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National Bureau of Economic Research
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Dear application reviewers,

Nov. 6th, 2019

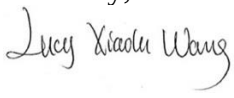
My name is Lucy Xiaolu Wang. I am a job market candidate in economics at Cornell University. My main research area is economics of innovation with a focus on health care markets (U.S. and global). My dissertation committee consists of Sean Nicholson (co-chair), Michael Waldman (co-chair), Chris Forman, and Michael Lovenheim. I am working on a dissertation titled "*Essays on Innovation and Digitization in Health Care Markets.*" I expect to complete my degree in the summer of 2020.

My dissertation includes three essays on the causes and consequences of innovation in health care markets, particularly in the pharmaceutical industry and health information technology (IT) area. Essay 1 (JMP, *under review*) studies global drug diffusion and innovation with a joint licensing platform, the Medicines Patent Pool, which facilitates inter-firm bundling of HIV drug patents. Essay 2 (*R&R, American Journal of Health Economics*) examines the complementarity between health IT and health information on opioid-induced mortality and morbidity. Essay 3 (work-in-progress) studies biomedical innovation in the shadow of litigation by investigating the strategic reactions to patentability uncertainty in digitization. Also, in a non-dissertation project joint with a co-advisor and digital health entrepreneurs (*submitted*), we estimate the savings from 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. I have also worked as a teaching assistant or guest lecturer for business, economics, and policy courses at undergraduate, graduate, and executive levels, including managerial economics, corporations and policy, econometrics, computer modeling, and public finance.

I am writing to apply for the NBER Digitization Tutorial 2020. I have enclosed in this document a list of selected graduate coursework by topics and a summary of my works on health care digitization topics. Please let me know if there is any other information that you require. I attended and learned a lot in the digitization tutorials in the past two years, and I am eager to learn more as a returning student to understand new topics in digitization and communicate 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 Xiaolu Wang

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I. Coursework Preparation: List of Selected Graduate Courses

Health (Care) Economics & Innovation
Key Management Issues in the Biotech and Pharmaceutical Industries, Sean Nicholson (Cornell)
Graduate Independent Study – Economics of Health Care, Sean Nicholson (Cornell)
Health Economics - Supply Side, Frank A. Sloan, Charles M. Becker (Duke)
Health Information Technology Boot Camp[+] (Cornell; Field Learning in Boston)
Health Care Finance[+], Sean Nicholson (Cornell)
Platform Strategy[+], Chris Forman (Cornell)
Big Data in Health Care[+], Arnaub Chatterjee (Cornell)
NBER Entrepreneurship Research Boot Camp (NBER)
NBER Digitization Tutorial and Winter Meeting (NBER)
NBER Summer Institute: Productivity, Innovation, and Entrepreneurship; Healthcare & Aging (NBER)

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
Strategy and Business Economics, Industrial Organization, Health Economics, Public Economics

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

II. Current Research Projects on Digitization in Health Care Markets

One part of my research agenda studies the implications of technological changes in health care markets. In particular, I investigate economic issues associated with digitization in health care markets—a costly investment in the U.S. that can generate health benefits but with ambiguous effects on cost savings. The saliency, complexity, and fast-growing nature of digitization offers many research opportunities.

In medical settings as in other industries, technological innovation can increase productivity. In **"*The Complementarity of Health Information and Health IT for Reducing Opioid-Related Mortality and Morbidity"*** (*Revise and Resubmit, American Journal of Health Economics*), I find that better health information technology improves physicians' access to patient information and reduces opioid-related mortality and morbidity. Specifically, I investigate whether integrating controlled substance information into electronic health systems and enabling interstate data sharing can reduce opioid-related mortality and morbidity. In this setting, technological innovation can increase productivity by reducing barriers to access and analyze sensitive patient data that were previously stored in a separate system. Using newly collected data on state policies that facilitate such integration and allow interstate data sharing for controlled substances, I find that integration substantially reduces negative opioid-related health outcomes. While interstate data sharing does not by itself have an impact, it complements existing integrated systems. 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.

However, the emergence of digital technologies in health care also raises concerns about cost increases. Can consumers save costs by utilizing new options provided by digital software? In joint work with Jordan Epstein (Stroll Health), Sean Nicholson (Cornell), Katherine Hempstead (RWJF), and Sam Asin (Stroll Health), "**The Secret Menu in Health Care: A Cash Market for Imaging in California"** (*Submitted*), we simulate potential cost savings if consumers are willing to shop around for imaging services. We use both the insurer-specific in-network prices and posted cash prices. We use proprietary data assembled by Stroll Health, a digital health start-up, including data from five private health insurers and 142 imaging facilities in the San Francesco Bay area. We estimate that patients could save 11–22% of their insurer's in-network prices by paying cash and could save even more (45–64%) if patients could choose the lowest cash or in-network prices for a given imaging service in the Bay area.

In an ongoing project, "**Biomedical Innovation in the Shadow of Litigation: Patentability Uncertainty & Strategic Reactions**" (work-in-progress) I study how firms react to opportunistic litigations induced by patentability uncertainty in the *digital* era. U.S. patent litigation has exploded in the past two decades, which raises concerns regarding the ambiguity of patentability standards and the lack of consensus between the patent office and courts. Although most discussions focus on the software industry, the drug and medical device sector has the highest litigation growth rate once adjusting for the number of patents granted. I am exploring how biomedical firms adapt innovation activities and IP strategy in an era of involving laws and increasingly complicated inter-firm behaviors. I use a simple theoretical model and high-profile Supreme Court cases to analyze these questions.

I plan to extend my existing research in several directions. First, I will further examine how electronic prescription of controlled substances (EPCS) affect the prescription and utilization of opioids, and how the effects differ through a purely market-based adaption versus policy intervention (esp. as EPCS will be mandated nation-wide by 2020). For identification, I will use both technology-specific IV approach and difference-in-differences model exploiting state-level EPCS adoption mandate on state or county-level panel outcomes. Second, I will look beyond health IT to investigate how blockchain technologies, which supposed to improve interoperability in a decentralized manner, progress in health care—a market full of opportunities and stringent regulations.