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Citizenship: China

Fields of Concentration:

Econometrics
Microeconomic Theory
Economics of Networks

Desired Teaching:

Econometrics, microeconomics, social and economic networks

Comprehensive Examinations Completed:

Oral: microeconomic theory (2016), industrial organization (2016)
Written: macroeconomics (2015), microeconomics (2014)

Dissertation Title: *Essays on Network and Panel Modeling*

Committee:

Professor Peter C.B. Phillips (co-chair)
Professor Xiaohong Chen (co-chair)
Professor Larry Samuelson
Professor Philip A. Haile

Expected Completion Date: May 2019

Degrees:

Ph.D., Economics, Yale University, 2019 (expected)
M.Phil., Economics, Yale University, 2016
M.A., Economics, Duke University, 2014
B. Economics & Finance, University of Hong Kong, 2012

Fellowships, Honors and Awards:

University Dissertation Fellowship, Yale University, 2018-2019.
Carl Arvid Anderson Prize Fellowship in Economics, Cowles Foundation, 2017.
Cowles Foundation Fellowship, 2014-2018.
University Fellowship (Hastings Fellow), Yale University, 2014-2018.
HKU Foundation Scholarship, University of Hong Kong, 2009-2012.
Dean's Honours List, University of Hong Kong, 2009-2012.
Bank of East Asia 75th Anniversary Scholarships, 2011.

Teaching Experience:

Teaching assistant for core and advanced PhD courses at Yale University:
Econometrics IV, instructed by Prof. Peter C.B. Phillips and Prof. Xiaoxia Shi, Fall 2017.
Econometrics II, instructed by Prof. Timothy Armstrong, Spring 2017.
Econometrics IV, instructed by Prof. Peter C.B. Phillips, Fall 2016.

Research and Work Experience:

Research assistant to Mira Frick (2018), Peter C.B. Phillips (2015-2017), Philip Haile (2016) and John Geanakoplos (2015-2016) at Yale University; to Attila Ambrus (2014), Patrick Bayer (2013) and Peter Arcidiacono (2013) at Duke University.
Econometrics consultant at Duke Perkins Library, Data & GIS Lab (2012-2013).
Graduate administrative assistant at Department of Economics, Duke University (2012).

Publications:

1. Gao, W.Y. (2018). "Minimax Linear Estimation at a Boundary Point". *Journal of Multivariate Analysis*, 165, 262-269.
2. Phillips, P.C.B., & Gao, W.Y. (2017). "Structural Inference from Reduced Forms with Many Instruments". *Journal of Econometrics*, 199(2), 96-116.
3. Gao, W.Y., & Moon, E. (2016). "Informal Insurance Networks". *The BE Journal of Theoretical Economics*, 16(2), 455-484.

Working Papers:

1. Gao, W.Y., & Li, M. (2018). "Robust Semiparametric Estimation in Panel Multinomial Choice Models": *Job Market Paper*.
2. Ambrus, A., Gao, W.Y., & Milán, P. (2018). "Informal Risk Sharing with Local Information": revised & resubmitted to *Econometrica*.
3. Gao, W.Y. (2018). "Nonparametric Identification in Index Models of Link Formation".

Work in Progress:

1. Gao, W.Y., Li, M., & Xu, S. (2018). “Logical Differencing in Network Formation Models under Nontransferable Utilities”.
2. Gao, W.Y. (2018). “A Unified Model of Network Bargaining and Network Formation”

Conference Presentations:

Econometric Society Meetings: Asia 2017 (CUHK), North America 2018 (UC Davis).
NSF Conferences on Network Science: 2016 (Stanford), 2018 (Vanderbilt).
HU-HUE-SMU Tripartite Conference: 2018 (Singapore Management University).
Warren Center Workshop on Trade & Diffusion of Shocks in Networks: 2018 (U Penn).
Southern Economic Association Annual Meeting: 2017 (Tampa).

Referee Service:

Econometrica, Journal of Econometrics, Journal of Economic Theory, Economic Development and Cultural Change.

Languages:

Chinese (native), English (fluent)

References:

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Dissertation Abstract: *Essays on Network and Panel Modeling*

The prevalence of heterogeneity and its importance in economic modeling and empirical research are now well recognized. Agents are heterogeneous in multiple dimensions, from their preferences and their information sets to the social environments in which they interact. My dissertation

examines various forms of heterogeneity in network and panel models, developing new methods to tackle heterogeneity in ways that seek to better integrate economic theory, econometric method and empirical data.

Robust Semiparametric Estimation in Panel Multinomial Choice Models (*Job Market Paper*),
with Ming Li

This paper proposes a simple yet robust method for semiparametric identification and estimation in panel multinomial choice models, where we allow for infinite dimensional fixed effects in the presence of additive nonseparability, thus incorporating rich forms of unobserved heterogeneity.

Our identification strategy exploits the standard notion of multivariate monotonicity in its *contrapositive* form, which provides powerful leverage for converting observable events into identifying restrictions on unknown parameters. Specifically, we show how certain configurations of conditional choice probabilities preserve weak monotonicity in an index vector, despite the presence of infinite-dimensional nuisance parameters. Then, by taking the logical contraposition of an intertemporal inequality on conditional choice probabilities from two time periods, we obtain an identifying restriction on the index values.

Based on our identification result, we construct consistent set (or point) estimators, together with a computational algorithm adapted to the challenges of this framework. The first step of our two-stage procedure nonparametrically estimates a collection of inequalities concerning intertemporal differences in conditional choice probabilities, where we adopt a machine learning algorithm using artificial neural networks. In the second stage, we compute the final estimator as the minimizers of our sample criterion function. Here, we adopt a spherical-coordinate reparameterization to exploit a combination of topological, geometric and computational advantages. The estimated model is then shown to be further utilizable for counterfactual analysis, such as predicting the effect of a promotional campaign on product sales.

We conduct a simulation study to analyze the finite-sample performance of our method and the adequacy of our computational procedure for practical implementation. We then apply our procedure to the Nielsen data on popcorn sales to explore the effects of marketing promotion effects. In our model, we permit rich unobserved heterogeneity in factors such as brand loyalty or responsiveness to subtle flavor and packaging designs, which may affect choices in complex ways. The results show that our procedure produces estimates that conform well with economic intuition. For example, we find that special in-store displays boost sales not only through a direct promotion effect but also through the attenuation of consumers' price sensitivity.

Informal Risk Sharing with Local Information, with Attila Ambrus and Pau Milán

This paper considers the effect of contracting limitations in risk-sharing networks that arise, for example, from local information constraints. We derive necessary and sufficient conditions for Pareto efficiency under these constraints in a general setting and provide an explicit characterization of the optimal risk-sharing arrangements under CARA utilities and normally distributed endowments. In our model, individuals with higher centralities become quasi-insurance providers to more peripheral individuals. We show that network centrality is (asymptotically)

positively correlated with consumption volatility in dense and moderately sparse random graphs, and empirically corroborate this prediction using consumption and network data on rural villages in Thailand. We also provide a discussion about the implications of network heterogeneity on empirical tests of risk-sharing efficiency.

Nonparametric Identification in Index Models of Link Formation

The focus of this paper is the identification of an index model of dyadic link formation with nonparametric homophily effects and unobserved degree heterogeneity. The paper derives sharp nonparametric identification results for these unknown elements. The key to the identification strategy is a novel form of scale normalization that controls an arbitrary *inter-quantile range* of the error distribution and provides a convenient linkage between observable conditional choice probabilities and the unknown index values. Under this normalization we deploy a new recursive *in-fill* and *out-expansion* algorithm to establish the main identification results. Extensions of the results are explored to accommodate other relevant features such as additive nonseparability and network sparsity. As a byproduct of the analysis a notion of *modeling equivalence* is proposed as a refinement of the traditional concept of observational equivalence. The relevance of this notion in econometric modeling is illustrated in a formal discussion about normalization, identification and their interplay with counterfactual analysis.

Logical Differencing in Network Formation Models with Nontransferable Utilities, with Ming Li and Sheng Xu

This paper considers a semiparametric model of dyadic network formation under nontransferable utilities. Such dyadic links arise frequently in real-world social interactions that require bilateral consent but by their nature induce additive nonseparability. The formation of friendship among U.S. high-school students, which naturally requires mutual acceptance, is one particularly relevant example of considerable academic and policy interest. In our model we show how two-way fixed effects (corresponding to unobserved individual heterogeneity in sociability) can be canceled out without requiring additivity. The approach uses a new method we call *logical differencing*. The key idea is to construct an observable event involving the intersection of two mutually exclusive restrictions on the fixed effects, while these restrictions are obtained by taking the logical contraposition of multivariate monotonicity. Based on this identification strategy we provide consistent estimates of the network formation model. Finite-sample performance is analyzed in a simulation study.