Hajime Shimao

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Education

Ph.D. Economics, Purdue University — May 2018 (expected)
Dissertation: *Essays on Structural Econometric Modeling and Machine Learning*
Committee: Ralph Siebert (chair), Mohitosh Kejriwal, Justin Tobias, Joe Mazur, Stephen Martin

M.S. Economics, Purdue University — 2014

M.A. Decision Science, Tokyo Institute of Technology — 2012
Concentration: Evolutionary Game Theory, Experimental Economics
Thesis Title: *Strict or Graduated Punishment? Effect of Punishment Strictness on the Evolution of Cooperation in Continuous Public Goods Games*

B.S. Psychology, University of Tokyo — 2009
Concentration: Decision Theory
Thesis Title: *The Effect of Self-Esteem on the Decision Making in Bargaining Games*

Research Interests

Primary Fields: Industrial Organization, Econometrics, Applied Microeconomics
Secondary Fields: Experimental Economics, Machine Learning

Research

Working Papers:

1. "Cross-Validation Based Model Selection on Generalized Method of Moments with Application to Dynamic Pricing Model" [*Job Market Paper*] (with Junpei Komiyama)

2. "Estimating Skill-Added: A Revealed Choice Set Approach of College Major and Occupation Choices" (with Xiaoxiao Li, and Sebastian Linde)

Publication and Submitted Papers:

1. "So You Think You are Safe: Implication of Quality Uncertainty in Security Software." (with Warut Khernamnuai and Kirthik Kannan) *R&R at* ***Management Science*** (3rd round revision)
(*Draft Available at* `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2621846`)

2. "Two-stage Algorithm for Fairness-aware Machine Learning." (with Junpei Komiyama) *submitted.* (*Draft Available at* `https://arxiv.org/abs/1710.04924`)

3. "Reciprocity and Exclusion in Informal Financial Institutions: An Experimental Study of Rotating Savings and Credit Associations." (with Takehiko Yamato, et. al) *submitted.* (*Draft Available at* `http://econpapers.repec.org/paper/kobdpaper/dp2015-31.htm`)

4. "Strict or Graduated Punishment? Effect of Punishment Strictness on the Evolution of Cooperation in Continuous Public Goods Games." (with Mayuko Nakamaru) *published at* ***PloS one***,**8**(3). (*Available at* `http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0059894`)

Work in Progress:

1. "Estimating Heterogeneity in Platform Pricing under Dynamic Environment." (with Ralph Siebert)

2. "Dynamic Pricing with Direct Network Externality." (with Ralph Siebert)

3. "Improving Instrumental Variables Estimation Using Support Vector Machine." (with Junpei Komiyama, and Xiaoxiao Li)

4. "Identifying Complementarity of Goods from Pattern Mining." (with Junpei Komiyama)

Refereed conferences

1. Shimao H. and Komiyama J. "Cross-Validation Based Model Selection on Generalized Method of Moments with Application to Dynamic Pricing Model" American Economic Association: ASSA Annual Meeting, Philadelphia, PA, January 2018 (poster session, scheduled).

2. Li X., Linde, S., and Shimao, H. "Estimating Skill-Added: A Revealed Choice Set Approach of College Major and Occupation Choices." American Economic Association: ASSA Annual Meeting, Philadelphia, PA, January 2018 (scheduled).

3. Komiyama J., Li X., and Shimao H. "Improving Instrumental Variables Estimation Using Support Vector Machine" 87th Southern Economics Association Annual Meeting (SEA), Washington, DC, November 2017 (scheduled).

4. Shimao H. and Komiyama J. "Cross-Validation Based Model Selection on Generalized Method of Moments with Application to Dynamic Pricing Model" 87th Southern Economics Association Annual Meeting (SEA), Washington, DC, November 2017 (scheduled).

5. Khern-am-nuai, W., Shimao, H., and Kannan, K. So You Think You Are Safe: Implication of Quality Uncertainty in Security Software. Conference on Information Systems and Technology (CIST), Philadelphia, PA, October 2015.

Invited seminar presentations

Department of Economics, Kent State University	(scheduled) December, 2017
Department of Economics, Villanova University	(scheduled) November, 2017
Purdue Ph.D. Research Symposium	November, 2016
Game Theory Workshop, Kyushu University	March, 2010
Human Behavior and Evolution Society of Japan, Kyushu University	December, 2009
Research Institute for Mathematical Science, Ryukoku University	November, 2009

Professional Activity

Editorial Staff of ***Letters on Evolutionary Behavioral Science*** Spring 2010 - Summer 2011

Affiliations

American Economic Association (AEA), Southern Economics Association (SEA)

Awards, Grants, and Fellowships

Fellowship from *Japan Student Service Organization*	Summer 2012 - Summer 2015
Graduate Scholarship, Purdue University	Summer 2015 - Summer 2017

Research Experience

Research Assistant to Ralph Siebert Summer 2015 - Summer 2017

Teaching Experience

Teaching Assistant (Undergrad Level)

Econ 499 Honors Thesis Course	Fall 2015

Teaching Assistant (Master Level)

Econ 510 Game Theory	Spring 2016
Mathematical Modeling in Social Science	Spring 2009

Teaching Assistant (Ph.D. Level)

Econ 621 Applied Industrial Organization	Fall 2016
Econ 631 Industrial Organization	Spring 2016
Econ 673 Time Series Econometrics	Spring 2016

Other Teaching Experience

Tutor for *Scientific Education Group* 2004-2006

Skills

Programming: Python, C/C++, Matlab, R
Software: AMPL, Mathematica, Stata, SAS
Languages: English & Japanese (fluent); Chinese & French (beginner)

References*

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Paper Abstracts (selected)

"Cross-Validation Based Model Selection on Generalized Method of Moments with Application to Dynamic Pricing Model" (with Junpei Komiyama)

Structural estimation is a widely used methodology in empirical economics, and a large class of structural econometric models are estimated through generalized method of moments (GMM). Traditionally, a model to be estimated is chosen by researchers based on their intuition on the model, and the structural estimation itself does not directly test it from the data. In other words, not sufficient amount of attention is paid to devise a principled method to verify such an intuition. In this paper, we propose a model selection for GMM by using cross-validation, which is widely used in machine learning and statistics communities. We prove the consistency of the cross-validation. The empirical property of the proposed model selection is compared with existing model selection methods by Monte Carlo simulations of a linear instrumental variable regression and oligopoly pricing model. In addition, we propose the way to apply our method to Mathematical Programming of Equilibrium Constraint (MPEC) approach. Finally, we perform our method to online-retail sales data to compare dynamic model to static model.

"Estimating Skill-Added: A Revealed Choice Set Approach of College Major and Occupation Choices" (with Xiaoxiao Li, and Sebastian Linde)

In this paper, we attempt to simultaneously estimate (i) multidimensional skill growth of students in different majors in college education, and (ii) heterogeneous non-monetary preference for occupation. While each of the two has its own difficulty when separately estimated, we show that they can be jointly identified through a unified model of major and occupation choices. Skill growth estimation is challenging since the skill level of students at graduation are not directly observed. It cannot be easily inferred from their occupation outcomes either because students not choosing occupations with high skill requirements does not necessarily imply they lack those skills when they have non-pecuniary preferences. Occupational preference is hard to estimate for a similar reason: When we observe a student is matched to an occupation, we cannot identify whether it is because she strongly prefers that occupation over others, or she just does not possess skills required by other occupations. Therefore, the main idea of this paper is that by combining data of major and occupation choices together, we have additional variations to detect the preference of students, which in turn helps us to identify revealed "choice set" that students face and therefore their skill level at graduation. Choice set of a student is defined as the occupations of which she satisfies the skill requirements. Our model treats the choice set that a student faces as a latent variable, and estimate it together with skill growth parameters and preference parameters in a Bayesian framework. State-of-the-art sampling algorithm and parallel processing on GPU enable us to estimate our high-dimensional model in a realistic computational time.

"So You Think You are Safe: Implication of Quality Uncertainty in Security Software." (with Warut Khernamnuai and Kirthik Kannan) *R&R at* ***Management Science*** (3rd round revision)

The issue of information uncertainty in the context of information security is increasingly important. Many users lack the ability to correctly estimate the true quality of the security software they purchase, as evidenced by some anecdotes and some academic research. Yet, most of the analytical research assumes otherwise. Hence, we were motivated to incorporate this "false sense of security" behavior into a game-theoretic model and study the implications on welfare parameters. We formulate a model that features a market consists of monopolistic software vendor who decides price and quality, and consumers who choose the amount of risky behavior to engage in as well as whether to purchase security software under uncertainty of quality of the product. As George Akerlof famously pointed out, uncertainty for consumers may discourage the vendor from investing in quality and result in poor social welfare. Another important feature is risk compensation: after consumers equip a security software, they may exhibit riskier behavior as they think it is safer to do so. Surprisingly, we find that the level of the uncertainty is not necessarily harmful to social welfare once these two effects interact. We prove the existence of cases where uncertainty of quality improves the social welfare in our framework and analyze the underlying mechanism. Furthermore, there exist some extreme circumstances where society and consumers could be better off if the security software did not exist. These results contrast with the conventional wisdom and are crucially important in developing appropriate policies in this context.

"Two-stage Algorithm for Fairness-aware Machine Learning." (with Junpei Komiyama)

Algorithmic decision making process now affects many aspects of our lives. Standard tools for machine learning, such as classification and regression, are subject to the bias in data, and thus direct application of such off-the-shelf tools could lead to a statistical discrimination of specific group. This may be problematic in certain applications such as judicial decision, hiring, and college enrollment. Simply excluding sensitive attributes from data does not solve this problem because statistical discrimination (or *disparate impact*) still arises when non-sensitive attributes and sensitive attributes are correlated. Here, we study a fair machine learning algorithm that avoids such a disparate impact when making a decision. Inspired by the two-stage least squares method that is widely used in the field of economics, we propose a two-stage algorithm that removes bias in the training data. The proposed algorithm is conceptually simple. Unlike most of existing fair algorithms that are designed for classification tasks, the proposed method is able to (i) deal with regression tasks, (ii) combine explanatory attributes to remove reverse discrimination, and (iii) deal with numerical sensitive attributes. The performance and fairness of the proposed algorithm are evaluated in simulations with synthetic and real-world datasets.