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Dear application reviewers,

Nov. 9th, 2018

My name is Lucy Xiaolu Wang; I am a 5th year Ph.D. candidate in Economics at Cornell University. My main research area is Economics of Innovation with a focus on health care markets. My dissertation committee includes Profs. Sean Nicholson (co-chair), Michael Waldman (co-chair), Chris Forman, and Michael Lovenheim. I am working on my proposed dissertation titled "*Essays on Innovation and Digitization in Health Care Markets.*" 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 (JMP, in-progress) studies global drug diffusion and innovation with a joint licensing platform, the Medicines Patent Pool, that facilitates inter-firm bundling of antiretroviral drug patents. Essay 2 (under review) examines the complementarity between health IT and health information on opioid-induced mortality and morbidity. Essay 3 (work-in-progress) studies biomedical innovation under the shadow of litigation by investigating the strategic reactions to patentability uncertainty in digitization. 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 2019. I have enclosed in this document a list of selected graduate coursework by topics and abstracts of current working papers and work-in-progress. Please let me know if there is any other information that you require. I participated and learned a lot in the digitization tutorial last year, and I am eager to learn more as a returning student to understand new topics in digitization and communicate 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 (Care) Economics & Innovation
Graduate Independent Study – Economics of Health Care, Sean Nicholson (Cornell)
Health Economics - Supply Side, Frank A. Sloan, Charles M. Becker (Duke)
NBER Entrepreneurship Research Boot Camp (NBER)
NBER Digitization Tutorial and Winter Meeting (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 & Public Economics
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)
Empirical Public Finance and Taxation, Mike Lovenheim (Cornell)
Empirical Methods in Public Economics, Claire S.H. Lim (Cornell)

Econometrics, Computational and Statistical 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)
Advanced Topics: Numerical Computation for Economics, Donald Rose (Duke Computer Science elective)
Computer Modeling for Policy Analysis, Edward Tower (Duke)
Applied Econometrics, Daniel Yi Xu (Duke)
Special Topics in Economics: Stata & Matlab, Joe Mazur (Duke)

Other Topics
Topics in Behavioral Economics, Jean Tirole (MIT, summer)
Labor Economics I, Richard Mansfield & Victoria Prowse (Cornell)
Applied Microeconomics: Human Capital, Joseph Hotz (Duke)
Empirical Corporate Finance+, Murillo Campello (Cornell)
Networks, Theory and Development+, Rachel Kranton (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

+: courses audited or sit in, mostly during my 3rd year or above.

II. Research Papers/Work-in-Progress on Innovation & Digitization in Health Care Markets

1. Global Drug Diffusion and Innovation with a Patent Pool: The Case of Drug Cocktail
Abstract: Decades after AIDS deaths peaked, AIDS remains a leading global cause of death. The standard treatment requires multi-drug bundling (cocktails), yet extensive patenting creates substantial licensing costs to generic manufacturers and high litigation costs to patent owners. These licensing and litigation hurdles stifle the diffusion of existing drugs and the innovation of new drugs. I study whether a joint licensing platform, the Medicines Patent Pool, fosters the distribution of HIV drug cocktail while incentivizing generic and branded innovation. By exploiting the timing of drug-country pairs' inclusion into the pool and public procurement data covering over 100 countries, I find evidence that the patent pool causally increases generic drug access and market competitiveness. The results are stronger for country-drug pairs in which the drug is patented. A duration analysis suggests joining the pool shortens the time lag between branded and generic drug approvals and encourages generic development of new cocktails. Preliminary analysis on clinical trials indicates the pool does not reduce innovation incentives of branded drug makers yet has distributional impacts. Future work will structurally estimate how much impacts can be attributed to pool-associated drug bundling using a nested discrete choice model. Finally, I discuss which competing theoretical frameworks best explains my results.

Presentation: 2018: CHITA Doctoral Consortium, IHS Fall Graduate Colloquium.
Funds: Humane Studies Fellowship Grant, IHS, 2018; Cornell Economics Memorial Fellowship, 2018

2. The Complementarity of Health Information and Health IT for Reducing Opioid-Induced Mortality and Morbidity (under review)
Abstract: In response to the opioid crisis, each U.S. state has implemented a prescription drug monitoring program (PMP) to provide health providers with patients' controlled substance prescription information. I study whether health information technology (IT) complements the availability of patient information in PMPs to reduce opioid-related mortality and morbidity. I construct a novel data set that records state health IT policies that improve PMP data interoperability in cross-system integration and interstate data sharing. Utilizing difference-indifferences methods, I find that health IT policies reduce opioid-related mortality and morbidity. The inpatient morbidity reductions are most substantial in states that created PMPs but never mandated their use. The impacts are also strongest for the most vulnerable groups – middle-age and low- to middle-income patients and are robust when stratified by age, income, location, and insurer type. The total benefits from improved interoperability far exceed the associated costs. (JEL code: I1, K2, O3)

Presentations: 2018: EWMES, CHITA, AEA (poster), ASHEcon; 2017: APPAM, SPARK talks.
Awards/Grants: CHITA Young Researcher Best Paper Award 2018; IHS - Hayek Fund Award, 2017.

3. Innovation in the Shadow of Litigation: Strategic Reactions to Patentability Uncertainty
Question: How firms strategically react to opportunistic patent litigation induced by patentability uncertainty? I utilize rich data and institutional details in the biomedical field and exploit uncertainty generated by Supreme Court cases for systematic causal analyses. I further explain the phenomenon with an inventor-infringer game. (in-progress) *Presentation*: AEA 2019 (poster; an older version)

4. The Secret Menu in Health Care: A Cash Market for Imaging in California, with Jordan Epstein, *Stroll Health*; Sean Nicholson, *Cornell*; Katherine Hempstead, *RWJF*; Sam Asin, *Stroll Health*
Question: How much can privately-insured consumers potentially save from knowing both in-network negotiated service prices and cash prices? (working paper available)
Presentation: ASHEcon, 2016 (by co-author); *Grant*: RWJF, 2016, PI: J. Epstein.