INTRODUCTION TO:

"Implementation of structural Dynamic Models: Methodology and Applications"

This special issue is the outcome of the conference on "Implementation of structural Dynamic Models" that was held at University College 29-30 August 2017. The aim of the conference was to bring together world-class researchers from applied microeconomics, computational economics and econometrics who work on structural dynamic models. It provided a forum at which new structural models with applications and new numerical/econometric methods for their implementation were presented and discussed.

To disseminate the ideas and results presented at the conference, participants were invited to submit papers to this special issue on the same topic. The papers that made it into the special issue can roughly be divided into two groups: The first contains methodological contributions where either new structural models or new methods for analyzing them are developed. The second group contains novel applications of existing models and/or methods with emphasis on their practical implementation and usages in answering policy-relevant questions. All together the special issue provides the reader with a good overview of state-of-the-art methods and their implementations for structural dynamic models in economics.

In "Sufficient Statistics for Unobserved Heterogeneity in Structural Dynamic Logit Models", Victor Aguirregabiria, Yao Luo and Jiaying Gu analyze which parameters can be identified in a class of structural dynamic discrete choice (DDC) models with fixed effects. The authors take the so-called fixed-effect conditional likelihood (FE-CML) approach where a set of sufficient statistics for the incidental parameters are derived and estimators are obtained by maximization of the likelihood conditional on these sufficient statistics. For non-structural (i.e., myopic) dynamic logit models with unobserved heterogeneity only in the intercept, Chamberlain (1985) and Honoré and Kyriazidou (2000) have shown that the FE-CML approach can identify the parameters of interest. Augirregabiria et al show that this approach extends to a class of structural DDC models with logit errors and so is the first paper providing an econometric theory for fixed-effects structural dynamic models with all existing papers focusing on random-effects models.

Nicholas Buchholz, Matt Shum and Haiqing Xu also provide an econometric analysis of a class of structural DDC models in "Semiparametric Estimation of Dynamic Discrete Choice Models". Their focus is on weakening the fully parametric restrictions that are normally imposed on the unobserved components entering the models. Buckholz et al show identification of a class of semiparametric structural DDC models in which the utility indices are parametrically specified but the shock distribution is left unspecified and treated as a nonparametric object. Their identification result is constructive in the sense that an estimator can be developed based on their identification argument. The authors provide an asymptotic analysis of this estimator.

Their novel results open up the door for more flexible DDC models in applied work. Related papers include Blevins (2014), Norets and Tang (2014) and Chen (2017) but in contrast to these, Buchholz et al not rely on exclusion restrictions, but rather exploit the optimality conditions to achieve identification.

In “Bidding Frictions in Ascending Auctions”, Aaron Barkley, Joachim Groeger and Bob Miller develop novel identification and estimation results for the distribution of valuations in ascending auctions where an indeterminate number of bidders have an unknown number of bidding opportunities. They fully specify the auction game but only impose a subset of the conditions that define a best reply. In particular, their assumptions are weaker than imposing Bayesian rationality, and so their results are robust to failures in equilibrium refinements that are not rationalizable. While it is not possible to compute the equilibrium of the game, the authors also derive bounds on the expected value of winning valuations, and hence provide bounds on the costs of bidding frictions. The paper is related to Haile and Tamer (2003) who also consider an incomplete auction mechanism but use other restrictions to achieve identification.

Most structural DDC models cannot be solved on closed form and so involve numerical solution methods. The standard method is to discretize the state space of the model, but this comes with a built-in curse-of-dimensionality. To circumvent these issues, Dennis Kristensen, Jong Myun Moon, Patrick Mogensen and Bertel Scherning propose a novel solution method that combines sieve methods in simulations in “Solving Dynamic Discrete Choice Models Using Smoothing and Sieve Methods”. In contrast to existing methods (see, e.g., Rust 1997 and Pal and Stachurski, 2013), theirs take into account the particular features of DDC models used in economics, including the presence of unobserved i.i.d. shocks. They utilize these to obtain a new class of numerical solution methods that work for a broad class of DDC models.

Mixed hitting-time (MHT) models make up a class of duration models that can be applied to the analysis of optimal stopping decisions by heterogeneous agents; see Abbring (2012). In “The likelihood of mixed hitting times”, Jaap Abbring and Tim Salimans considers likelihood-based empirical methods for MHT models where the latent process is a spectrally-negative Levy process with a nontrivial Gaussian component. The authors show that this implies a duration distribution with nonzero Lebesgue density at all positive durations and that it is nonparametrically identified up to innocuous scale normalizations. Abbring and Salimans then adapt numerical methods for the inversion of the Laplace transforms of the hitting times of Levy processes to compute the conditional density and survival function implied by the MHT model. In turn, these are used to construct a likelihood for independently censored duration data.

Structural models are commonly used to evaluate the effects of public policies on labour market decisions. Fedor Iskhakov and Michael Keane evaluate effects of income taxes and means tested safety net pensions on labor supply, consumption and retirement decisions using a structurally estimated life-cycle model in “Effects of Taxes and Safety Net Pensions on

Life-Cycle Labor Supply, Savings and Human Capital: the Case of Australia". Their life-cycle model, building upon the ones found in van der Klaauw and Wolpin (2008) and Keane and Wasi (2016), incorporates several key features such as asset accumulation, liquidity constraints, human capital accumulation via learning by doing, and a discrete choice of hours involving six possible levels. The resulting model involves solving a mixed continuous-discrete choice problem which generate kinks in the value function describing the individual's problem. To deal with this problem, they use the discrete-continuous generalization of the endogenous grid point method (DC-EGM) developed in Iskhakov et al. (2017).

Matteo Bobba, Luca Flabbi, Santiago Levy and Mauricio Tejada also consider labour market oucomes. In "Labor Market Frictions, Informality and on-the-job Human Capital Accumulation", they analyze human capital accumulation on-the-job, taking into account its possible depreciation while searching for a new job, and whether and how the formality status of the job significantly affects this dynamic. This is a companion paper to Bobba et al. (2017) who focus human capital accumulation decisions before entering the labor market. The formal analysis is done through the lens of a search and matching model where formal and informal jobs arise endogenously and where transitions between formality regimes occur both between and within jobs.

In "Illegal Drugs, Education and Labor Market Outcomes", Alvaro Mezza and Moshe Buchinsky extend the addiction model of Becker and Murphy (1988) to incorporate individuals' education and employment decisions within a dynamic finite horizon model of drug consumption choice. This rich framework allows the authors to examine the dynamic causal effects of drug use on important outcomes for young individuals and to carry out counterfactual experiments that would otherwise be impossible.

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