. Building on the theoretical framework developed by Doraszelski and Judd (2008), we propose an estimation strategy for continuous time discrete choice models that can be implemented either via a full-solution nested fixed point algorithm or using a CCP-based approach. We also consider estimation in situations with imperfectly sampled data, such as when there is an unobserved choice, for example a passive decision to not invest, or when data is aggregated over time, such as when only discrete-time data are available at regularly-spaced intervals.

*Job Market Paper 2: Partial Identification and Inference in Binary Choice and Duration Panel Data Models*

This paper considers semiparametric binary choice panel data models: a simple fixed effects model and a dynamic extension which allows for state dependence. An extension to a class of duration models follows. Such models are point identified when at least one regressor satisfies a full support condition, however, if only discrete or bounded regressors are available, I show that the models are only partially identified and provide sharp characterizations of the identified sets. Due to the discrete nature of these models the assumptions of Chernozhukov, Hong, and Tamer (2007) are not satisfied, however my analysis proceeds in a similar fashion under different assumptions. Using maximum score criterion functions, I develop consistent set estimators and derive their rates of convergence. In the case of purely discrete regressors, I show that the estimators converge arbitrarily fast to the identified set. When one or more regressors is continuous, but with compact support, the estimators are essentially consistent at the $n^{-1/3}$ rate. I also establish the validity of a subsampling-based inference procedure to obtain confidence regions for the identified set. Finally, I conduct a series of Monte Carlo experiments to explore the finite sample properties of the estimators.

*Sequential Monte Carlo Methods for Estimating Dynamic Microeconomic Models*

In this paper I consider estimation of a general class of dynamic structural microeconomic models with serially correlated unobserved state variables. Two important special cases are single agent dynamic discrete choice models and dynamic games of incomplete information. I develop methods for classical likelihood-based estimation based on nonlinear filtering methods called sequential Monte Carlo methods, or particle filters, which simultaneously estimate both the structural parameters and the trajectory of the unobserved state variables. The methods are applicable to models with both continuous and discrete state spaces and can be applied in conjunction with traditional estimation approaches such as full-solution and two-step estimators. The proposed estimators are thus extensions of existing, widely-used estimation methods and provide a relatively simple way to control for serially correlated unobservables in existing applications. Finally, I carry out Monte Carlo experiments and provide empirical results in the context of Rust's classic bus engine replacement model.

*References*

Chernozhukov, V., H. Hong, and E. Tamer (2007). Estimation and confidence regions for parameter sets in econometric models. *Econometrica 75*, 1243–1284. [2]

Doraszelski, U. and K. L. Judd (2008). Avoiding the curse of dimensionality in dynamic stochastic games. Working paper, Harvard University. [1]

Rust, J. (1987). Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher. *Econometrica 55*, 999–1013. [2]