THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

Kate S. Whitefoot
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Washington, D.C. 20001
(202) 334-1643
kwhitefoot@nae.edu

March 25, 2012

Dear ERBC Admissions Committee,

I am a Senior Program Officer at the National Academy of Engineering where I research innovation and entrepreneurship in the manufacturing sector. Prior to this position, in August 2011, I earned a Ph.D. from the University of Michigan in the multidisciplinary Design Science program where I completed both the Economics Ph.D. curriculum in microeconomics and industrial organization, and the graduate Mechanical Engineering design curriculum. I am eager to develop my knowledge of entrepreneurship economics and believe my unique background and research experience will make a valuable contribution to the Entrepreneurship Research Boot Camp.

My research focuses on firms' technological decisions and the implications for public policy, entrepreneurship, and social welfare. This work investigates how internal factors—such as a firm's product development process—as well as external factors—such as public policy, technology-specific engineering constraints, and industry structure—influence the technological and product-design decisions that firms make. My Ph.D. research focused on the automotive industry, examining the influence of fuel-economy regulations on firms' technology and production strategies. In my current position, I am developing a program of activities to investigate firms' technological strategies across many manufacturing industries and the implications for U.S. innovation, economic growth, and employment.

Completing the Entrepreneurship Research Boot Camp is a valuable opportunity for me to develop my knowledge of the economics of entrepreneurship and the role of financing. Understanding how the structure of financing and other external factors influence entrepreneurial decisions is critical to understand innovation in the manufacturing industry. Developing my knowledge of research in this field will therefore be particularly valuable to my current line of research.

Enclosed in my application is a statement describing why I would like to attend the Boot Camp, my curriculum vitae, and a list of relevant courses I've completed. In addition to these materials, my Ph.D. advisor—Meredith Fowlie, Assistant Professor of Agricultural and Resource Economics at the University of California, Berkeley—will be submitting a letter of recommendation. If you would like any additional information, please contact me at kwhitefoot@umich.edu or (202) 334-1643. Thank you for your time and consideration. I look forward to hearing from you.

Sincerely,



Katie Whitefoot

UNIVERSITY OF CALIFORNIA, BERKELEY

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April 5, 2012

Re: Letter of recommendation for Kate Whitefoot

Dear ERBC Admissions Committee,:

I am delighted to write this letter of recommendation for Kate Whitefoot. Kate is exceptionally talented and committed to doing high quality, interdisciplinary work on entrepreneurship, industrial policy, and product design. I give her my highest recommendation.

I know Kate very well. We met six years ago when I was on the faculty at the University of Michigan and Katie was a student in my course. I have since left Michigan to join the faculty at UC Berkeley, but we have remained in close contact. I served as a member of Katie's dissertation committee. We are now collaborating on some exciting research projects. She is smart, creative, and a delight to work with.

Kate's background and training may be somewhat unique among applicants to this Entrepreneurship Research Boot Camp. Kate completed her Ph.D. student in Mechanical Engineering at the University of Michigan. She was part of Michigan's esteemed "Design Science" program which encourages students to integrate quantitative engineering design research with one or more complementary disciplines. Kate rose to this challenge, completing core PhD courses in Economics alongside her full load of Engineering courses. Perhaps more importantly, over the course of her graduate career, she mastered concepts and methods from both economics and engineering. Her dissertation work received accolades from engineers and economists alike.

After completing her graduate work, Kate accepted a position of Senior Program Officer at the National Academy of Engineering. In this capacity, she is leading an ambitious research project that considers innovation and entrepreneurship in the manufacturing sector.

To sum up, Kate is a very talented and thoughtful researcher with excellent potential. I know that Kate would benefit tremendously from participating in this Entrepreneurship Boot Camp. She is very interested in the topics covered by your curriculum. She would arrive well prepared and bring a unique and insightful perspective.

Please do not hesitate to contact me if you have any questions at (510) 642-4820 or fowlie@berkeley.edu.

With best regards,



Meredith Fowlie, Assistant Professor
ARE, University of California, Berkeley

My research studies how firms make technological decisions and the implications for public policy, entrepreneurship, and social welfare. This research investigates the impact of market structure, policy instruments, and technology-specific engineering constraints on the development and implementation of technological innovations. Understanding entrepreneurial decision-making is an important part of this line of research. I believe that developing my understanding of the economics of entrepreneurship and the role of financing, by completing the Entrepreneurship Research Boot Camp, is a natural extension of my Ph.D. research and will directly contribute to my current research.

My Ph.D. research focuses on the automotive industry, investigating the impact of environmental regulations on firms' decisions to deploy fuel-saving technologies. The research approach of this work combines traditional industrial organization analyses of the industry with engineering simulations that characterize the physics-based constraints that govern firms' technology decisions. This approach has the advantage of accounting for technology options that are not currently deployed in the market but are feasible and potentially optimal under counterfactual policy designs. Important findings of this research include 1) considerable fuel-economy improvements are possible using conventional technologies and are often more profitable than deploying advanced fuel-saving technologies; 2) under fuel-economy standards that assign lower fuel-economy targets for larger vehicles, it is often more profitable for firms to increase the sizes of their vehicles than to deploy advanced technologies or change other aspects of vehicle design; 3) this latter property illustrates that the recently enacted fuel-economy standards are likely to create a perverse incentive for firms to increase the sizes of their vehicles.

My current research expands this focus to investigate firms' technology decisions across a wide-range of manufacturing industries. In my current position, I am developing a program of

activities to study innovation in U.S.-based manufacturing firms and the impact on job creation, productivity, and sustainability. Through this work, I interact closely with manufacturing entrepreneurs in electronics, nanotechnology, and biomaterials. Preliminary interviews with these entrepreneurs identified financing as a major barrier to developing innovations in these fields. Consequently, I would like to strengthen my understanding of research on financing and entrepreneurial economics to better design research activities to investigate manufacturing entrepreneurship.

Completing the Entrepreneurship Research Boot Camp will add tremendous value to my research by developing my knowledge of the economics of entrepreneurship and the role of financing. I am particularly interested in learning about the economics of pursuing innovations, new business development, and job creation. I believe that gaining a better understanding of the research approaches used to study these activities as well as research findings on the influence of financing and public policy will add immediate and significant value to my research.

In addition to expanding my knowledge of the economics of entrepreneurship, I hope to positively contribute to the Boot Camp. I believe that my background in mechanical engineering in addition to my proficiency in industrial-organizational economics will add value to classroom discussions during the program. I am exited to develop my understanding of entrepreneurship research and look forward to contributing to the Boot Camp.

Kate S. Whitefoot

500 Fifth Street
Washington, DC 20001
(202) 334-1643
kwhitefoot@nae.edu

CURRENT POSITION

The National Academies 2011-present
Senior Program Officer, National Academy of Engineering

EDUCATION

Ph.D., Design Science, University of Michigan, Ann Arbor 2008-2011
Curriculum: PhD Industrial Organization Economics track and Mech. Eng. Design track
Dissertation: *Quantifying the Impact of Environmental Policy on Engineering Design Decisions*

M.S., Mechanical Engineering, University of Michigan 2007-2008
Summa Cum Laude

B.S., Mechanical Engineering, University of Michigan 2002-2006
Political Science Minor
Magna Cum Laude

RESEARCH EXPERIENCE

PhD Research 2007-present

This research seeks to integrate engineering design approaches with econometric consumer utility models in order to: 1) develop the first full-scale model of the U.S. automotive industry in partial oligopolistic equilibrium with respect to prices and vehicle designs, and 2) exercise this model to evaluate the impact of various environmental policies on greenhouse gas emissions, producer and consumer surplus, and adoption of fuel-saving technologies.

Resources for the Future 2010-present

Evaluation of inducement prizes as technology policy

The objective of this research is to evaluate the potential for competitive prizes to encourage innovation in comparison to other policy instruments such as intellectual property rights, procurement contracts, and research grants. My contribution to this project includes identifying research methods to evaluate innovation inducement competitions, collecting data, devising empirical econometric strategies to analyze the data, and authoring an issue brief.

Ford Motors Sustainability Project 2006-2008

Ford Motor Company-Univ. of Michigan Sustainability Alliance

The objective of this research project was to 1) propose sustainable vehicle designs and business models for Ford, and 2) identify design "cues" that consumers perceive as environmentally friendly. For three years, I held a core-member position on this project, regularly presenting findings to Ford representatives and managing two students' work. My research contributions included proposing and evaluating vehicle designs and services, designing surveys on customer perceptions, and developing consumer utility models to evaluate demand for vehicle designs.

ICF International 2007

EPA Smartway fuel-efficiency program

This project aims to reduce CO_2 from freight transportation by partnering with carrier and logistic companies. While consulting with the EPA, I developed CO_2 emission calculation tools to evaluate and improve fleet emissions and designed a concept for a new multimodal (i.e., road, rail, ship) emission calculation tool.

EPA Planet-People-Prosperity Projects

Energy-saving Building Façades 2006

This project aimed to design and validate façade concepts that could reduce building energy needs. As part of an interdisciplinary team of faculty and students from architecture and mechanical engineering, I designed and built a thermal testing system to evaluate the façade concepts, and conducted experiments to determine the heat-transfer properties of the façades at various longitudes. This project was presented at the National Sustainable Design Expo in Washington D.C. and won the EPA People-Planet-Prosperity Award.

Tools for Environmentally Aware Consumerism 2005

The goal of this project was to develop tools to inform consumers of the environmental impact of products at the point-of-purchase. We designed and built a working prototype of software that (in a pre-smart-phone world) could display environmental ratings of products on a personal phone or key-chain accessory by scanning the product's barcode. On this team, I designed the product rating system to communicate environmental lifecycle assessment data in both an intuitive and transparent manner. This project was presented at the National Sustainable Design Expo.

PUBLICATIONS

Refereed Journal Publications

K.S. Whitefoot and S.J. Skerlos. 2012. Design Incentives to Increase Vehicle Size Created from the U.S. Footprint-based Fuel Economy Standards. *Energy Policy* 41: 402-411.

K.S. Whitefoot, H. Grimes-Casey, C. Girata, W.R. Morrow, J. Winebrake, S.J. Skerlos. 2011. Consequential Lifecycle Assessment with Market-Driven Design Decisions: Development and Discussion. *Journal of Industrial Ecology* 15(5): 726-742.

B.D. Frischknecht, **K.S. Whitefoot**, and P.Y. Papalambros. 2010.On the Suitability of Econometric Demand Models in Design for Market Systems. *Journal of Mechanical Design* 132(12): 57-68.

Refereed Proceedings Publications

E.M. MacDonald, **K.S. Whitefoot**, J. Allison, P.Y. Papalambros and R. Gonzalez. 2010. An Investigation of Sustainability, Preference, and Profitability in Design Optimization. *ASME International Design Engineering Technical Conferences,* Montreal, Quebec.

B.D. Frischknecht, **K.S. Whitefoot**, and P.Y. Papalambros. 2009. Methods for Evaluating the Suitability of Econometric Demand Models in Design for Market Systems. *ASME International Design Engineering Technical Conferences*, San Diego, CA.

Other Conference Papers

K.S. Whitefoot, M.L. Fowlie and S.J. Skerlos. 2012. Product Design Response to Industrial Policy: Evaluating Fuel Economy Policies Using and Engineering Model of Endogenous Product Design. *ASSA Annual Meeting*, January 5-8, Chicago, IL.

K.S. Whitefoot, M.L. Fowlie and S.J. Skerlos. 2010. Evaluating U.S. Reformed Corporate Average Fuel Economy Standards with Endogenous Product Attributes. *World Congress of Environmental and Resource Economics*, June 28-July 2, Montreal, Quebec, CA.

Brennan, T., M.S. Macauley, and **K.S. Whitefoot**. 2010. Prizes, Patents, and Procurement: A Framework for Comparing Methods for Encouraging Innovation. *International Industrial Organization Conference*. April 8-10, Boston, MA.

Working Papers and Papers Under Review

K.S. Whitefoot, M.L. Fowlie and S.J. Skerlos. Evaluating U.S. Reformed Fuel Economy Policies with Endogenous Engineering Attribute Selection. *University of California Energy Institute Working Paper Series.*

T. Brennan, M.S. Macauley, and **K.S. Whitefoot**. Prizes, Patents, and Technology Procurement: A Proposed Analytical Framework. *Resources for the Future Discussion Paper* No. 11-21.

W.R. Morrow, J. Mineroff, and **K.S. Whitefoot**. Numerically Stable Design Optimization with Price Competition. (under review, ASME International Design Engineering Technical Conferences)

PRESENTATIONS

Invited Presentations

MIT Energy and Environmental Policy Workshop, May 3-4, 2012 in Cambridge, MA.

INFORMS Annual Meeting, Special Section on Regulatory Compliance in the Automotive Industry, Nov. 15, 2011 in Charlotte, NC.

ASME International Design and Engineering Technical Conference, Special Session on Environmental Policy in Vehicle Design, Aug. 30, 2011 in Washington, DC.

University of California Energy Institute Seminar Series, Nov. 5, 2010 in Berkeley, CA.

University of Michigan Earth Day Symposium, Panel on Climate Action beyond Copenhagen, Mar. 25, 2010 in Ann Arbor, MI

University of Michigan Industrial Organization Seminar, Mar. 23, 2009 in Ann Arbor, MI.

NSF Design as a Discipline Colloquium, Oct. 22, 2009 in Ann Arbor, MI

Selected Conference Presentations

ASME International Design Engineering Technical Conferences, Aug. 29-31 in Washington, DC.

World Congress of Environmental and Resource Economics, Jun.-Jul. 2010 in Montreal, Canada

INFORMS Marketing Science Conference, Jun., 2009 in Ann Arbor, MI

TEACHING AND MENTORSHIP

Teaching Assistant Fall 2004-10

Analytical Product Design: Sr. / Grad course in Mechanical Engineering and Design Science

- Team-taught six semesters of this course
- Prepared and taught course materials for multiple segments of the course, including Logit Consumer Utility Models, Environmental Design, and Profit Optimization with Product Design
- Met bi-weekly with student teams to assist with their project development

Teaching Tutorials 2004-5

- Researched methods to measure and incorporate consumer visceral preferences for product aesthetics into design optimization
- Authored two teaching tutorials on Kansei Engineering (design for emotional appeal) and the role of proportionality in consumer aesthetic assessments

Research Manager 2007-8, 2010

- Directed four undergraduate and master's students in interdisciplinary research projects
- Taught introductory material to students and managed their progress throughout the projects

Student Mentor 2008-10

- Advise prospective PhD students interested in pursuing interdisciplinary programs

SERVICE AND ACTIVITIES

Professional Service

Publication Reviews

Transportation Research Part A: Policy and Practice 2011

International Journal of Greenhouse Gas Control 2011

ASME International Design and Engineering Technical Conferences 2008, 2009

Academic Service

Graduate Student Representative to the Dean of Academic Affairs 2010-2011

Professional Memberships

Association of Environmental and Resource Economists

Society of Automotive Engineers

American Society of Mechanical Engineers

Society of Women Engineers

Environmental Service

Climate Blue, 2010-2011

- Co-founded organization to bring together climate-change research, activities, and opinions from across the U-M campus and alumni

UNFCCC COP15 Climate Summit, Copenhagen 2009

- Raised funds to finance group travel by applying for grants and soliciting departmental funds
- Organized and presented on a cross-campus panel discussion of international climate activities

The Climate Group, Climate Leader's Summit 2009
- Helped coordinate roundtable discussion between government and industry representatives on Electric Vehicle Financing and City Partnership initiatives

BLUELab / Engineers without Borders 2005
- Led a team to design a gallery exhibit on three international environmental problems and a competition with multidisciplinary student groups to propose deployable solutions
- Organized a lecture series to educate students on the presence of engineers in government

GRANTS AND AWARDS

MLK Spirit Award 2009
Rackham Merit Fellowship 2008
Mechanical Engineering Departmental Fellowship 2007
EPA People, Planet, Prosperity Award 2005

REFERENCES

Assistant Professor Meredith Fowlie
Agricultural and Resource Economics
University of California-Berkeley
fowlie@berkeley.edu
510.642.4820

Molly Macauley
Research Director and Senior Fellow
Resources for the Future
macauley@rff.org
202.328.5043

Associate Professor Steven Skerlos
Mechanical Engineering
University of Michigan
skerlos@umich.edu
734.615.5253

Professor Panos Papalambros
Mechanical Engineering
University of Michigan
pyp@umich.edu
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Economics PhD track courses

Econ 675: Applied Microeconometrics
Topics: Binary choice models, multinomial choice models, censored regression models, duration models, quantile regression, instrumental variables (and related parametric selection models), longitudinal methods and discontinuity designs, issues of variance estimation including complex survey design and bootstrap

Econ 631: Industrial Organization and Public Policy
Topics: Theoretical analysis of behavior in markets, price discrimination, oligopoly theory with and without differentiated products, strategic trade, market dominance, mergers, collusion, entry deterrence, structural models of industry dynamics, numerical optimization and function approximation, basic monte carlo methods, discrete time dynamic models, GMM, MLE

Econ 603: Microeconomic Theory III
Topics: Classical general equilibrium, pure exchange, 2x2 production models, welfare analysis, the positive theory of equilibrium, Pareto optimality, core convergence, equilibrium under uncertainty, Arrow-Pratt risk aversion, risk comparisons, sequential trade, asset markets, incomplete markets

Econ 602: Microeconomic Theory II
Topics: Game theory, normal form and extensive form representation of non-cooperative games, solution concepts for games, dominance including dominance considerations and rationalizability to Nash equilibrium, subgame-perfect equilibrium, sequential equilibrium, static and dynamic games with incomplete information, adverse selections, moral hazard, screening, contract theory, mechanisms design, auction theory, first-price auctions, second-price auctions

PubPol 564: Government Regulation of Industry and Environment
Topics: theory of perfectly competitive markets, market failure, appropriate form of government intervention in a market, regulation of natural monopolies, price and quantity regulation, industry restructuring, environmental policy instruments, how product market structure can inform the design of effective environmental policy, impact of environmental regulation on technology diffusion and innovation

Relevant math courses

ME 555: Design Optimization
Topics: nonlinear programming, mathematical modeling for design optimization, boundedness and monotonicity analysis of models, necessary and sufficient conditions of optimality, constraint activity, numerical methods of nonlinear programming, local approximations of functions, gradient and Newton's methods, line search, trust regions, generalized reduced gradient method, quasi-Newton methods, sequential quadratic programming, active-set strategies, non-gradient methods

Math 525: Advanced Probability
Topics: Mathematical theory of probability, probability spaces, random variables, moment generating functions, limit theorems, conditional expectation, Markov chains, Poisson processes

Complex Systems 535: Theory of Social and Technological Networks
Topics: Mathematical theory of networks, experimental studies of social networks, information, and technological networks, methods and computation algorithms for the analysis and interpretation of network data, graph theory, random graphs, preferential attachment models, small-world model, network dynamics

Summer Workshop: Introduction to Modern Bayesian Modeling and Computations
Topics: Prior distribution, likelihood, and posterior distribution, prior selection, parameter estimation, MCMC simulation