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Dear application reviewers,

Nov. 9th, 2017

My name is Lucy Xiaolu Wang; I am a 4th year Ph.D. candidate in Economics at Cornell University. My main research area is Health Economics with a minor in Industrial Organization. My dissertation committee includes Profs. Sean Nicholson (co-chair), Michael Waldman (co-chair), and Michael Lovenheim. I defended my proposed dissertation titled "*Essays on Intellectual Property Rights and Innovation in Health Care Markets*" this September. I expect to complete my degree in summer 2020.

My proposed dissertation includes three essays investigating the causes and consequences of innovation in health care markets, particularly in the biopharmaceutical industry and health information technology. Essay 1 (working paper) examines the complementarity between health IT and health information on opioid-induced mortality and morbidity. Essay 2 (work-in-progress) studies global drug diffusion and innovation with joint marketing alliances, in the case of the Medicines Patent Pool that facilitates inter-firm bundling of antiretroviral drug patents. Essay 3 (work-in-progress) investigates the inter-firm alliances between academia and industry on cancer clinical trials, reacting to business and legal shocks. Also, in a non-dissertation project joint with one of my co-advisors and digital health entrepreneurs, we estimate the savings from having access to transparent cash prices for imaging services in the Bay area.

During my Ph.D. and Master's studies at Cornell University and Duke University, I have completed a mixture of graduate theory, methods, and topic courses. I supplemented my regular coursework with external summer training at NBER and MIT to expand my skill set. I have also worked as a teaching assistant for business, economics, and policy courses at undergraduate, graduate, and executive levels, including managerial economics, corporations and policy, computer modeling, and public finance.

I am writing to apply for the NBER Digitization Tutorial 2018. I have enclosed in this document a list of selected graduate coursework by topics and two abstracts of current working papers on the returns to digitization in health care. Please let me know if there is any other information that you require. I am eager to gain a deeper understanding of the "economics of digitization" by attending the tutorial workshop and communicating ideas with scholars working in this area. I appreciate the potential chance to participate and would try my best to make you proud as a future alumna.

Sincerely,
Lucy X. Wang

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I. Coursework Preparation: List of Selected Graduate Courses

Health Economics & Innovation
Graduate Independent Study – Economics of Health Care, Sean Nicholson (Cornell)
Health Economics - Supply Side, Frank Sloan, Charles M. Becker (Duke)
NBER Entrepreneurship Research Boot Camp (NBER)
NBER Summer Institute: Productivity, Innovation, and Entrepreneurship; Healthcare & Aging (NBER)
Health Information Technology Boot Camp[+] (Cornell; Field Learning in Boston)
Health Care Finance[+], Sean Nicholson (Cornell)
Big Data in Health Care[+], Arnaub Chatterjee (Cornell)

Industrial Organization
Topics in Industrial Organization, Jean Tirole (MIT, summer)
Industrial Organization & Regulation II, Panle Jia Barwick (Cornell)
Industrial Organization & Regulation I[+], Jean-François Houde (Cornell)
Demand Models, Andrew Sweeting (Duke)

Public Economics
Empirical Public Finance and Taxation, Mike Lovenheim (Cornell)
Empirical Methods in Public Economics, Claire S.H. Lim (Cornell)

Econometrics and Statistics Modeling
Semi/Non-parametric Econometrics and Partial Identification, Francesca Molinari (Cornell)
Empirical Strategy for Policy Analysis I & II[+], Zhuan Pei, Jordan Matsudaira (Cornell)
Bayesian and Modern Statistics, David Dunson (Duke Statistics Ph.D. core)
Applied Econometrics, Daniel Y. Xu (Duke)
Computer Modeling for Policy Analysis, Edward Tower (Duke)
Special Topics in Economics: Stata & Matlab, Joe Mazur (Duke)

Others
Topics in Behavioral Economics, Jean Tirole (MIT, summer)
Labor Economics I, Richard Mansfield & Victoria Prowse (Cornell)
Empirical Corporate Finance[+], Murillo Campello (Cornell)
Human Capital, Joseph Hotz (Duke)

Standard 1st year Ph.D. Economics Core
Microeconomic I & II, Philipp Sadowski, Curtis Taylor (Duke); David Easley, Larry Blume (Cornell)
Econometrics I & II, Yongmiao Hong, Jörg Stoye; Mathematical Economics, Tapan Mitra (Cornell)
Macroeconomics I & II, Julieta Caunedo, Karl Shell, Karel Mertens, Francesco Bianchi (Cornell)

Selective Seminar/Workshop Attendance
Health Economics, Industrial Organization, Strategy and Business Economics, Public Economics

[+]: audited courses, mostly during my 3rd year or above.

II. Research Preparation: working papers on digitization in health care

I list two current projects related to returns to technological innovation in health care markets. The first paper investigates the role of health information technology on reducing the opioid crisis, and the second one simulated potential savings with transparent insurance and cash prices in imaging services.

1. The Complementarity of Health Information and Health IT on Opioid-Induced Mortality and Morbidity

Abstract: All 50 U.S. states now have enacted prescription drug monitoring programs (PMPs) to provide eligible professionals with patients' controlled prescription information to combat the opioid crisis. This paper studies the complementarity of health information technology (IT) and restricted patient information in drug monitoring programs on reducing opioid-related mortality and hospital discharge morbidity. I construct a novel data set that records state health IT policies that facilitate PMP data interoperability, including cross-system integration and interstate data sharing. These policies allow physicians to improve analysis of adverse drug interactions and identify patients who shop for amenable physicians across states. Utilizing difference-in-difference and event study methods, I find that health IT policies in addition to drug monitoring reduce opioid-induced mortality and morbidity. The reductions are most significant in states that never issued a PMP user mandate. The impacts are most salient among patients between ages 25 and 44 and are robust across outcomes stratified by gender, income, and insurer. A back-of-the-envelope calculation indicates that the total benefits from improved interoperability far exceed the costs of adopting health IT policies. I argue that health policies should be integrated with technology policies to expand the impacts of both.

Keywords: opioid crisis, prescription drug monitoring, health IT interoperability, technology policy
JEL Classification: I1 (Health), K2 (Regulation and Business Law), O3 (Innovation • Research and Development • Technological Change • Intellectual Property Rights)

Presentations: 2018 American Economics Association/ASSA Annual Meeting, PA (poster & featured interview scheduled); APPAM 39th Annual Fall Research Conference, Chicago, IL (paper; Nov. 2017); *SPARK Talks*: Scholars Present About Research and Knowledge, Cornell Univ. (Oct. 2017)
Research Grant: The Institute for Humane Studies' Conference and Research Grant, 2017

2. The Secret Menu in Health Care: A Cash Market for Imaging in California

Co-authors: Jordan Epstein, *Stroll Health*; Sean Nicholson, *Cornell University*; Katherine Hempstead, *Robert Wood Johnson Foundation*; Sam Asin, *Stroll Health*

Abstract: In addition to the prices they negotiate with private health insurers, most providers also have a cash price schedule for patients who have the wherewithal to ask and are willing to pay in full when they receive a service. This is the first study to our knowledge that estimates the potential benefits of allowing privately-insured consumers to observe both in-network negotiated prices and cash prices, which is of particular interest given the growing importance of high-deductible health plans. Using data from five private health insurers and over 200 imaging facilities in the San Francisco Bay Area, we estimate that patients could save between 10 percent and 22 percent of their insurer's in-network price by paying cash. Potential savings are much larger (between 45 percent and 64 percent of their insurer's in-network price) if consumers observe both cash and in-network prices and select the facility in the region offering the lowest price for a particular service.

Presentation: 6th Biennial Conference of the American Society of Health Economists, 2016, by S.N.
Research Grant: Robert Wood Johnson Foundation Grant 2016, PI: J. Epstein; Co-PI: S. Nicholson
Project Status: first draft: Jun. 2016; current draft: Jul. 2017; current status: under major revision