Variation in Start-Up Quality:
Management Practices, Productivity, and Employment Growth of Young Manufacturing Firms

Proposal for the NBER Productivity, Innovation and Entrepreneurship (PIE) Research Grant

Proposal Submitted by Kristina McElheran, Assistant Professor, University of Toronto
(Joint with Wang Jin, MIT & Kathryn Shaw, Stanford University)

Research Question; How do the management practices of start-ups differ from those of more-established firms? Does the adoption of more innovative practices at birth explain performance gains in productivity and employment that are associated with startups?

Motivation

Start-up firms are considered to be a central driver of job creation and economic growth in the United States (e.g., Haltiwanger, et al. 2013). However, there is considerable heterogeneity in the quality of young ventures, with higher incidence of both rapid growth and failure. Some of this variation in quality may be predicted by features observable at founding (Guzman and Stern 2015; Belenzon et al. 2014). **The goal of this research proposal is to understand how a broader set of choices made at birth – or soon thereafter – may impact how quickly a firm creates jobs, innovates, and contributes to overall productivity and economic growth.**

Recent work has demonstrated important relationships between managerial practices and firm performance. Bloom et al. (2013) document the correlation between productivity and the adoption of more "structured" management practices governing human resource management, lean manufacturing, and performance-based compensation and promotion. Brynjolfsson and McElheran (2016) find additional benefits (i.e., controlling for structured management) from investments in both information technology and practices that emphasize the collection and use of data in decision-making.

However, an open and essential question concerns whether young firms are more able to take advantage of these managerial innovations. Start-ups may begin with frontier management practices or pivot to them more easily than incumbent firms. Start-ups do not face the adjustment costs that large, established organizations must overcome as they seek to introduce managerial innovations. On the other hand, start-ups may lack the knowledge that comes from large national firms, or may lack the complementary investments that make managerial innovations profitable. Due to the relationship between age and size (Haltiwanger et al. 2013), young firms may lack the scale required to leverage certain practices effectively.

We propose to investigate: a) the extent to which start-ups adopt modern management practices; b) the extent to which job creation and productivity growth among start-up firms is due to the adoption of these innovations at founding, c) whether young firms are more able to adjust their managerial practices after establishment.

The manufacturing sector is little-studied in the field of entrepreneurship, but manufacturing is an industry that has been known for its high wages and continuous productivity gains. Attention to this sector is robust among policy makers (Levinson 2015), and important prior work on firm age and growth dynamics takes places in this sector (e.g., Evans 1987).

Data

This investigation will take advantage of detailed Census Bureau data on a sample of over 30,000 young and old establishments in the manufacturing sector. The key data set is the Managerial and Organizational Practices Survey (MOPS), which provides data on a rich set of management practices in 2005 and 2010. It is linked to the Annual Survey of Manufactures, the Longitudinal Business Database, and the Census of Manufactures (CMF), providing data at the establishment level on: sales, employment, capital investment, information technology (IT) investment, input purchases, plant age, multi-unit status, age of parent firm (if any), location, and more. These data are available over a longer time frame, allowing for the analysis of learning curves over different time periods. The most recent year of data available is 2012, but that is likely to extend to 2013 over the timeframe of this proposal. The survey samples are designed to provide representative statistics on the population of manufacturing plants in the United States and response is required by federal law, leading to high response rates and comprehensive representation of the manufacturing sector, including newly-founded establishments.

To employ fixed-effects models of changes in the adoption of practices on performance, the data is restricted to a smaller sample. However, preliminary investigations suggest that enough power remains to find significant correlations between meaningful economic measures and managerial practices among a representative sample of young manufacturing establishments.

Empirical Strategy

Models of the adoption of management practices can be estimated for 2005-2010 as a function of plant size, industry, multi-unit status, and other observable characteristics such as capital intensity, skill mix, IT capital stock, and other – potentially complementary – practices. Sales, employment, and productivity gains from 2005 to 2012 can be modeled as a function of management practices, other complementary practices and investments, and age. Productivity will be estimated following Foster et al., (2014), using 6-digit NAICS industry definitions to determine factor shares and imputing for missing capital investment data in non-CMF years. Time-invariant heterogeneity among plants can be accounted for with plant-fixed effects. Parent-firm characteristics may also be used to explain variation in adoption and performance of young establishments.

Preliminary Results and Timeline

Data construction is complete, and preliminary investigations suggest interesting directions for investigation to culminate in a submission-ready working paper by summer of 2017:

- Though manufacturing is a declining share of employment in the U.S., new establishment entry is robust.
- Certain management practices, such as rapid firing of underperforming workers, are adopted more readily by young firms than old firms.
- Young stand-alone firms adopt fewer managerial innovations than young establishments belonging to older parent organizations.
- Certain management practices appear to be quasi-fixed; from 2005 to 2010, plants display little change in: the percentage of workers with bachelor's degrees, union presence, and whether promotions within the firm are based primarily on performance.

Budget

Access to the data requires being physically present in a Census Bureau Research Data Center (RDC). Thus, the grant funds will be used primarily to support frequent travel to the Boston and Stanford RDCs for data analysis and research collaboration.

REFERENCES

Audretsch, D. B. and T. Mahmood (1994). "The rate of hazard confronting new firms and plants in US manufacturing." Review of Industrial organization **9**(1): 41-56.

Belenzon, S., A. Chatterji, and B. Daley (2014). "Eponymous entrepreneurs." Duke University Working paper.

Bloom, N., E. Brynjolfsson, L. Foster, R. S. Jarmin, I. Saporta-Eksten and J. Van Reenen (2013). "Management in America." Center for Economic Studies Discussion Papers #CES 13-01, U.S. Census Bureau.

Brynjolfsson, E. and K. McElheran (2016). "Data in Action: Data-Driven Decision Making in U.S. Manufacturing." Center for Economic Studies Discussion Papers #CES 16-06, U.S. Census Bureau.

Evans, D. S. (1987). "The relationship between firm growth, size, and age: Estimates for 100 manufacturing industries." The Journal of Industrial Economics: 567-581.

Foster, L., C. Grim, and j. Haltiwanger (2016)." Reallocation in the Great Recession: Cleansing or Not?" Journal of Labor Economics **34** (S1, part 2).

Guzman, J. and S. Stern (2015). Nowcasting and Placecasting: Entrepreneurial Quality and Performance. Measuring Entrepreneurial Businesses: Current Knowledge and Challenges, University of Chicago Press.

Haltiwanger, J., R. S. Jarmin and J. Miranda (2013). "Who creates jobs? Small versus large versus young." Review of Economics and Statistics **95**(2): 347-361.

Levinson, M. (2015) "Job Creation in the Manufacturing Revival." Congressional Research Service report #7-5700.

Kristina Steffenson McElheran

University of Toronto
105 St. George Street
Toronto, ON M5S 3E6
CANADA

k.mcelheran@utoronto.ca
kmcel@mit.edu

ACADEMIC EMPLOYMENT

2014-present	**University of Toronto** *Assistant Professor, Strategic Management* *U of T Scarborough Campus & Rotman School of Management*
2013-present	**Massachusetts Institute of Technology** *Visiting Scholar & Digital Fellow, Initiative on the Digital Economy* *Sloan School of Management*
2008 – 2013	**Harvard Business School** *Assistant Professor, Technology and Operations Management Unit* Lumry Family Assistant Professor of Business Administration 2009-2013 ***On parental leave 2009-2010 and 2011-2012***

EDUCATION

2009	**Kellogg School of Management,** Northwestern University Ph.D. in Managerial Economics and Strategy Dissertation: *Market Position and Organizational Structure in Information Technology Investment* Committee: Shane Greenstein, Scott Stern, Ranjay Gulati, Leemore Dafny
1999	**London School of Economics** Diploma in Economics, *with credit*
	Stanford University
1994	A.M. in International Development Policy
1993	A.B. in Political Science, Stanford University, *with distinction*
1988-1991	**Albion College** Undergraduate studies in political philosophy and French B.A. in French (awarded 1993), *summa cum laude*

RESEARCH INTERESTS

Innovation and technological change, information technology, corporate strategy, organizational economics, industrial organization, supply chain management, managerial decision making

MAIN PUBLICATIONS

"The Rapid Rise of Data-Driven Decision Making" (with Erik Brynjolfsson) *American Economic Review Papers and Proceedings*, forthcoming 2016

"Do Market Leaders Lead in Business Process Innovation? The Case(s) of E-Business Adoption," *Management Science*, **61**(6) June 2015, pp. 1197-1216. ***Lead article***

"Delegation in Multi-Establishment Firms: Adaptation vs. Coordination in I.T. Purchasing Authority," *Journal of Economics and Management Strategy*, **23**(2), Summer 2014, pp. 225-257. ***Lead article***

OTHER PUBLICATIONS

"The Rise of Data-Driven Decision Making is Real but Uneven" (with Erik Brynjolfsson) *Harvard Business Review* online February 3, 2016. https://hbr.org/2016/02/the-rise-of-data-driven-decision-making-is-real-but-uneven

"Decentralization vs. Centralization in IT Governance: It's Not as Simple as You Might Think," *Communications of the ACM*, no. 11, November 2012, pp. 28-30

"The Short Life of Online Sales Leads" (with James B. Oldroyd and David Elkington) *Harvard Business Review* **89** (3), March 2011, p. 28

"Productivity Leadership and Strategic Investments in Innovation: The Adoption of E-Business Capabilities," *Academy of Management Best Paper Proceedings,* George T. Solomon (Ed.), 2008

SUBMITTED/WORKING PAPERS

"The Digital Reorganization of Firm Boundaries: IT Use and Vertical Integration in U.S. Manufacturing" (with Chris Forman), R&R at *Management Science*

"Data in Action: Data-Driven Decision Making in U.S. Manufacturing" (with Erik Brynjolfsson) Center for Economic Studies Discussion Papers #CES 16-06, U.S. Census Bureau

WORK IN-PROGRESS

"Managerial Practices, Productivity, and Employment Growth of Young Manufacturing Firms" with Wang Jin and Kathryn Shaw

"Data-Driven Management Practices and Innovation Trajectories" with Wang Jin

"IT, Geography, and Diffusion of Management Practices" with Naomi Hausman & Raffaella Sadun

"Delegation in U.S. Manufacturing" with Erik Brynjolfsson

"The Diffusion of IT-based Capabilities in Supply Networks" with Frank Nagle and Steven Kahl

AWARDS, HONORS & FELLOWSHIPS

2015	Connaught New Researcher Award, University of Toronto
2015	Finalist, Best Paper Award, Workshop on Information Systems and Economics (WISE)
2014	Finalist, Oliver E. Williamson Best Conference Paper Award, ISNIE 2014 Annual Conference
2013	$120,000 U.S. – Israel Binational Science Foundation Grant, joint with Naomi Hausman
2010	Finalist, Best Dissertation Award, Technology & Innovation Management (TIM) Division, Academy of Management
2008	Best Paper Proceedings, Academy of Management
2008	Finalist, Best Student Paper - TIM Division, Academy of Management
2007-2008	U.S. Census Bureau Dissertation Fellowship
2007	State Farm Companies Foundation Doctoral Dissertation Award
2007	Kellogg Nominee, BPS Dissertation Consortium, Academy of Management
2007	Kellogg Nominee, CCC Doctoral Student Colloquium
2006	Kellogg Nominee, TIM Doctoral Student Consortium, Academy of Management
2002-2007	Kellogg School of Management Doctoral Fellowship
1993	Phi Beta Kappa, Stanford University

PROFESSIONAL ACTIVITIES

Presentations

2016	Cornell University Applied Microeconomics Seminar American Economic Association Annual Meeting, San Francisco CA webcast on January 4, 2016: https://www.aeaweb.org/webcasts/2016/index.php in "Digitization and Innovation" session
2015	Workshop on Information Systems and Economics (WISE), Dallas TX **– best paper finalist** Empirical Management Conference, Stanford MIT Organizational Economics Lunch Academy of Management annual meeting, Vancouver- *All-Academy PDW on "Big Data Management and Strategy: Emerging Research Directions"* Initiative on the Digital Economy Annual Meeting, MIT Wharton, University of Pennsylvania Fox School of Business, Temple University National Bureau of Economic Research (NBER) Winter Digitization Meetings, Stanford
2014	Carey Business School, Johns Hopkins University NBER Productivity Lunch, Cambridge MA ISNIE Annual Conference, Duke University – **best paper finalist**
2013	Roundtable for Engineering Entrepreneurship Research (REER), Georgia Tech 3rd ICT Conference Munich 12th Conference on the Comparative Analysis of Enterprise Data (CAED), Atlanta Fed Academy of Management annual meeting, Orlando NBER Summer Institute: Economics of IT and Digitization

2013, con't	DRUID, Barcelona
	Atlanta Competitive Advantage Conference
	Smith Entrepreneurship and Innovation Research Conference, University of Maryland
	Center for Economic Studies, U.S. Census Bureau, Washington D.C.
	Brandeis University International Business School
	Fuqua School of Business, Duke University
	Weatherhead School of Management, Case Western Reserve University
	Rotman School of Management, University of Toronto
	Scheller College of Business, Georgia Tech
	American Economic Association annual meeting, San Diego
	Harvard Business School Digital Business Seminar
2012	Workshop on Information Systems and Economics (WISE), Orlando
	Toulouse Network for Information Technology, Washington D.C.
	Academy of Management annual meeting, Boston
	NYU Economics of Strategy Workshop
	Statistical Challenges in e-Commerce Research (SCECR), Montreal
	DRUID, Copenhagen – **semi-plenary session**
	MIT Organizational Economics Lunch
	NBER Productivity Lunch
2011	Census Research Data Center Annual Conference, Minneapolis
	NBER Summer Institute: Personnel Economics
2010	International Industrial Organization Conference (IIOC), Vancouver
	Sloan Industry Studies Association conference, Chicago
	American Economic Association annual meeting, Atlanta
2009	Harvard/MIT Organizational Economics Seminar
	Academy of Management annual conference, Chicago
	International Industrial Organization Conference (IIOC), Boston
2008	NBER Productivity Lunch, Cambridge
	MIT Innovation and Entrepreneurship Seminar
	HBS Technology and Operations Management Seminar
	Workshop on Information Systems and Economics (WISE), Paris
	North American Productivity Workshop (NAPW), New York
2007	
	Federal Reserve Bank of Chicago
	Workshop on Information Systems and Economics (WISE), Montreal
	NBER Productivity Lunch
	Management and Strategy Seminar, Kellogg School of Management
	Research Data Centers Annual Research Conference, U.S. Census Bureau, Washington DC
	Center for Economic Studies, U.S. Census Bureau, Washington D.C.
	CCC Doctoral Student Consortium, Georgia Tech

Job Market Talks: Harvard Business School; Goizueta Business School; Fuqua School of Business; Wharton School of Management; University of Illinois at Urbana-Champaign College of Business; Robert H. Smith School of Business; Columbia University Graduate School of Business; HEC Montréal École de Gestion; Center for Economic Studies, U.S. Census Bureau

Discussant

2015	NBER Summer Institute: Economics of IT and Digitization Workshop
2013	DRUID, Barcelona
2011	NBER Summer Institute: Economics of IT and Digitization Workshop
2010	Workshop on Information Systems and Economics (WISE), Phoenix
	International Industrial Organization Conference (IIOC), Vancouver
2009	Workshop on Information Systems and Economics (WISE)
	International Industrial Organization Conference (IIOC), Boston
2008	Workshop on Information Systems and Economics (WISE)

Participant

2009-present	NBER Summer Institute and winter meetings for Economics of Digitization, Organizational Economics, and Productivity, Innovation, and Entrepreneurship
2013, 2014, 2015	CCC Doctoral Student Consortium (faculty participant)
2010	BPS Division New Faculty Consortium, Academy of Management
2009	TIM Division New Faculty Consortium, Academy of Management
2005	Center for Digital Economy Research Summer Workshop on the Economics of Information Technology, Stern School of Business, New York, NY
2004	European Science Days Summer School on Economics of Organizations in Steyr, Austria

Ad-Hoc Referee

American Economic Review; DRUID annual meeting; Information Economics and Policy; Information Systems Research; Journal of Business and Economic Statistics; Journal of Economics and Management Strategy; Journal of Financial Economics; Journal of Law, Economics, and Organization; Journal of Industrial Economics; Journal of Management Information Systems; Journal of Productivity Analysis; Management Science; Organization Science; Production and Operations Management Journal; Strategic Management Journal; Social Sciences and Humanities Research Council of Canada (SSHRC)

Primary Investigator

2014 - present	"Organizations in the Digital Economy: Information Technology Use, Complementary Investments, and Their Impacts on Firm Outcomes," U.S. Census Research Data Center Project, joint with Chris Forman
2007-2012	"Productivity, Supply Chain Structure, and Information Technology Investment," Census Research Data Center Project #CH-00615

Post-Doctoral Advising

Wang Jin (2014- present)
Meng Liu (2015- present)
Erina Ytsima (2015- present)

Doctoral Advising & Committees

Frank Nagle (2015, University of Southern California)
Venkat Kuppuswamy (2011, University of North Carolina)

Service

2012-2014 Industry Studies Association Early Career Development Committee

Member

Academy of Management
American Economic Association
DRUID
INFORMS
Society for Institutional and Organizational Economics

NON-ACADEMIC EMPLOYMENT

2000-2002 **Exemplary Software** **Cupertino, CA**
Marketing Manager, Sr. Product Marketing Analyst, and Quality Assurance Lead
Early-stage software startup focused on web-based supply chain management solutions. Assisted in business plan development, presentations to investors, development of initial marketing collateral, and initial product strategy and specification development. Built the first software testing team and protocols.

1994-1998 **Risk Management Solutions, Inc.** **Menlo Park, CA**
Senior Analyst, Analyst, and Quality Assurance Engineer
Now a leading provider of software and services for managing insurance portfolio risk from natural disasters. Joined when the firm was an early-stage startup of roughly 30 people. Used early versions of the product on behalf of insurance and re-insurance clients, helped in specification development, tested later versions of the software.

PERSONAL

Citizenship: United States
Married; 2 children (born 2006 and 2011)

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