Business Economics and Public Policy Department

The Wharton School
University of Pennsylvania

3000 Steinberg Hall – Dietrich Hall
3620 Locust Walk
Philadelphia, PA 19104-6372

+1.781.266.8088 phone
+1.781.862.2640 fax
andywu@wharton.upenn.edu

Andy Wu
Ph.D. Student in Applied Economics

Saturday, March 24, 2012

Thomas Hellmann
University of British Columbia
Sauder School of Business
2053 Main Mall, Vancouver, BC
Canada V6T 1Z2

Dear Professor Hellmann,

It is with great interest that I am submitting my application for the 5th NBER Entrepreneurship Research Boot Camp. After this cover letter, you will find the following attached: curriculum vitae, course list, and my application essay detailing my research interests and current research projects. My letter of recommendation is by *David H. Hsu, Richard A. Sapp Associate Professor of Management of the Wharton School*; his letter has been sent separately.

Thank you for assembling such an amazing group of experts to lecture the class. It will be wonderful to hear their opinion on their fields of specialization; in particular, I look forward to Professor Stern, who I hope will discuss startup commercialization strategy and the role of intellectual property. Furthermore, meeting the other participants encourages further academic dialog and create countless co-authorship opportunities.

Please do not hesitate to contact me by phone or email if there are any additional questions. I look forward to the chance to attend this boot camp and learn from and meet the top scholars and up and coming students in the entrepreneurship research field. Thank you again for this opportunity.

Sincerely,



Andy Wu
Ph.D. Student in Applied Economics
The Wharton School of the
University of Pennsylvania

Management Department

The Wharton School
University of Pennsylvania

2000 Steinberg Hall-Dietrich Hall
3620 Locust Walk
Philadelphia, PA 19104-6372

(215) 746-0125 phone
(215) 898-0401 fax

dhsu@wharton.upenn.edu

David H. Hsu
Richard A. Sapp
Associate Professor of Management

March 29, 2012

Thomas Hellmann
University of British Columbia
Sauder School of Business
2053 Main Mall, Vancouver, BC,
Canada V6T 1Z2

Dear Thomas,
I am writing to offer my highest recommendation for **Andy Wu**, who is applying to participate in this summer's NBER Entrepreneurship boot camp. Andy, a first year PhD student in the Applied Economics program at Wharton, has been working with me over the past year as my research assistant. He comes to Wharton with an undergraduate degree from MIT in economics and math. Despite taking only three years to complete his undergraduate studies, he managed course work and RAships covering a range of fields in economics. As my RA, he hired and managed a team of undergraduates for a variety of tasks including computer programming and data structuring work. I was so impressed with his work that I felt a co-authorship relationship on new work would be the next logical step. So we are now in the early stages of co-authored work on the sequence and nature of entrepreneurial strategic alliances and how that shapes entrepreneurial exits.

I know that Andy just meets the minimal requirement of PhD program tenure for the boot camp, but as you know, it is rare to get a student of this caliber in the field of entrepreneurship. He has a capacity to learn a great deal from and contribute to the program. For that reason I strongly endorse Andy's candidacy. Thanks for your consideration, and please let me know if you would like to clarify or discuss the above.

Best wishes,



David Hsu

Andy Wu

TERM ADDRESS:
3620 Locust Walk; Suite 3000
Philadelphia, PA 19104

PHONE: (781) 266-8088
FAX: (781) 862-2640
EMAIL: andywu@wharton.upenn.edu

PERMANENT ADDRESS:
5 Appletree Lane
Lexington, MA 02420

EDUCATION

The Wharton School of the University of Pennsylvania, Philadelphia, PA
Business Economics and Public Policy Department Aug '11—Present

- Student, *Doctor of Philosophy (Ph.D.) in Applied Economics*
- Coursework: Microeconomic Theory, Game Theory, Econometrics, Financial Economics, Optimization, Empirical Public Policy, Intertemporal Macro Finance

Massachusetts Institute of Technology (M.I.T.) Cambridge, MA
Sep '08—Jun '11

- *Bachelor of Science (S.B.) in Economics and in Mathematics*, GPA: 4.8/5.0
- Coursework in Economics: Econometrics, Game Theory, Public Finance, Labor Economics, Industrial Organization, Mutual Funds, Finance Theory, Thesis
- Coursework in Mathematics: Real Analysis, Statistics, Probability and Random Variables, Combinatorial Analysis, Differential Equations, Linear Algebra, Multivariable Calculus
- Thesis: *State Alcohol Excise Taxes: Effects on Consumption and Traffic Fatalities*, MIT Undergraduate Economics Journal

Lexington High School Lexington, MA
Sep '04—Jun '08

- Unweighted GPA: 3.93/4.0, Weighted GPA: 4.57/5.0, SAT: 2400/2400

AWARDS

NSF Graduate Research Fellowship Honorable Mention (2011)
Wharton Doctoral Fellowship (2011)
MIT Burchard Scholar (2010)—For undergraduates distinguished in the humanities, arts, and social sciences
Roy H. Lane Scholarship (2008)— Awarded to top mathematics students in Massachusetts
Paul Serben Scholarship (2008)
National AP Scholar (2008)
1st Place at MA State Science & Engineering Fair & Osram Sylvania $1000 Award (2007)
1st Place & $1000 Scholarship at WPI Mathematics Invitational (2007)

RESEARCH INTERESTS

Entrepreneurship & Innovation, Industrial Organization, Labor Economics, Applied Econometrics

RESEARCH EXPERIENCE

Management Department, The Wharton School, *Research Assistant* Philadelphia, PA
Advisor: Professor David H. Hsu (Wharton) & **Professor Vikas A. Aggarwal** (INSEAD), Sept '11—Present
Research on topics in Entrepreneurship & Innovation

- Provided data collection , construction, and analytics on *Entrepreneurial Exits and Innovation*, which examines how IPOs and M&As affect entrepreneurial innovation; paper finds evidence showing a short-run positive IPO effect on innovation, with the effect reversing over a longer time window (Aggarwal and Hsu 2012)
- Supervised team of undergraduate researchers working on background research

MIT Department of Economics, *Research Assistant* Cambridge, MA
Advisor: Professor Jonathan Gruber, Research on topics in Public Finance May '09—Jun '10

- Conducted data collection, data analysis, and literature reviews on policy issues, including Medicare Part D, unemployment insurance, TARP executive bonuses, and stimulus bill
- Researched empirical and anecdotal evidence demonstrating the liquidity of personal income, in support of Professor Gruber's work on health care reform and the Cadillac tax
- Updated data and wrote for leading public finance textbook, *Public Finance and Public Policy* (2010), 3rd Edition, Worth Publishers

MIT Department of Economics, *Research Assistant* — Cambridge, MA
Advisor: Professor Peter Temin, Research on topics in Labor Economics & Economic History — Sep '08—Dec '08

- Analyzed historical data and collected literature on early 20th century labor relations
- Provided considerable research support for Temin paper *Changes in Labor Relations during the New Deal and War* (2009), which argued that in the time period, there was simultaneous movement of organizing forces, which rise with union density and resources, and forces opposing unions, which are a linear declining function of union density, as employers spend more effort to keep unions out altogether than restricting the growth of established unions

MIT Department of Economics, *Independent Research* — Cambridge, MA
Advisor: Professor James Feyrer, Dartmouth College Department of Economics — Sep '10—Jun '11
State Alcohol Excise Taxes: Effects on Consumption and Traffic Fatalities, MIT Undergraduate Economics Journal

- Studied the effect of state-level alcohol excise tax laws on alcohol sales, alcohol consumption, and alcohol-related traffic fatalities, using a fixed effects panel regression on data from the 50 states and D.C. over the time period from 2000-2007
- Found there is small but significant negative price elasticity on alcohol sales, as well as significant effects from taxes and consumption level on the frequency of alcohol fatalities. In particular, beer taxes have the largest negative effect on alcohol-related traffic fatalities, and beer and spirit consumption has a notable positive effect.

WORK EXPERIENCE

MassChallenge, Inc., *Business Development Intern* — Boston, MA
May '11—Aug '11

- Advised CEO and Director on business development strategy, sourcing potential sponsors, designing discussion materials, and building financial projections
- Listened to over 40 pitches, assisting experienced investors, lawyers, and entrepreneurs with judging process

The Peter J. Solomon Company, *Analyst* — New York, NY
Jun '10—Aug '10

- Worked with a team of five bankers on a live sell-side deal representing a leading women's fashion retailer; conducted due diligence, developed offering memorandum and board book, and maintained buyer's contacts
- Prepared pitch books for various industries, including aerospace, health care, and retail
- Assisted managing director with technical presentation on valuation techniques and issues

Office of Governor Deval Patrick, *Intern Staffer* — Boston, MA
Jun '09—Aug '09

- Prepared executive summaries under tight deadline for Governor's daily briefing
- Developed and launched new civic engagement strategies with a team of four interns, including a new website and new grassroots outreach methods
- Served in MA Department of Veteran Services, advising on young veteran engagement

Consortium for Energy Efficiency, *Database Intern* — Boston, MA
Jan '09

- Examined utility and appliance industry and related trade groups
- Designed and implemented database to integrate various data streams as part of next generation IT project

MIT Information Center, *Tour Guide* — Cambridge, MA
Sep '08—Jun '11

- Lead weekly campus tours and answer questions about MIT

Vivox Inc., *Consumer Strategy Intern* — Framingham, MA
Jul '08—Aug '08

- Surveyed and evaluated Voice over IP (VoIP), telecommunications, and gaming industries
- Planned, oversaw, and led engineering of Facebook® application to integrate VoIP application
- Initiated research on a white paper on latency

Office of State Rep. Jay R. Kaufman/MA Joint Committee on Public Service, *Intern Staffer* — Boston, MA
Jun '07—Dec '07

- Represented constituents in bureaucratic disputes and responded to constituent correspondence
- Developed policy position regarding Chapter 40B zoning issues
- Documented official testimony for committee

INSTITUTIONAL SERVICE

Penn Graduate and Professional Student Assembly, *Wharton Doctoral Representative* Sep '11—Present
- Served on Research Student Council and Finance Committee

MIT Undergraduate Economics Association, *President and former Treasurer* Sep '08—Jun '11
- Represent undergraduate economics majors and students interested in economics, and work with economics faculty and administrators to improve the undergraduate experience
- Host economics-related events: lunches with professors, career events, guest speakers, etc.

MIT Everett Moore Baker House Dormitory, *President & former VP of Residential Exploration* Sep '08—Jun '11
- Tackle various policy and infrastructure issues, including risk management and reform of $40,000 annual budget

MIT Dormitory Council, *Risk Manager and Member* Jul '10—Jun '11
- Represented dormitory to the Council, which is the association of dormitory presidents
- Contributed to writing of campus-wide risk management policy

MIT Associate Advising Program, *Associate Advisor* Jun '09—Jun '11
- Worked with Professor Nancy Rose to advise group of freshmen interested in economics, finance, and public policy on their course selection, extracurricular activities, etc.

PATENTS

"Single-Action Three-Dimensional Model Printing Methods", Patent Pending, Docket No. 6598-001 (2011)

SKILLS SUMMARY

Stata and *R* statistical software and *MATLAB*
C++, *JAVA*, *Visual Basic*, *MySQL*
Microsoft Office—extensive knowledge of *Excel* and *Access*—can write macros in *VBA*
Extensive web development skills in *HTML (HTML, XHTML & CSS)* and *PHP*

Andy Wu, Ph.D. Student in Applied Economics
The Wharton School of the University of Pennsylvania

PH.D. COURSES

FALL 2011

ECON 681	Microeconomic Theory
ECON 705	Econometrics I: Fundamentals
FNCE 911	Financial Economics
OPIM 912	Introduction to Optimization
STAT 520	Applied Econometrics (Audit)

SPRING 2012

ECON 682	Game Theory & Applications
FNCE 924	Intertemporal Macro Finance
STAT 521	Applied Econometrics II
BPUB 911	Empirical Public Policy
ECON 792	Economics of Labor (Audit)

Andy Wu, Ph.D. Student in Applied Economics
The Wharton School of the University of Pennsylvania

NBER ENTREPRENEURSHIP RESEARCH BOOT CAMP APPLICATION ESSAY

The NBER Entrepreneurship Research Boot Camp is an amazing opportunity to delve headfirst into both the classics of the entrepreneurship literature and cutting edge research. My past research experience and diverse research interests in the field of entrepreneurship and innovation put me in a strong position to make intellectual contributions to seminar discussions and the work of other participants. In addition, the discussions at the boot camp will fit in nicely to improve my current research. As my undergraduate research experience is available on my curriculum vitae, I will focus here on discussing my current research projects, and I'll briefly touch upon my aspirations as a researcher in the entrepreneurship field.

Heading straight from undergrad to graduate school at the Wharton School of the University of Pennsylvania, I leap right into research and I was lucky enough to meet Professor Hsu (Wharton) and Professor Aggarwal (INSEAD) and assist them with their paper *Entrepreneurial Exits and Innovation* (Hsu & Aggarwal 2012). In the paper, they examine how IPOs and M&As affect entrepreneurial innovation as measured by forward patent citations and product development. They address the possibility of unobserved self-selection into exit mode by comparing firms that filed for an IPO or announced a merger with those who did not complete the transaction for reasons unrelated to innovation, and they use an instrumental variables approach based on relative financing channel liquidity at the industry level. They find evidence of a short-run positive IPO effect on innovation, with the effect reversing over a longer time window, additionally supporting their results with an inventor level analysis. As a research assistant on this project, I used the NBER (Hall et al.) and the Harvard IQSS Patent Databases (Lai et al.) to generate the unbalanced firm-year and inventor-year panel with generality, originality, and other key values that formed the basis of the project. I also played a key role in developing the inventor level analysis, constructing entire patenting histories of focal individuals, a unique contribution of the paper.

In conjunction with Andrew Johnston (Wharton), I am in the early stages of a paper that studies the positive externalities of high-skills immigration to the U.S. Continuing on the work of Kerr and Lincoln (2011), we plan to explore the extent to which an exogenous shock of technically trained immigrants impact on the domestic innovation regime using a natural experiment. In 1992, George H. W. Bush signed the Chinese Student Protection Act in response to the events of Tiananmen Square. This order deferred deportations and granted employment authorization until January 1994, affecting about 80,000 Chinese nationals in the U.S. Unlike previous immigration programs in the United States, this program primarily affected a large population of students on legal student visas. These students were notably well-educated, disproportionately in the fields of science and engineering. With this change, these students were able to adjust their future plans and plan for residence and employment in the United States, thus increasing their propensity to reside in the United States and subsequently contribute to the domestic innovative community. Our work will make three major contributions. First, prior literature has been unable to accurately identify immigrant contribution on an exact level. Using the data from INS and State Dept. will give exact identification of immigrants, and by matching them up to the USPTO database, we will have exact identification of the contributions of our immigrant cohort. Second, the new Harvard IQSS patent dataset (Lai et al. 2011) allows us to track individual inventor histories, of both those in our immigrant cohort, and other inventors whom we deem connected to these immigrants, like co-inventors. We can then build a detailed panel dataset tracking inventor-year patent histories of our immigrants and those connected to the immigrants, with details including patent counts, forward citation counts, generality, originality, and others. Third, we plan to generate a dynamic social network portrayal of the innovation community to which these immigrants have contributed. We can trace their connections with other co-inventors, the companies where they worked, and their communities, based solely on their patent histories. A visual representation of the network and related statistics will provide us with a fuller picture of the contributions of the

immigrants; their contribution is not only the patents they file, but also in the network effects they have on native inventors.

I am also in the process of developing a long term field experiment to study the impact of startup accelerators and the role social networks play in early stage firm growth. With the success of the experimental research in development economics and personnel economics, it is natural to extend the methodology to entrepreneurship, and the accelerator environment is the perfect laboratory. An accelerator works similarly to an incubator, and offers services such as mentoring, networking with entrepreneurs, office space, and seed funding. Incubators bring in companies and keep them in a protected environment, and the incubated companies often have trouble breaking away and succeeding on their own. Enter the startup accelerator, in which participating startups often face a tight time limit on occupancy to encourage a focus upon explosive growth post-exit from the accelerator. Through the cooperation of a large Boston, MA based startup accelerator, which in its last program cycle hosted 125 different startups—making it the world's largest startup accelerator—we now have the opportunity to test our questions out. I will be able to obtain panel data regarding firm inputs and characteristics (funds raised, IP, etc.) and founder and employee characteristics of each firm, on a two week basis during the course of the accelerator and longitudinally for up to 5 years after exit. Additionally, the accelerator has authorized me to randomize mentor assignments to the startups: through interviews with accelerator organizers and participating firms, it appears to be conventional wisdom that the highest value-add of accelerator lies in the mentorship program. The paper will make three major contributions to the literature. Along the lines of Hsu's work on the value of venture capital affiliations (Hsu 2004), it will help address the increasingly relevant question of the value of startup accelerators and incubators, and provide policy makers with information on whether or not to support these organizations with public funds. Second, it will examine the role social networks play in entrepreneurial returns, much like Hochberg, Ljungqvist, and Lu did in their analysis of venture capital networks (Hochberg et al. 2007). Third, it will open the door for future field experiments on entrepreneurship, which will enable us to address many questions we have not been able to before.

Finally, Professor Hsu and I are beginning a new project to explore the linkage between startup alliance and M&A/IPO in enterprise development. Specifically, we wish to investigate the following research question: (how) do entrepreneurial alliances shape its merger likelihoods and performance? We are interested in exploring a knowledge mechanism which can cut both ways: as startups develop portfolios of alliance partners, there may be higher incentives for a given counterparty to try to acquire the startup so that it can mitigate the outflow of knowledge to other firms. Alternatively, startup firm counterparties may be interested in an alliance relationship mainly because of the possibility of knowledge spillovers from the startup's other alliance relationships; under an acquisition, the flow of knowledge from the startup's alliances may cease or be curtailed.

My research ambitions in entrepreneurship are driven by my past experiences in academic research, public service, and personal interactions with real life entrepreneurs. It is clear to me that entrepreneurs perpetually spur the *gale of creative destruction*, and in the research community we should whatever we can to encourage entrepreneurship-favorable public policy and improve entrepreneurship education. Hopefully as a future professor in the field, I hope to mentor and educate future researchers, policy makers, and entrepreneurs to advance this goal.

REFERENCES

Aggarwal, V., & Hsu, D. H. (2012). Entrepreneurial Exits and Innovation. Wharton Mangement Department Working Paper.
Dyer, J. H., Kale, P., & Singh, H. (2001). How to Make Strategic Alliances Work. MIT Sloan Management Review, 37-43.
Hall, B. H., Jaffe, A. B., & Trajtenberg, M. (2001). The NBER U.S. Patent Citations Data File: Lessons, Insights, and Methodological Tools. NBER Working Paper 8498.
Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom You Know Matters: Venture Capital Networks And Investment Performance. Journal of Finance, 251-301.
Hsu, D. H. (2004). What Do Entrepreneurs Pay for Venture Capital Affiliation? Journal of Finance, 1805-1844.
Kerr, W. R., & Lincoln, W. F. (2010). The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention. Journal of Labor Economics, 473-508.
Lai, R., D'Amour, A., Yu, A., Sun, Y., & Fleming, L. (n.d.). Disambiguation and Co-authorship Networks of the U.S. Patent Inventor Database (1975 - 2010).