



DEPARTMENT OF AGRICULTURAL & RESOURCE ECONOMICS

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Chair
Search Committee Chair

Dear Search Committee Chair:

It is a pleasure to be writing regarding the qualifications of Mr. Yongdong Liu for a position as assistant professor.

Yongdong's fields include Industrial Organization, Applied Econometrics, Microeconomics, Economics of Digitalization, Economics of Innovation, and Applied Statistics.

I have been advising Mr. Liu since he was admitted to our PhD program in 2009. Mr. Liu is a very bright and industrious student. In his first two years in the program, he did an excellent job on coursework and passed our PhD qualification exams with outstanding grades. In addition to the courses required by our program, Mr. Liu has taken advanced courses from the Department of Economics and the Department of Statistics here at Berkeley, obtaining a Masters from the Department of Statistics. As will be made clear below, he also has gained experience handling (*very*) big data problems. His solid training makes him well prepared to address demanding modern research challenges.

Mr. Liu's job market paper addresses entry decisions on the mobile app market, an area of high interest to top business schools. This is a very new market and attracts much interest, but it has not been widely studied so far, for several good reasons. First of all, data on this industry are hard to obtain. Even when data are available, it is beyond many researchers' ability to process and analyze such big data sets, and to

construct and estimate econometric models that address relevant and interesting questions. Third, as an emerging online market, the mobile app market differentiates from conventional industries in many significant ways, so it requires great effort and more than a little ingenuity to address issues relevant to this new marketing environment.

This research became possible when Mr. Liu persuaded a Silicon Valley consulting firm to share its data on app markets for free, a rare achievement for a PhD student. Mr. Liu built and manages the resulting very large data set on his own, a challenging task. It contains information on all the apps on two platforms, Google Play and Apple's App Store, over a two-year period. He adopts a highly efficient hierarchical sequential linking schema to identify app genres, and uses latent semantic analysis for feature extraction, and the support vector machine (SVM) for text classification. (Often large teams of specialized graduate students are employed for such demanding work on a data set of this size.)

It is well known that a very small proportion of apps attract a very large share of demand, and the remainder attract negligible demand. Under this unusual market structure, Mr. Liu constructs a model of heterogeneous developers' platform entry decisions on the two very distinct platforms in an incomplete information game framework. The entry model in the paper shows his command of relevant tools and his ability to overcome daunting data limitations, making judicious modeling choices regarding app quality recovery, the process of app discovery by potential users, and app adoption.

A dominant feature of the apps on each platform is their skewness with respect to quality. He estimates differential competitive effects of high and low quality incumbents on entry: high quality incumbent apps strongly deter entry on the relevant platform, but low quality apps tend to encourage entry. His results help explain the observed heterogeneity of app quality on each platform.

Yongdong has a second paper on apps, co-authored with Professors Nekipelov and Park, on the timing of cross-platform entry related to an existing app, and the quality of that related cross-platform app entry. I assume his co-authors will describe that paper, which has already been presented at an NBER conference.

In another paper, prepared under my direction, Liu chose to pursue the interesting question of why big firms might choose to disclose large amounts of proprietary innovative knowledge to the public domain, and studies the impacts of such disclosures on the subsequent R&D. For a long time, academia has been puzzled by firms' disclosure behavior. Several theoretical papers provide various explanations,

which, however, still lack empirical support. Mr. Liu's work constitutes the first empirical research on voluntary disclosure in lieu of patenting that uses advanced economic modeling techniques. Using systematic disclosures by IBM and patents citing these disclosures, he studies the utilization of these disclosures and firms' R&D interactions in related technical fields, shedding light on the motives behind these disclosures.

Liu finds that IBM discloses innovations on the periphery of its core expertise. It then selectively cites patents of others building on these disclosures, to extend the margins of its innovation domain. This work is an interesting extension of the literature on innovation and intellectual property protection. Its closest relative is probably a 2012 paper by Sharon Belenzon in the *Economic Journal* that shows that patents citing a firm's patents, on which that firm builds new patents, increase the firm's market value. But in that case the information revelation is an inevitable consequence of the patent decision and does not indicate a positive net expected effect of disclosure; here disclosure is entirely voluntary, and indicates that IBM believes that the net value it accrues from selective unprotected inventions is positive.

I expect Mr. Liu to obtain several top academic publications from these papers. Moreover he does not present the strong identification dilemma seen in many students with great academic records and excellent job market papers influenced by strong advisers. He already has several papers in good field journals in comparative economics and insurance in his C.V., and he has demonstrated his initiative in identifying great topics and accessing and analyzing large relevant data sets. He will certainly keep on publishing creative research after he leaves graduate school.

Liu has shown he is very willing to observe reality and apply economic theory on practical issues, key qualities for an empirical economic researcher. He is able to discover interesting topics in diverse new fields and push them forward. Mr. Liu is also highly motivated and is a quick learner, able to pick up essential skills for challenging projects very quickly. I am pointing this out because in an interview he is likely to be charmingly modest about his capacities. He continually surprises me with the extent of his toolkit.

Yongdong also has the necessary teaching experience here at Berkeley and has very good English speaking skills. He has a recent award for "Outstanding Student Abroad" from the Chinese Government, among many other awards including a Chancellor's Scholarship from the Chinese Academy of Science, a rare achievement for a Masters student.

In short, Yongdong's achievements display the technical ability, modeling skills, creativity and initiative that are all too rarely seen in job market candidates. I have been collaborating for many years with David Mowery and later Lee Fleming in running the Haas Innovation Seminar. As you know Lee has a strong interest in problems involving large data sets and so we see a number of speakers working in this area. Liu's paper is however on a more challenging big data problem than I have seen in the papers presented in the seminar. The most comparable student in our department is Dan Hammer, junior to Liu. Dan is impressive indeed in handling big data (including Twitter data) but at this stage Liu is by far the superior modeler.

What more can I say? Liu has very strong skills and impressive research output in Applied Economics, Digital Markets, Economics of Digitalization, Empirical Industrial Organization, Intellectual Property and Data Science. He has already generated significant interest on the job market. I recommend him highly, and urge you to interview him and see his strengths for yourself.

If I can be of any further assistance, please do not hesitate to contact me. However until mid-December I am at U. Católica in Chile, so email is better than phone for the initial contact.

Sincerely yours,

A handwritten signature in blue ink, appearing to read 'Brian Wright', with a long horizontal flourish extending to the right.

Brian Wright

Professor,
Department of Agricultural and Resource Economics