ABSTRACT

Title of Dissertation: ESSAYS ON THE MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

Scott William Ohlmacher
Doctor of Philosophy, 2017

Dissertation directed by: Professor John Haltiwanger
Department of Economics

This dissertation examines the role that management practices play in plant performance and addresses the many challenges that accompany efforts to measure accurately the adoption of management practices.

I first provide background on a recent Census Bureau survey, the Management and Organizational Practices Survey (MOPS), which measures management and organizational practices at manufacturing plants in the United States. Economists have long hypothesized that management is an important component of firm success, but until recently, the study of management was confined to hypotheses, anecdotes, and case studies. Building upon the work of Bloom and Van Reenen (2007), the Census Bureau conducted the first-ever large-scale survey of management practices in the United States, the MOPS, for 2010. The Census Bureau conducted a second, enhanced version of the MOPS for 2015.

Next, I use data from the MOPS 2010 to examine changes in establishment-level management practices at approximately 12,000 continuing establishments between 2005 and 2010. I find that within-establishment changes in productivity are correlated primarily with practices related to performance incentives, particularly performance bonus practices. I present evidence that plants use performance bonuses as a channel of wage adjustment during the Great Recession, which explains most of the within-plant correlation between structured management practices and productivity. That is, negative demand shocks during the Great Recession negatively affect both measured productivity and the availability of bonuses and manufacturing plants. There is limited evidence that changes in bonus practices for reasons other than demand shocks have an impact on plant outcomes over the period from 2005 to 2010.

Finally, I present further background on the cognitive testing practices that the Census Bureau used to develop the MOPS. Because management is an intangible input into plant production functions, it is not as easily measured as conventional inputs such as labor or capital. Pretesting was essential to ensure that quality data was collected. The results of the pretesting process provide insight into how respondents interpret the MOPS questionnaire, including the questions related to bonus practices, which in turn influences the interpretation of the results presented in the preceding chapter.

ESSAYS ON THE MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

by

Scott William Ohlmacher

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2017

Advisory Committee:
Professor John Haltiwanger, Chair
Professor Ethan Kaplan
Professor John Shea
Professor Luminita Stevens
Professor Liu Yang

Dedication

For Charmaine, who waits for me, should I fall behind.

Acknowledgements

A great many people made this dissertation possible. I am especially grateful to my dissertation committee. My primary advisor, John Haltiwanger, introduced me to the data that drives this paper, the field of microproductivity research more broadly, and the Center for Economic Studies (CES) at the U.S. Census Bureau. John Shea read every draft of my primary research and provided detailed feedback of the content and the presentation. Ethan Kaplan was a constant source of positivity about my research, helping me think through the difficult identification problems. Luminita Stevens got me interested in the role that management plays in firm decision-making and taught me the basics of conducting independent research. Liu Yang's interest in the central dataset in this dissertation gave me the opportunity to better understand that data.

I could not have written this dissertation without the support of my colleagues at CES. Lucia Foster gave me the opportunity to start working on the Management and Organizational Practices Survey (MOPS), for which I am extremely grateful. She has been an outstanding mentor. She and Cathy Buffington took me under their wings and made me a full-fledged partner in the MOPS project. The expertise that I gained from working with them on this project is the subject of this dissertation. Emek Basker and Javier Miranda gave generously of their time to provide thoughtful feedback about my paper. Many others, including, but not limited to, Shawn Klimek, Cheryl Grim, and Emin Dinlersoz also provided mentorship and feedback.

I owe much to my classmates at the University of Maryland. I am grateful to all of my colleagues from the 2012 cohort, but I should highlight Martha Caulkins, Stephanie Rennane, Marisol Rodriguez Chatruc, and Sebastian Ramirez, who are all

brilliant people and better friends. Jake Blackwood provided advice on this research both at UMD and CES.

I would not be an economist now if not for my undergraduate economics experience at the University of Delaware. Ken Lewis, Vera Brusentsev, Eleanor Craig, and Jeff Miller all encouraged me to pursue this career from day one of my freshman year. Kolver Hernandez and Burton Abrams gave me early research experience. Jim Butkiewicz provided mentorship and tirelessly worked to help me get admitted to the best graduate program possible. My classmate and best friend, Bill Dowd, has given me advice on every piece of research I have ever written. I also owe the mathematics department, especially Russell Luke, David Braun, John Pelesko, and Tom Angell, a debt of gratitude for their support.

I became interested in economics as a freshman in high school thanks to the Federal Reserve's Fed Challenge program. Not many people get such early exposure to this field, and I am grateful to all involved, especially Seth Roberts, my first economics teacher.

I am thankful to all of my family and friends, especially my parents, Debbie and Bill Ohlmacher, who encouraged me to follow this twisting road after coercing me to sign up for Fed Challenge in the first place.

Finally, I thank my number one supporter, my wife, Charmaine. Her love and patience made this possible.

Disclaimer

Any opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information was disclosed.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Does management matter for business performance? If so, are there specific, transferable practices that are associated with success? Can management be learned? How much of management is embodied in the manager and how much can be institutionalized? How does one measure management?

This flurry of questions has vexed economists and business people for generations, but answering the last question is key to unlocking the answers to all of the preceding questions. This dissertation covers one possible answer, a new Census Bureau dataset, the Management and Organizational Practices Survey (MOPS). This dataset, developed in partnership with researchers from Stanford University and MIT, is the first large-scale attempt to measure management practices in the United States.

One module of the MOPS covers a set of structured management practices: practices related to performance monitoring, targeting, and incentives that are explicit, formal, frequent, and specific. These questions can be used to create a measure of the degree of structure in a plant's management practices.

Although the MOPS is the first survey of its kind, it did not arise out of a vacuum. It follows in a rich tradition of survey data to measure management, and builds on several innovative predecessors. The second chapter of this dissertation discusses the development of the MOPS and its context. That chapter details the content of the MOPS related to management, organizational practices, data in decision making, and uncertainty.

The third chapter of this dissertation utilizes the MOPS data directly to address the first question above. Consistent with the existing literature on

management, I find that structured management practices are positively correlated with plant-level outcomes such as productivity and employment growth. However, I find that within-plants, most of the correlation between changes in management practices and changes in productivity can be explained by changes in the availability of bonuses.

This finding highlights the complexity of measuring management. Plants may change the availability of bonuses for several reasons. Bonuses may become more or less available based on management decisions to incentivize workers, or they may become more or less available based upon demand shocks that affect the cash flow of the business. If the latter effect dominates, it weakens the argument that changes in structured management practices have a causal impact on firm outcomes. I find evidence that changes in bonuses are demand-driven, but limited evidence that changes in bonus practices for reasons other than demand shocks have an impact on plant productivity.

The key distinction in the third chapter is between the plant's policies related to bonuses and its realization of those policies. The intent of the MOPS is to measure, amongst other things, the management policies of the respondent plants. Taking bonuses as an example, the intent is to ask, "in normal economic conditions, what share of workers would be eligible for bonuses?" However, with survey data, respondents are free to interpret questions as they see fit. This may lead respondents to answer instead "what share of workers received bonuses?" The answer to this interpretation is much more likely to be influenced by economic conditions than the intended interpretation.

The final chapter of this dissertation is an exploration of how the MOPS was tested and written in order to address these concerns. All survey data is susceptible to the risk that some respondents misinterpret the questions. The Census Bureau rigorously pretests all surveys prior to fielding them. However, because management is, by definition, a less concrete concept than traditionally measured inputs such as capital and labor, the respondent's interpretation is more difficult to gauge or predict. The last chapter offers insight into just how respondents understood questions during pretesting. It provides useful information for researchers hoping to use the MOPS data or conduct their own research on management. It also provides further context for the results in preceding chapters.

Chapter 2: The Management and Organizational Practices Survey: An Overview[1]

(with Cathy Buffington, Lucia Foster, and Ron Jarmin)

Introduction

As noted above, the important role of management in the success of firms has long been stressed by academics in business and management, the media, and consultants, but most evidence has been anecdotal or based primarily on case studies. In this chapter, we describe one of the innovative steps forward in measuring management practices: the development and fielding of the first ever large-scale survey of management in the United States, the Management and Organizational Practices Survey (MOPS). The MOPS was developed as a partnership between the Census Bureau and an external research team of Nick Bloom (Stanford), Erik Brynjolfsson (MIT), and John Van Reenen (MIT), and later Steven Davis (University of Chicago) and Kristina McElheran (University of Toronto), and was sent to about 50,000 manufacturing establishments in 2011 and 2016. In this chapter, we provide the background and motivation for developing the MOPS by describing the existing empirical literature on management practices, uncertainty, and data and decision making.

Already the MOPS has had wide-ranging impacts on the study of management practices worldwide, as questions based on the MOPS have been or will soon be

[1] This paper is adapted from a working paper co-authored with Cathy Buffington, Lucia Foster, and Ron Jarmin and issued as part of the Center for Economic Studies (CES) Working Paper series. (Buffington, Foster, Jarmin, and Ohlmacher; 2016a)

issued as part of censuses in Canada, Germany, Pakistan, Japan, Australia, and the United Kingdom (Haltom and Bloom, 2014). The statistical agencies of Pakistan and Mexico have issued surveys that were adapted from the MOPS, although these surveys were conducted face-to-face rather than with paper instruments or electronically due to the fact that mail and e-mail were considered unreliable for contacting firms (Bloom, Lemos, Sadun, Scur, and Van Reenen; 2016).

While economists have been interested in the structure of the firm since at least the birth of the modern profession,[2] it has only been in the post-war period that management has been considered explicitly in the study of firms. Early "managerial" models of the firm (Marris, 1964) focus on principal-agent problems, wherein a manager of a firm may seek to solve a different objective than her profit-maximizing employer. A small theoretical literature developed around a more robust model of the role of management in firm structure starting in the early 1990's, but meaningful empirical studies of the role of management began to supplement these early theories only much later.

The theoretical literature on management that developed starting with Radner (1992) largely focused on incorporating the anecdotal evidence available in the business press and aggregate data into models of firm structure. Radner's (1992) interest in management stems largely from the observation that the growing number of large firms must require a more complex internal structure than allowed by the simple model of a profit-maximizing agent, or even a principal-agent model. While

[2] Syverson (2011) notes that academic writing on the importance of management for profitability dates back at least to Francis Walker (1887).

Radner's (1992) motivations are not rooted in extensive empirical study of the role of management, this small literature has had far-reaching implications, including motivation for macroeconomic models of rational inattention (Adam, 2007). Milgrom and Roberts (1990) propose a theoretical model of technological adoption that exhibits complementarities with changes in work practices and firm organization.

Recent findings on productivity have shown that there is significant and persistent dispersion of productivity across firms and even establishments that can only partially be explained by differences in inputs (Syverson, 2004), production technologies, price heterogeneity (Foster, Haltiwanger, and Syverson; 2008), and idiosyncratic shocks (Hsieh and Klenow, 2009). Based on pre-existing theoretical research and anecdotal evidence regarding the importance of management practices, the hypothesis was put forward that perhaps management practices could account for some of the firm- and establishment-level heterogeneity in productivity.

Unlike these studies of firm- and establishment-level heterogeneity in productivity, which were made possible by the availability of representative or even population-level microdata from government sources, empirical studies of management were virtually non-existent until ten years ago. Syverson (2011) goes so far as to state that "perhaps no potential driver of productivity differences has seen a higher ratio of speculation to actual empirical study." Several recent studies have begun to alter this ratio, however, making creative use of existing datasets. Bertrand and Schoar (2003) use publically available data to match CEOs to firm performance and find that CEO demographic data predict management style. Ichniowski, Shaw, and Prennushi (1997) and Bartel, Ichniowski, and Shaw (2007)

examine the impact of changing management practices on productivity in industry-specific samples of steel finishing and valve manufacturing plants, respectively. Ichniowski et al. (1997) and Bartel et al. (2007) develop specific surveys of the human resource management practices for their respective samples; the latter also considers complementary IT investment. Acemoglu, Aghion, Lelarge, Van Reenen, and Zilibotti (2007) use measures of decentralization from two French data sets (Changements Organisationnels et Informatisation and Enquête Response) and a British data set (Workplace Employee Relations Survey) as proxies for delegation of decision making to managers. Related work by McElheran (2014) links the private Harte Hanks Computer Intelligence database to performance data from the 1997 Census of Manufactures to examine decentralization of decision making within multi-unit firms.

In addition, a sizeable literature in the field of development economics has taken shape over the past five years focusing on the business training of microenterprises. This literature is primarily experimental in nature, offering business training to selected entrepreneurs, with mixed results.[3] For example, Bloom, Eifert, Mahajan, McKenzie, and Roberts (2013) conducted a field experiment on 17 Indian textile firms having between 100 and 1,000 employees wherein the experimental firms were given management training, and performance was extensively monitored during and after the training period.

---

[3] See Karlan, Knight, and Udry (2012) and McKenzie and Woodruff (2012) for surveys of this literature. De Mel, McKenzie, and Woodruff (2014) also constructed a survey tool to gauge the existing management skills of entrepreneurs in Sri Lanka. The instrument can be found at http://www2.warwick.ac.uk/fac/soc/economics/staff/cwoodruff/data.

More ambitious direct measurement efforts have also taken shape. Several large-scale, multi-industry surveys were recently developed and administered. One of these, the World Management Survey (WMS), is of special interest since it has served as a starting point of a sort for the MOPS. The WMS, started in 2004, has run extensive double-blind telephone interviews on management practices with over 11,300 organizations in manufacturing across 34 countries between 2004 and 2014, and its methodology has been extended to samples in the retail, education, and healthcare industries in that time. As detailed below, the WMS has been adapted by international organizations for a survey and Statistics Canada has also developed two related surveys.

This chapter proceeds as follows: we provide an overview of existing surveys of management, followed by a discussion of the core content of the MOPS. We then discuss the two modules added to the MOPS for 2015, "Data and Decision Making" and "Uncertainty." Finally, we provide discussion of future directions and conclude.

Existing Management Surveys and Research

Management practices have long been used as an explanation for the residual firm- and establishment-level heterogeneity in productivity that could not be explained by other, more measurable factors, even in the absence of strong empirical support. However, increasingly economists and government agencies have conducted surveys in an effort to measure management practices. Tables 2.1 and 2.2 provide an overview of these surveys; we discuss each in turn below.

The most widely cited empirical study of management at this time, the WMS, uses 18-question telephone interviews to gather evidence regarding the importance of

management practices. A summary of the practices of the WMS is offered in Bloom, Lemos, Sadun, Scur, and Van Reenen (2014b) and a synopsis is given here.[4] The WMS hires students in Master of Business Administration (MBA) or similar programs to call mid-level managers of firms in manufacturing, healthcare, education, and retail in 20 countries. Each interview is conducted in the native language of the interviewee, and the calls last 45 minutes on average. The interview questions are open-ended, and then the interviewers score the responses on a scale from one (worst) to five (best).

The interviewee is not aware that the responses are scored, nor is the interviewer provided information about the firm's performance when conducting the interview; moreover, the sample firms are chosen so that the interviewer is unlikely to have prior knowledge of the firm. The firms' performance and financial data are obtained from independent sources. The interviewees are randomly selected from the population of all medium-sized firms in the given industry and country, defined as manufacturing and retail firms that have 50-500 employees, hospitals that deliver acute care, and schools that educate 15-year-old students.

The questions asked of the interviewee fall into three categories: monitoring, targeting, and incentives/personnel management. The questions on monitoring ask the extent to which firms measure performance within the firm and use that data (if collected) to improve performance. The questions on targeting attempt to gauge how well firms set forward-looking goals and course correct if those goals are not met.

---

[4] For a detailed methodology, to view the survey instruments, or to access WMS data, visit worldmanagementsurvey.org.

Incentives/personnel management questions examine how employees are promoted, rewarded, and retained, or alternately reprimanded and dismissed.

Bloom and Van Reenen (2007) present the first results of the WMS, finding that greater implementation of structured management practices -- that is, increased monitoring of firm activity, implementation of clear targeting practices, and the presence of strong incentives for achieving the establishment's targets -- is associated with higher productivity, profitability, and survival rates. They also compare cross-country results and find that U.S. firms generally implement more structured management practices than European firms, although there remain high levels of within-country dispersion of practices. Poor management practices are frequently associated with weaker competitive pressures and firms practicing primogeniture.

Bloom, Sadun, and Van Reenen (2012b) examine the management practices of multi-national firms and find that firms with establishments in countries with high levels of trust tend to decentralize decision making. Establishments of multinational firms tend to have high levels of structured management practice implementation in general. Bloom, Sadun, and Van Reenen (2015) find that private equity owned firms have more structured management practices than do government, family, or privately-owned firms, particularly in monitoring practices. Private equity owned firms are also more likely to be structured in a way that grants more autonomy to individual establishments relative to other types of firms.

Bloom et al. (2014b) note that there are high levels of dispersion in adoption of structured management practices across schools (Bloom, Lemos, Sadun, and Van Reenen; 2014c) and hospitals (Bloom, Sadun, and Van Reenen; 2013c), with

government-run schools and hospitals generally having lower scores on structured management scores than their privately-owned counterparts. Other users of the WMS methodology have found a spectrum of adoption of structured management practices in foster care, adoption, and nursing homes (Delfgaauw, Dur, Propper, and Smith; 2011); tax agencies in OECD countries (Dohrmann and Pinshaw, 2009); public-private partnerships (Homkes, 2011); substance abuse clinics (McConnell, Hoffman, Quanbeck, and McCarty; 2009); UK university departments (McCormack, Propper, and Smith, 2013); tradable service firms in Ireland (McKinsey and Company, 2009); Nigerian civil service (Rasul and Rogger, 2013); and American hospitals and cardiac care units (McConnell, Lindrooth, Wholey, Maddox, and Bloom; 2013, 2016). Rasul and Rogger (2015) also find that ethnic diversity at public sector organizations in Nigeria is positively correlated with structured management practices. Rahaman and Al Zaman (2013) combine the Bloom and Van Reenen (2007) WMS data set with Loan Pricing Corporation DealScan data to show that structured management practices are negatively correlated with interest rates on corporate loans and that firms with more structured practices are more likely to borrow from more reputable lenders than firms with less structured practices.

In 2008 and 2009, the European Bank for Reconstruction and Development and the World Bank adapted the WMS to conduct the Management, Organisation, and Innovation survey (MOI) to study management practices in 10 transition countries. Although the 12 questions on the MOI survey instrument were adapted from the WMS, the questions were closed rather than open-ended, and interviews were conducted face-to-face rather than over the telephone. Using MOI data, Bloom,

Schweiger, and Van Reenen (2012c) find that management scores in Central European transition countries are quite similar to management scores in Western Europe, while Central Asian transition countries trail other developing Asian countries in structured management practice adoption.

The National Employer Survey (NES), conducted by the Census Bureau over three waves (1993, 1997, and 2000), asked questions related to employees and employment, employee training, business characteristics, and equipment and technology. The NES had 3,358 respondents for 1993 and 5,465 respondents for 1997 (and a longitudinal component).[5] Supplements on partnerships between employers and schools were conducted by telephone interview in 1996 and 1998. A third wave of the NES was run in 2000, sampling 2,825 establishments that responded to the second wave of the survey as well as 50 employees each for 225 matched establishments. The establishment component of the NES, which was a joint venture with the National Center for the Educational Quality of the Workforce, was conducted as a computer-aided telephone interview of plant managers.

Cappelli and Neumark (2001) use NES data and find weak evidence of a positive impact of increased decision making power for employees on productivity. Black and Lynch (2001) find that unionized establishments with increased worker decision making have higher productivity than do similar nonunion establishments and unionized firms with traditional decision making structures. Establishments whose employees have higher education levels are more productive than

[5] For a detailed description of the NES, see Cappelli (2001).

establishments with lower education levels, and establishments with more computer usage by non-managers are more productive than establishments where non-managers are less likely to use computers.

Statistics Canada conducted the Workplace and Employee Survey (WES) annually on a representative sample of approximately 10,000 to 15,000 establishments between 1999 and 2006. The survey included questions on compensation, training, human resources practices, organizational change, performance, business strategy, innovation, and technology use. Statistics Canada also ran the Survey of Innovation and Business Strategy on roughly 4,000 and 8,000 establishments in 2010 and 2013, respectively. The establishments were drawn from fourteen industries as defined by the North American Industry Classification System (NAICS). The survey sought to gather information on monitoring, structure, use of advanced technology, human resource management, and other business strategies.

Statistics Canada's WES was conducted in two parts: a computer-aided phone survey administered to employers and a telephone interview conducted with employee participants.[6] The survey covered a longitudinal sample of establishments, with approximately 9,000 establishments selected in 1999, and with new establishments gradually added (and naturally other establishments exiting), leading to a sample of approximately 15,000 units in 2005. The establishments were selected to be representative of workplaces in Canada. The employer survey consisted of 50 questions divided into nine sections: workforce characteristics and job organization,

[6] The 2006 survey consists only of the employer component. For more information on the WES, visit www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=2615.

compensation, training, human resources practices, collective bargaining, workplace performance, business strategy, innovation, and technology use.

The employee sample consisted of no more than 24 randomly-selected employees per establishment, with an annual sample of about 20,000 workers. Employees are surveyed for two years, and then a new sample is drawn. The employee survey consisted of 59 questions across ten categories: job characteristics, computers and other technologies, training and development, career-related training, employee participation, personal and family support programs, worker representation and industrial relations, compensation, work history/turnover, and demographics.

Yang, Kueng, and Hong (2015) use the employer component of the WES to show that adoption of particular structured management practices is strongly correlated with particular business strategies of for-profit firms. These strategies are: novelty, low-cost, and high-quality. Firms pursuing "novelty" strategies seek to provide a good or service that is unique in itself. Firms pursuing low-cost or high-quality strategies seek to compete on either cost or quality. Low-cost firms tend to delegate more to managers, whereas novelty firms tend to implement more autonomy for all workers. Both high-quality and novelty firms are likely to implement structured management practices related to incentives. Hong, Kueng, and Yang (2015) also use the employer component of the WES to show that performance-based pay systems are complementary to decentralization of decision making from principals to managers.

The Survey of Innovation and Business Strategy (SIBS), also from Statistics Canada, took representative samples of approximately 4,000 and 8,000

establishments in 14 NAICS industries in 2010 and 2012, respectively.[7] The survey consisted of over 100 questions on business strategies and monitoring, enterprise structure, operational activities, relocation of activities in to and out of Canada, sales, relationships with suppliers, technology usage, innovation, structured management practices, and use of government support programs. This survey was sent to establishments both as a paper and an electronic survey form.

Brouillette and Ershov (2014) use the SIBS to construct a measure of management practices that is analogous to the index created by Bloom and Van Reenen (2007) and find that larger firms implement more structured practices. They find that this measure is positively correlated with a measure of business innovation for all sectors, but only in manufacturing industries are structured practices positively and significantly correlated with sales and profits.

Management and Organizational Practices Survey

The Management and Organizational Practices Survey (MOPS) collects information on targeting, monitoring and incentives managerial practices; the locus of decision making within the organizational structure of the firm to which the establishment belongs; and related background information from a sample of U.S. manufacturing establishments.[8] The 2010 survey consisted of 37 questions in three sections: management practices, organization, and background characteristics. The

[7] For more information on the SIBS, visit www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5171.

[8] The Census Bureau's informational website on MOPS can be found at www.census.gov/mcd/mops/index.html.

2015 survey consists of 47 questions covering the original (modified) sections and new sections on data and decision making and uncertainty. We first discuss the overall sample and collection strategies and the three common sections, and then discuss the two new modules. Appendices A and B contain the complete instruments for 2010 and 2015, respectively.

Sampling, Collection, and Dissemination Strategies

The sample for the MOPS consists of the approximately 50,000 establishments in the Annual Survey of Manufactures (ASM) mailout sample. The mailout sample for the ASM is redesigned at 5-year intervals beginning the second survey year subsequent to the Economic Census. (The Economic Census is conducted every five years in years ending in '2' or '7.') For the 2009 and 2014 survey years, a new probability sample was selected from a frame of manufacturing establishments of multi-location companies and large single-establishment companies in the 2007 and 2012 Economic Census, which surveys establishments with paid employees located in the United States. The size of this sampling frame was approximately 101,250 establishments in 2014. Using the Census Bureau's Business Register, the mailout sample was supplemented annually by new establishments, which have paid employees, are located in the United States, and entered business in 2008 – 2010 or 2013 – 2015.[9]

[9] This paragraph is the official methodological documentation for the 2010 MOPS, which can be found at https://www.census.gov/mcd/mops/how_the_data_are_collected/index.html. The certainty category slightly differs over industries. For more details on the ASM sample design see: http://www.census.gov/programs-surveys/asm/technical-documentation/methodology.html

The MOPS is conducted using paper and electronic survey instruments; the respondent may select the reporting mode. The MOPS is sent in the spring of the year after the reference year (April 2011 for MOPS 2010, May 2016 for MOPS 2015). Most Census Bureau surveys, including the ASM, are mailed to the firm's business address in the BR. For single-establishment firms, this is the business mailing address.[10] For multi-unit firms, forms for all establishments in the sample are usually grouped and sent to the business mailing address, which is often the firm's headquarters, with instructions for the survey coordinator to distribute forms to the respondent plants as necessary.[11]

Because the MOPS asks respondents about practices that may vary across plants within a multi-unit firm and information about those practices may not be known at the firm level, the MOPS follows a unique mail strategy. For plants in multi-unit firms, the MOPS is mailed to the establishment physical address of the plant rather than to the firm's business address. In the absence of a physical address for the establishment, the BR is populated with the firm's business address. If the form is returned by the U.S. Postal Service as "undeliverable as addressed," it is then re-mailed to the firm business address. More detailed information on the collection and processing of the MOPS is available in Buffington, Hennessy, and Ohlmacher (forthcoming).

---

[10] This address may or may not be the physical location of the establishment. It can be an administrative office, co-located with the plant or not.

[11] For respondents who prefer to answer surveys online, a letter is mailed to the enterprise address with login information. For multi-unit firms, the survey director at the firm distributes the login information to respondents at various plants as necessary.

An important feature of the MOPS is that it can be linked with little effort to Census Bureau data sets on plant-level outcomes. Since every establishment in the MOPS sample is also in the ASM sample, the results of MOPS can be linked with near certainty to annual performance data at the plant level, including outcomes on sales, shipments, payroll, employment, inventories, capital expenditure, and more for the corresponding ASM panel.[12] Matching the MOPS to the Longitudinal Business Dataset (LBD) enables longitudinal research on establishment-level management practices and allows researchers to link MOPS data to numerous Census Bureau microdata sets, including the quinquennial Census of Manufactures, which is sent to all manufacturing establishments for years ending in '2' or '7.'

Dissemination Strategy

Raw data from the MOPS 2010 is available to qualified researchers on approved projects through the Federal Statistical Research Data Center (FSRDC) network. Once the MOPS 2015 collection is complete and the data has been processed, the raw data for the MOPS 2015 will also be available in the FSRDCs. For the MOPS 2015, the Census Bureau plans to release official tables using the data for management questions 1-16. Planned tables will provide aggregated results by subsector, state, plant employment size, and plant age, as well as question-level statistics. Statistics from MOPS 2010 were released via a press release and a detailed

[12] The ASM sample is updated over the course of the sample period to reflect establishment openings and closures, and thus not all establishments will be matched to the ASM for all years between 2009 and 2013. Similarly, non-response issues may prevent some establishments from being matched.

working paper (Bloom, Brynjolfsson, Foster, Jarmin, Saporta-Eksten, and Van Reenen; 2013a).

Researchers in the FSRDCs have begun utilizing the MOPS 2010 raw data. Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten, and Van Reenen (2016a) have explored possible drivers of differences in management within and across firms. Brynjolffson and McElheran (2016) show rapid adoption of data-driven decision-making practices between 2005 and 2010. Chapter 3 utilizes the MOPS 2010 data to show that the relationship between within-plant changes in management practices and within-plant changes in productivity can largely be explained by demand-driven changes in bonus practices.

Results of Collection in 2010

MOPS 2010 received responses from approximately 37,000 establishments (about 78% of the establishments to whom the survey was successfully delivered), making it by far the largest panel of establishments surveyed about management practices to date. For MOPS 2010, 58.4% of respondents answered the survey electronically and the remaining 41.6% returned a paper form. Establishments in the sample were mailed the MOPS form, instructions, and a cover letter in April 2011. After approximately two months, establishments that had received the package but not yet responded were again sent the form, instructions, and cover letter. Due to a processing error, some respondents received this follow-up despite having already responded. After approximately another month, a follow-up letter was sent to establishments who had not yet responded. A round of telephone follow-ups was completed between September 2011 and January 2012.

Developing Content

The 2010 MOPS was developed using the WMS and existing Census Bureau collections as a starting point. In order to capture some of the dynamics of these core management practices, most questions on the MOPS are asked with two points of reference; respondents are asked to report their responses for the past year (e.g., 2015) and to look backwards and respond for five years earlier (e.g., 2010). Chapter 3 utilizes this recall data to examine how within-establishment reported changes in management practices co-vary with establishment-level changes in outcomes.

The U.S. Census Bureau's quality standards require that all data collection instruments must be tested and refined to ensure that the instrument can be understood and answered and does not cause undue burden for the respondents.[13] One method of pre-testing a survey instrument is through expert review, which was conducted early in the development of the original MOPS survey and for its revised content. Another method of pre-testing is via cognitive interviews. Cognitive interviews are used to understand the respondents' thought processes as they work through the instrument and to use that knowledge to improve the survey questions. The 2010 and 2015 MOPS survey instruments were tested and refined based on the results of cognitive interviews, as well as usability testing to ensure that the instrument was functional for respondents. Chapter 4 discusses this process in detail,

[13] The specific standard is A2. For more information on the Census Bureau's quality standards, see http://www.census.gov/about/policies/quality/standards.html

and provides context for how the testing procedure should influence researchers' interpretation of the data.

Measuring Management Practices

The sixteen questions in the "Management Practices" section of the MOPS deal primarily with the structured management practices also covered by the WMS: namely, how activity is monitored, how targets for production and other monitored performance indicators are set, and how achievement of those targets is incentivized. The five monitoring questions concern the collection and use of information to monitor production. For example, *how many key performance indicators were monitored at this establishment?* The three targets questions concern the nature of targets and their integration. For example, *who was aware of production targets at this establishment?* The eight incentive questions concern whether personnel practices provide incentives to workers and managers. For example, *when was an under-performing manager reassigned or dismissed?* The sixteen questions on management practices were unchanged between the 2010 and 2015 instruments to maximize comparability. These questions are the focus of the analysis in Chapter 3.

Measuring Organization

The original "Organization" section had thirteen questions that covered the level of decision making, span of control, and data and decision making. The five questions on the level of decision making concern whether resource (personnel and capital) and output (marketing, pricing) decisions are made at the establishment or headquarters. For example, *where were decisions on new product introductions*

made? Three questions concern the structure of the organization. For example, *who prioritized or allocated tasks to production workers at this establishment?* The three remaining questions include two questions about data and decision making and one question about sources of information about management practices. For example, *what best describes the use of data to support decision making at this establishment?* The "Organization" section was modified for the 2015 MOPS and now only includes seven questions. The three questions concerning organization were dropped due to low quality responses: respondents are no longer asked for the number of employees that report directly to the plant manager, the number of direct report layers at the establishment, or who allocates tasks to production workers. The two questions on data and decision making were moved to a new expanded section (described below) and the question about the sources of information about management practices was dropped.

Measuring Background Characteristics

The questions in the "Background Characteristics" section cover both the establishment and the respondent. There were 8 background questions in 2010. The five establishment questions covered the number of managers and employees, their college education, and the presence of a union. The two respondent questions asked for seniority and tenure. The final question is a certification question for the instrument.[14]

[14] The certification question asks the respondent for her name, title, and contact information, as well as the time frame covered by the survey and the date that the survey was completed. This question is standard on Census forms. Bloom et al. (2013a) use some information from the Certification as noise controls, and this question was used during processing to evaluate duplicate responses. In Chapter 3, I

The MOPS 2015 includes a revised the background section, with two questions dropped and four questions added. These questions concerned the level of seniority of the respondent and the number of employees at the establishment (the latter is collected by the ASM). The first two questions added to the MOPS 2015 concern business strategies and production technologies. The second two additional questions concern the firm to which the establishment belongs.

For MOPS 2015, respondents are asked about changes in usage of the labor force; respondents are asked to estimate shares of workers who worked part-time, shares of workers who worked flexible hours, shares of workers who worked from home one or more day per week, and shares of workers who were cross-trained. This question will enable researchers to study the complementarities between management practices and labor practices in the U.S. as Yang et al. (2015) find for Canadian firms.

Structured management practices might be complementary to a more flexible labor force; alternatively, more structure on monitoring, targeting, and incentives may prevent such flexible arrangements from being made. Furthermore, these human resources practices are interesting in themselves for how they describe the relationship between employees and their workplaces. The 2015 MOPS will provide information on work-life balance that could be useful to both researchers and policymakers.

Respondents are also asked whether their production process can be best described as “job shop,” “batch production,” “cellular manufacturing,” “continuous

---

use the name provided in the certification question to evaluate whether or not all plants within a firm were answered by the same respondent.

flow (other than cellular manufacturing)," or "research & development or prototyping." In contrast with the view of management taken by most of the empirical literature discussed above that more structured management practices can be institutional and make firms more productive, the organizational economics literature, including Gibbons and Henderson (2013) and Roberts and Saloner (2013), tends to emphasize management as a relational concept. That is, management practices must be tailored to the unique strategic and interpersonal needs of each establishment.

Bloom, Sadun, and Van Reenen (2016c) argue that empirical results on management practices are consistent with structured management practices being a technology that firms can adopt. Introducing this new question on production technologies will allow researchers to further test the "management as a technology" model of Bloom et al. (2016c) against the "management as design" hypothesis of Gibbons and Henderson (2013) and others. Although Bloom et al. (2013a) control for industry-level fixed effects in their research, type of production may not be perfectly correlated with industry, and may provide additional insight into the relationship between management practices and outcomes.

Respondents are asked whether or not the firm is majority-owned by its founder(s) or members of a founder's family, and if it is, whether or not a founder or a member of a founder's family currently serves the firm as CEO. This will enable future research on primogeniture to compare with Bloom and Van Reenen (2007). The final additional question concerns whether the establishment is a part of a firm with production establishments in countries other than the United States. This enables research on the impact of multinational status on management practices, and is a

useful variable for many of the projects undertaken within the Census Bureau and the network of FSRDCs, even those that are not specifically focused on management and organizational practices, expanding the value of the MOPS for the statistical community, policy makers, and academics. The organizational question on the location of the firm's headquarters, which was present on MOPS 2010, has been enhanced to include a write-in box for the state or country in which the firm's headquarters was located, which serves as a useful complement to this new question, as management and organizational practices may be country (or even state) dependent.

Measuring Dynamics

The addition of a second generation of the MOPS will introduce interesting dynamics between and across the two collections of the survey. Although the MOPS is a supplement to an annual survey (the ASM), a five year time interval between survey waves was selected for the MOPS since economic theory and anecdotal evidence suggest that it takes time for management practices to change. Bloom et al. (2016c) use their model of "management as a technology" to calculate the adjustment costs of management and find that management (as measured by the WMS) has a higher adjustment cost than capital. As a result of this higher adjustment cost and the assumption that management practices are irreversible, in the sense that management scores would only decline due to depreciation, their model produces smoother five-year moments for growth in management scores than for capital growth.

In the next chapter, I discuss changes in management practices between 2005 and 2010 in great detail. I find that although the overall management score

distribution is consistent with the irreversibility story of Bloom et al. (2016c), select practices, namely incentives practices, are likely not irreversible.

MOPS 2010 is the first survey of establishment-level management practices across time by virtue of including a retrospective component of nearly every question. The longitudinal component of MOPS 2010 relies solely on the recall of the respondent, asking the respondent about her establishment's management practices in 2005.[15] As a result, there could be concerns about recall bias and therefore about the quality of the responses for 2005. Chapter 3 discusses the impact of recall bias in more detail.

MOPS 2015 includes a similar recall component for 2010. By comparing the recall responses for 2010 on MOPS 2015 to the responses for 2010 from MOPS 2010, one can measure the quality of the responses to recall questions on structured management practices. It should be noted that the 2010 and 2015 MOPS were mailed to independent samples, so not all MOPS 2015 responses will be able to be matched to responses from the MOPS 2010. However, where such matches exist, the longitudinal benefit of reissuing the MOPS survey for 2015 extends beyond adding one additional time period to the data, and can assist in assessing the quality of existing data for 2005.

As noted above, Bloom et al. (2013a) find the average management score for 2010 is higher than the average reported score for 2005, with much of that growth coming from an increase in monitoring practices. This finding supports the work by

[15] The five year time gap between the reporting period and the recall period was selected for the same reason that the MOPS 2015 was issued five years after the MOPS 2010.

Bresnahan, Brynjolfsson, and Hitt (2002) and Aral, Brynjolfsson, and Wu (2012) that finds that IT adoption and structured management practices are complementary. Brynjolfsson and McElheran (2016) combine several management questions with the two data-driven decision-making questions on the MOPS 2010 and find that a measure of data-driven decision-making also increased between 2005 and 2010. The relationship between technology adoption and structured management practice adoption is fertile ground for future research that is only possible with the recall data and repeated collection of the MOPS.

Furthermore, if structured management practices truly have a causal impact on establishment performance, a logical question is "How do establishments change their levels of implementation of structured management practices?" This is the central question addressed in Chapter 3. By adding an additional panel for 2015, MOPS 2015 allows for increased study of the dynamics of management practices in U.S. manufacturing industries. Once the MOPS 2015 data becomes available to researchers, the exercises in Chapter 3 can be extended to include this additional panel.

To this point, the existing surveys of management practices have lacked a strong longitudinal component. Although the WMS is long-running, each wave of the survey has focused on expanding the scope of the research across countries rather than across time. The WMS consists of five major waves in 2004, 2006, 2010, 2013, and 2014. All firms in the 2004 sample were re-contacted in 2006 in addition to firms that had not been previously contacted. Likewise, the 2010 sample re-contacted the

firms from the 2006 sample, but without adding new firms to the sample. The 2014 sample also re-contacted panel firms from 2013. (Bloom et al., 2016c)[16]

It is important to note that because the WMS sample is generated at the firm-level, the panels generally reflect the responses of different managers at possibly different establishments. The resampling of firms between 2006 and 2010 yielded a correlation between 2006 and 2010 management scores of 0.427, which could be a result of some combination of within-firm heterogeneity, changes in practices over time, and/or respondent bias. Additionally, the MOI deliberately resampled 404 firms (with possibly different plants and/or different respondents) from the WMS for the purpose of validating the MOI instrument and yielded a correlation between MOI and WMS management scores of 0.298 with two to three years having elapsed between the two interviews. (Bloom et al.; 2012c)

MOPS 2010 is conducted at the establishment-level, and the sample includes establishments of multi-unit firms. Bloom et al. (2016a) find that half of the variation in management practices in the MOPS sample can be accounted for by differences in management practices across establishments within the same firm. In Chapter 3, I find that firm fixed effects account for about one third of plant-level changes in bonus practices between 2005 and 2010. The WMS did perform some internal validation by re-sampling 5% of each sample using a second interviewer to contact a second plant manager within the firm. This sample of 222 firms yielded a correlation between

[16] Bloom et al. (2016c) use a panel of 13,944 firm-year observations between 2004 and 2014 to generate a 5-year growth rate of management which is then used in a simulated method of moments (SMM) estimation of the adjustment costs associated with structured management practices. However, some portion of the data is interpolated because the interview is not conducted annually.

management scores from the first and second interviews in the same year of 0.51. The difference is explained by some combination of within-firm heterogeneity and survey measurement error. (Bloom et al., 2016c)

Data and Decision Making

We start by providing motivation for the MOPS questions on data and decision making (two in 2010 and six in 2015) by reviewing the existing literature and research in this field. Part of the impetus for including management in theoretical economic models such as Radner (1992) or Adam (2007) is that managers may be essential for gathering and processing information. Indeed, two of the components of the structured management practices listed above, monitoring and targeting, can be described as a form of information processing. Management gathers information about production conditions both within and outside of the establishment (or firm) and then uses that information to set targets and make adjustments to the production process. The degree of data collection performed by firms is a key component of this relationship.

The rise of information technologies (IT) has made it possible for establishments to utilize ever increasing amounts of data in their decision making, and Brynjolfsson and Mendelson (1993) argue that the increasing availability of data has necessitated the development and implementation of structured management practices. Much of the existing work in this field is focused on the implementation of information technologies. While IT and data and decision making (DDD) are clearly complementary, they are not necessarily proxies for one another. A firm could

conceivably gather data for decision making without high levels of IT investment, while a firm that utilizes modern IT may not necessarily fully integrate DDD.

Bresnahan et al. (2002) use a combination of a telephone survey of 379 firms, computer capital data from Computer Intelligence InfoCorp, and input and output data from Compustat.[17] The telephone survey included 14 questions related to the organization of the firm's workforce, which are neither fully orthogonal to nor entirely consistent with the definition of structured management practices given above. The survey measures uses of teams, dispersion of authority, and education. The authors find that IT implementation and workplace reorganizations focused on teamwork and individual authority are both positively correlated with productivity and have complementary effects when implemented together. Similarly, Aral et al. (2012) find high levels of complementarities between IT implementation, implementation of performance pay, and human resource management practices that monitor performance and give employee feedback. Taken together, these three practices have a large positive impact on worker productivity in the 189 firms surveyed by a non-profit organization that educates firms on human resource practices that also purchased an IT system called Human Capital Management.

Bloom, Garicano, Sadun, and Van Reenen (2009) combine the WMS with a private software utilization data source called Harte-Hanks. They find that increased implementation of information technology leads to more decentralization in

[17] A detailed description of the data set is available in Brynjolfsson and Hitt (1997).

manufacturing firms, while implementation of communication technology leads to greater centralization.

The Census Bureau collected the Computer Network Use Supplement (CNUS) to the ASM sample in 1999. Like the MOPS, this data could be readily matched to high quality performance data from the ASM. Atrostic and Nguyen (2005) find that establishments that have computer networks have higher labor productivity than establishments that do not have computer networks. They find that moving from the 10^{th} to the 90^{th} percentile of computer network use was associated with a 7.2% increase in labor productivity, as well as evidence that establishments with low labor productivity in earlier periods use the introduction of computer networks to "catch up" with establishments that are more productive. Additionally, the use of networks in 1999 was more likely for establishments of multi-unit firms than for single units.

Results on DDD are similar to those on structured management practices. Using a survey conducted on 330 large, publicly traded firms in 2008, Brynjolfsson, Hitt, and Kim (2011) find that output and productivity are higher for firms that depend on data to make decisions than for other firms with similar levels of investment and IT usage. Using an instrumental variable method, they find that it seems likely that utilization of DDD leads to higher productivity, rather than it being the case that more productive firms are simply more able to then implement DDD.

Bloom, Sadun, and Van Reenen (2012a) use a modified version of the WMS survey instrument's questions on personnel management, as well as a private IT survey, accounting data, and a UK Office of National Statistics data set to show that

personnel management practices are positively correlated with IT investment and productivity. They find that U.S. multinationals achieve higher productivity from IT investment than do non-U.S. multinationals or non-U.S. companies broadly. The difference in IT productivity is attributed to complementary investment in personnel management practices in U.S. multinationals. Bartel et al. (2007) also find that investment in IT is accompanied by changes in personnel management practices in the valve production industry.

As noted above, the MOPS 2010 included two questions in "Organization" that touched upon DDD; MOPS 2015 moves these two questions to the start of the new "Data and Decision Making" component of the survey.[18] In effect, this does not affect the order of the questions, but only inserts a header above these two questions, and so the comparability of the 2010 and 2015 collections should not be adversely impacted due to question order bias. The two existing questions ask if data is available to establishments and if it is being used to make decisions when available, similar to the questions asked by Brynjolfsson et al. (2011).

Using the questions from the management section of the MOPS 2010, Bloom et al. (2013a) find that respondents report significant growth in data-driven monitoring practices between 2005 and 2010, which is a significant driver in overall improvement of management practices over that period, but they do not link this result to the two DDD questions. Brynjolfsson and McElheran (2016) use an index

[18] The new module is called "Data and Decision Making" rather than "Data-driven Decision Making" so as not to lead respondents to assign value to data utilization when it is not a part of their establishment's process.

constructed from the monitoring questions and the two DDD questions on the 2010 MOPS to find that larger, older plants of multi-unit firms adopt DDD earlier and to a larger extent than smaller, single-unit firms. However, the single-unit firms exhibit a higher correlation between DDD and performance than multi-unit firms do.

There are four new DDD questions on MOPS 2015. First, establishments are asked who chose what data was collected by the establishment. Second, respondents are asked to gauge how frequently four key data sources are used in the decision making process. The data sources referenced are production performance indicators from production technology or instruments, formal or informal feedback from managers, formal or informal feedback from non-managers, and outside data, which includes data from suppliers, customers, and/or outside data providers such as Federal statistical indicators. Third, MOPS 2015 also collects data on what types of decisions, namely new product design, demand forecasting, and supply chain management, are driven by data analysis and how frequently those decisions refer back to data. Fourth, respondents are asked about the reliance on predictive analytics.

As noted previously, two important components of structured management practices are targeting and monitoring. Monitoring is inherently coincidental, but targeting is a forward-looking process. The DDD section will include a fourth new question on the frequency with which decisions are made using predictive analytics such as statistical models of demand or production. This will enhance the ability of researchers to study the sophistication of the management practices being implemented by establishments. The role of DDD in predictive analysis also connects

DDD and management practices with the study of uncertainty, the second new section of questions in MOPS 2015, which we turn to next.

Uncertainty

The final new section of the MOPS concerns uncertainty. Here we give some background that led to the eight questions in the 2015 MOPS. Like management, "uncertainty" has long been a useful explanation for economic outcomes in the popular press, policymaking, and theoretical models. Knight (1921) defined uncertainty as the inability of a person to make a forecast about an upcoming event. In contrast to risk, where a person has some knowledge of an underlying probability distribution, uncertainty comes about when it is reasonably difficult to get a sense of the probability of outcomes, or even the entire outcome space. Because this definition of uncertainty involves unknown probabilities and outcomes, measuring the degree of uncertainty in the economy involves measuring the degree to which individuals are aware of unknown probability distributions.

This difficulty associated with measuring uncertainty has not stopped uncertainty from long being used as an explanation for economic outcomes. Bloom (2014) presents several key examples of the popular press suggesting that uncertainty over policy and growth has hindered investment and employment growth. For example, the Federal Open Market Committee attributed a slowdown in investment to firms' uncertainty about economic prospects in 2008, and the Chief Economist of the IMF Olivier Blanchard and then-Chair of the Council of Economic Advisors Christina Romer both cited uncertainty as a factor driving a reduction in demand in 2009. The theoretical literature allows for increasing uncertainty as an impetus for

reduction in economic activity through several channels, including increasing risk premia (for example, Arellano, Bai, and Kehoe (2010)) and precautionary savings (Bansel and Yaron, 2004).

Bloom (2014) examines many of the common measures of uncertainty, which include stock market volatility, GDP volatility, variation between consensus estimates and realized values of economic indicators, the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters, and the number of appearances of the word "uncertainty" in newspaper articles or the Federal Reserve's Beige Book. A research team including Scott Baker, Nick Bloom, and Steven Davis compiles indices of policy uncertainty generated from newspaper articles for the U.S., Europe, Canada, China, India, Japan, and Russia at www.policyuncertainty.com. Their index for the U.S. also includes data on expiring tax code provisions and disagreement between professional forecasters (drawn from the Survey of Professional Forecasters).

Baker, Bloom, and Davis (2013, 2015b) and Baker, Bloom, Canes-Wrone, Davis, and Rodden (2015a) examine the measurement of policy uncertainty, its role in stock market fluctuations, and its potential sources, respectively. However, Jurado, Ludvigson, and Ng (2015) note that the use of proxies to measure uncertainty may be useful only under a limited set of circumstances. For instance, they note that "stock market volatility can change over time even if there is no change in uncertainty about economic fundamentals, if leverage changes, or if movements in risk aversion or sentiment are important drivers of asset market fluctuations." (Jurado, Ludvigson, and Ng; 2015) As an alternative, Jurado, Ludvigson, and Ng (2015) use Markov chain

Monte Carlo methods to generate a measure of uncertainty from a time series consisting of 132 mostly macroeconomic variables and 147 financial variables.

The aforementioned proxies of policy uncertainty have been widely used in finance, and have been presented in congressional and Federal Reserve testimony.[19] Bloom (2009) uses stock market volatility to show that bad news uncertainty shocks are associated with reductions in hiring and investment. Similarly, Bloom, Bond, and Van Reenen (2007) use deviations in stock returns to show that uncertainty reduces investment. If one takes the view, as in Bloom, Sadun, and Van Reenen (2016) that management is a technology, then adoption of management practices can be viewed as a form of investment. However, the relationship between uncertainty and adoption of structured management practices has been largely untested to this point.

Several surveys by central banks take the approach of directly asking households and businesses for their expectations over various economic outcomes. The Bank of Japan's TANKAN is sent out to 210,000 large firms quarterly and can be answered by mail or online.[20] Firms are asked to judge their views of business conditions, inventories, capacity, employment, finances, and other topics at the present, and then asked to give annual projections on sales, exports, exchange rates, profits, income, investment, and inflation. Similarly, The Bank of Italy's Survey on Inflation and Growth Expectations is issued annually and manufacturing firms are

[19] For a list of applications of this data, visit www.policyuncertainty.com/research.html.

[20] For more information on TANKAN, visit www.boj.or.jp/en/statistics/tk/index.htm.

asked about investment levels for the current year, which includes a partial forecast.[21] D'Aurizio and Iezzi (2010) use these qualitative responses to build a forecasting model of investment. The Federal Reserve Bank of Philadelphia also runs a monthly Business Outlook Survey (BOS) in which 100-125 manufacturing firms are asked only if certain economic indicators (orders, shipments, prices, employees, etc.) are expected to increase, decrease, or remain unchanged within the next six months.[22] Variation in these forecasts can be used to construct measures of uncertainty.

The Ifo Institute Center for Economic Studies in Munich has run the Ifo Business Climate Survey (IFO-BCS) that surveys between 2,500 and 5,000 German products (which cover 2,000-4,000 continuing firms) on a monthly basis with consistent data running back to 1980. Respondents are asked to characterize their expectations of business conditions as "more favorable," "unchanged," or "more unfavorable."[23] Bachmann, Elstner, and Sims (2013) use both the BOS and IFO-BCS to show that adverse supply shocks tend to increase uncertainty, but uncertainty in the absence of shocks has only limited adverse effects on real activity.

The Federal Reserve Bank of Atlanta, in partnership with Steven Davis of the University of Chicago Booth School of Business and Nicholas Bloom of Stanford University, has created the Decision Maker Survey to measure firms' year-ahead

---

[21] For more information on the Survey on Inflation and Growth Expectations, visit www.bancaditalia.it/statistiche/tematiche/indagini-famiglie-imprese/aspettative-inflazione/index.html.

[22] For more information on the BOS, visit www.philadelphiafed.org/research-and-data/regional-economy/business-outlook-survey/

[23] For more information on the IFO-BCS, visit www.cesifo-group.de/ifoHome/facts/Survey-Results/Business-Climate.html.

expectations and associated uncertainties regarding changes in their costs, prices, profit margins, level of employment, capital investment, and sales revenue. The survey panel consists of a national sample of firms representing every sector of the economy (with the exception of agriculture and government) and a broad range of firm sizes. In addition, the Federal Reserve Bank of Atlanta runs the Business Inflation Expectations survey, which asks 300 firms monthly to assign probabilities to six potential outcomes for inflation over the next twelve months,[24] and asks a pair of questions on its biannual Small Business Survey (SBS) on uncertainty. The SBS covers firms with fewer than 500 employees and asks respondents whether "uncertainty" as a broad concept is having a larger or smaller impact on the firm's decision making relative to six months prior, and then asks respondents to cite the primary source of uncertainty.[25]

The link between management and uncertainty is discussed in some of the theoretical literature, including Adam (2007) which uses management as a motivator for limited capacity for information processing. If managers are responsible for gathering and processing information and setting targets, then managers are responsible, in some sense, for monitoring uncertainty. Do better management practices and more data-driven decision making lead to better forecasts and reduced uncertainty? Does the presence of uncertainty increase investment in management because of this effect? Or does uncertainty reduce investment in management

---

[24] For more information on the Business Inflation Expectations survey, visit www.frbatlanta.org/research/inflationproject/bie.aspx

[25] For more information on the SBS, visit www.frbatlanta.org/research/small-business/survey.aspx.

practices due to precautionary savings on the part of the establishment? Limited research exists to this point on the role of management in the quality of forecasts, but Ben-David, Graham, and Harvey (2013) find that executives are often incorrect with regards to their forecasts of stock market distributions.

MOPS 2015 includes eight new questions on uncertainty. There are two uncertainty questions on each of the following four subjects: shipments, capital expenditure, employment, and the cost of materials, parts, containers, and packaging. The first question for each subject asks for an estimate of the value of the variable in question in 2015 as well as a partial forecast of 2016, which will be roughly one-third complete at the time that respondents receive the survey. The latter portion of these questions is in the vein of the Italian Survey on Inflation and Growth Expectations, while the former allows for a measure of the measurement error of the respondents relative to the ASM.[26]

The second question asks respondents for five points of their possible distribution of possible outcomes at the plant for 2017 (lowest, low, middle, high, and highest) and the likelihood that they would assign to each outcome. Taken together these questions can be used to estimate the moments of the distributions of the variables in question, which provides a much richer measure of uncertainty than the proxies outlined above.[27] Because this set of questions is somewhat abstract, the

---

[26] Note that the questions on employment ask for employment as of March 12 for consistency with the ASM. Since MOPS 2015 was in 2016, the question on employment in 2015 and 2016 will not include a forecasting component.

[27] The Census Bureau's annual Business R&D and Innovation Survey (BRDIS) asks respondents for firm-level forecasts of R&D expenditure for the year following the coverage year (which is the year in which the survey is completed). The BRDIS also includes similarly structured questions on forecasted

section is preceded by instructions with an example of how a hypothetical respondent might fill out a pair of uncertainty questions.

Conclusions

Management has long been used as a residual in the explanation of why performance differs across firms and establishments. While business schools and the popular press have emphasized the importance of particular management practices, only in the last ten years have economists devoted significant empirical study to management practices. As the largest single study of management practices and the first large-scale study of management in the United States, the MOPS is at the center of this burgeoning field of research.

The research team (external researchers and Census researchers) published the first detailed results of the MOPS 2010 data in a CES working paper.[28] Bloom, et al. (2013a) report findings that are consistent with the earlier work from the WMS. Firms that adopt more of the structured management practices related to monitoring, targeting, and incentives are more productive, more profitable, and grow faster than firms with lower levels of structured management practice adoption. They also find that there are high levels of dispersion in structured management practice adoption, with higher levels of adoption being found in the South and Midwest, in larger

---

foreign and domestic R&D expenditure and the amount of R&D expenditure paid for by others. More information on the BRDIS can be found on the Census Bureau's informational webpage:

http://www.census.gov/manufacturing/brdis/

[28] The first publication reporting any results from the MOPS2010 was a Census Bureau press release. See http://www.census.gov/newsroom/press-releases/2013/cb13-03.html.

establishments, in establishments of large firms, in exporting establishments, and in establishments with more educated employees. Finally, the authors find that establishments generally report higher levels of implementation of structured management practices in 2010 than in 2005.

An updated version working paper was issued also including preliminary results involving investment in IT. Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten, and Van Reenen (2014a) utilize the linkages between MOPS and ASM performance data, as well as capital stock data from the Census of Manufacturers and link to Compustat data. They find that firms with higher management scores generally have higher rates of innovation, invest more heavily in IT, and have higher stock market valuations.

The second collection of the MOPS will enable us to better understand the dynamics of management practices. Moreover, the expanded version of the MOPS includes questions on two new subjects related to management: data and decision making and uncertainty. Because management is concerned at least in part with monitoring and setting forecasts, data collection and usage is an important complement to structured management practices. Furthermore, since targeting is at least in part forward-looking, structured management practices must also be related to the study of uncertainty. With its sixteen new questions (four on background, four on DDD, and eight on uncertainty), it will be exciting to see how the MOPS 2015 adds to our understanding of management practices in the U.S.

In the next chapter, I analyze results from the MOPS 2010 to examine the role that management practices play in plant-level performance.

Table 2.1: Management Surveys in the United States

Name of Survey	Conducted by	Unit of Observation	Number of Units	Industry
Computer Intelligence Database	Harte Hanks	Establishment	116,000	Representative
Management and Organizational Practices Survey (MOPS 2010)	U.S. Census Bureau	Establishment	37,177	Manufacturing
National Employer Survey (NES)	U.S. Census Bureau	Establishment	3100	All establishments with 20 or more employees, excluding agriculture and government
World Management Survey (WMS)	World Management Survey	Firm[29]	1487	Manufacturing
WMS	World Management Survey	School	279	Education
Self-Administered Survey	Bartel et al. (2013)	Establishment	212	Valve-making plants with more than 20 employees
Self-Administered Survey	Bertrand and Schoar (2003)	Firm/manager	Approximately 600 firms and 500 managers	Largest publicly-traded firms excluding banking, insurance, utilities.
Self-Administered Survey	Ichniowski et al. (1997)	Production Line	36	Steel
Self-Administered Survey	McConnell et al. (2009)	Firm	172	Addiction Treatment
Self-Administered Survey	McConnell et al. (2013)	Cardiac unit	597	Healthcare

[29] Although the WMS is conducted at the establishment level, analysis can only be conducted at the firm level due to the reliance on public data for performance. This note applies to other surveys that incorporate the WMS methodology, including the MOI survey.

Table 2.2: Management Surveys around the World

Name of Survey	Conducted by	Unit of Observation	Number of Units	Industry	Country
Changements Organisationnels et Informatisation (COI)	SESSI	Firm	4153	Manufacturing	France
Enquête Response (ER)	DARES	Establishment	2943	Manufacturing and non-manufacturing	France
Management, Organisation, and Innovation Survey (MOI)	European Bank for Reconstruction and Development, World Bank	Firm	1874	Manufacturing	10 transition countries, Germany, India
Survey of Innovation and Business Strategy (SIBS)	Statistics Canada	Establishment	Between 4000 and 8000	14 Industries	Canada
Workplace and Employee Survey (WES)	Statistics Canada	Establishment/worker	Approximately 10,000-15,000 establishments and 20,000 workers (varies by year)	Representative	Canada
Workplace Employee Relations Survey (WERS)	Department for Business, Innovation and Skills	Establishment/worker	Approximately 2500 workplaces and 23,000 workers (varies by year)	Representative	UK
World Management Survey (WMS)	World Management Survey	Firm	13,285	Manufacturing	33 countries
WMS	Centre for Economic Performance (LSE)	Firm	100	Healthcare	England
WMS	World Management Survey	Firm	1672	Education	7 countries
Self-Administered Survey	Bloom et al. (2013b)	Establishment	17	Textiles	India
Self-Administered Survey	Delfgaauw et al. (2013)	Firm	200	Fostering, adoption, and nursing	UK
Self-Administered Survey	McCormack et al. (2013)	Department	248	University	UK
Self-Administered Survey	McKinsey & Co.[30]	Agency	13	Tax Administration	13 countries

[30] Findings summarized in Dohrmann and Pinshaw (2009).

Name of Survey	Conducted by	Unit of Observation	Number of Units	Industry	Country
Self-Administered Survey	McKinsey & Co.	Firm	270	Manufacturing	Ireland, Northern Ireland
Self-Administered Survey	Rasul and Rogger (2013)	Agency	63	Civil Service	Nigeria

Chapter 3: Incentives Practices, Productivity, and the Great Recession

Introduction

As noted in the previous chapter, interest in management practices as a possible driver of dispersion in firm performance dates back at least 130 years. Nevertheless, many recent empirical studies for the United States have not focused on the causality of the relationship between performance and management.

Although recent papers about the use of structured management practices in developing countries by Karlan et al. (2012), McKenzie and Woodruff (2012), and Bloom et al. (2013b) have provided at least some evidence for a causal relationship between these practices and firm performance, it is not clear whether or not findings for developing countries generalize to the U.S. For instance, the practices suggested to the textile firms in Bloom et al. (2013b) included organizing inventory and protecting it from water damage, clearing inventory from the shop floor, and removing broken machinery. It is possible that many of the gains associated with such behaviors have already been realized in developed countries where there are prolific business education programs and consulting industries devoted to management.

The MOPS dataset described in the preceding chapter provides an opportunity not only to study the relationship between management practices and traditional measures of firm performance, but also to link results on management practices to Census Bureau data sets that span topics as wide-ranging as international trade, firm balance sheets, and firm dynamics. As noted above, the initial results of the survey described in Bloom et al. (2013a) show that there is significant dispersion in adoption

of structured management practices across U.S. manufacturing plants and that adoption of these practices is positively correlated with labor productivity.

Bloom et al. (2013a) perform a simple first-differences regression as part of their analysis, but this chapter is the first work to perform an in-depth study of the behavior of management practices within establishments over time. I find that the distribution of changes in management practices is positively skewed but displays high levels of net inaction, with some establishments reducing their implementation of structured management practices. The positive skewness is driven by increases in scores on questions related to data-driven performance monitoring, but many establishments became less likely to award monetary performance incentives over the period of observation, which covers the Great Recession.

This chapter is also the first work to closely examine the multidimensional nature of structured management practices. While the pioneering work in this literature developed a single index to assess the structure of management practices, this chapter examines how the related practices that comprise the index co-vary differently with outcomes. After controlling for local labor market effects, changes in labor productivity and total factor productivity (TFP) within establishments from 2005 to 2010 are positively correlated with changes in the actual administration of performance bonuses, but not with most other types of structured management practices. Performance bonus practices and data-driven performance monitoring practices both have positive relationships with employment growth, although the magnitude of the relationship between bonus practices and employment growth exceeds the magnitude of the relationship between monitoring practices and

employment growth. Variable selection techniques such as principal component analysis and double Least Absolute Shrinkage and Selection Operator regression support decomposing the index of structured management practices in this way.

The fact that the Great Recession falls between 2005 and 2010 suggests that establishing a causal relationship between management practices and productivity at manufacturing establishments in the United States may not be as straightforward as suggested by Bloom et al. (2013b). Negative demand shocks likely reduced both measured productivity and the availability of bonuses. This raises a new series of questions: Is the correlation between within-establishment changes in bonuses and within-establishment changes in measured revenue productivity merely a mechanical reflection of demand shocks that affect both simultaneously? If not, do reductions in bonus practices in response to shocks have a causal impact on productivity that causes them to serve as an amplification mechanism for negative demand shocks?

I show that the demand-driven component of bonuses is large and positively correlated with measured labor productivity. I use information from the MOPS pretesting program, described in Chapter 4, to show that unionization before the Great Recession is a strong predictor of later bonus practices. The component of bonus practices explained by pre-recession unionization is not correlated with plant performance, which is suggestive that there is not a causal link between the availability of bonuses and performance over this period.

Furthermore, there is evidence to suggest that decision-making involving bonus practices is made at the firm level for multi-unit firms. I find evidence that firm-wide changes in bonus practices are correlated with labor productivity once I

control for demand, which would support the hypothesis that reductions in bonuses serve as an amplification mechanism for negative demand shocks.

This chapter proceeds as follows: the next section discusses related literature. Subsequently, I detail empirical evidence on the adjustment of management practices from the MOPS. Two sections follow containing analysis of the relationship between changes in management practices and productivity. The first establishes that the relationship between management practices and plant outcomes is largely attributable to responses to questions related to bonus practices, while the second addresses the causal link between bonus practices and productivity shocks, finding limited evidence that increasing the availability of bonuses between 2005 and 2010 had a positive causal impact on outcomes. The final section of this chapter concludes.

Related Literature

As discussed in Chapter 2, over the last ten years, there has been a revolution in the measurement of management practices for empirical economics research. The WMS, the first large and consistent study of management practices, and its successor, the MOPS, have enabled new empirical research on structured management practices related to monitoring, targeting, and incentives. Research using these data or related data produced using similar methodologies has shown that establishments that adopt these structured practices are more productive, more profitable, and grow faster than establishments that adopt fewer structured management practices.

While structured management practices are positively correlated with several measures of firm performance, this correlation does not necessarily establish a causal relationship. One can certainly imagine a case where greater implementation of

management practices leads to higher productivity, profitability, size, and/or survivorship; for instance, it is possible that tighter monitoring and performance incentives lead to less shirking and thus higher labor productivity. However, it is also possible that large, productive firms have more structured organizational practices simply as a function of being large firms. For example, large firms may monitor more performance data mechanically as a function of having more data to monitor.

Bloom et al. (2016a) identify four possible drivers of the adoption of structured management practices in the MOPS data: product market competition, state business policies, learning spillovers, and human capital. Using exchange rate shocks and a Lerner index, "Right to Work" laws, location of "Million Dollar Plant" openings, and location of land grant colleges to proxy for each of these plausibly exogenous factors, respectively, they find that these factors can account for approximately one third of the variation in the adoption of structured management practices at the plant level. Most relevant for this paper, they find that "Right to Work" laws affect the adoption of practices related to promotion and dismissal, but not other management practices. Bloom et al. (2016a) do not address the question of whether or not management practice adoption is causally linked to plant-level outcomes such as productivity and employment.

As noted in Chapter 2, Bloom et al. (2013b) attempt to establish a causal link between management practices and performance by running an experiment on 17 large Indian textile firms. They offer management consulting to a subset of the sample establishments, and find that treated establishments see marked improvement in productivity and profitability after implementing the advice given during the

consulting period, and are more likely to expand in subsequent months than control firms. Furthermore, they find that treated firms more than recoup the costs of implementation of these management practices within one year.

The results from Bloom et al. (2013b) raise questions related to extendibility. Is this causal relationship present in firms in other countries and/or industries, including United States manufacturing firms? Examples of practices introduced in the treatment include moving broken equipment and organizing inventory stocks, while the MOPS focuses more on abstract practices such as monitoring key performance indicators (KPIs) and providing performance bonuses. It is conceivable that adopting the former set of practices does causally increase productivity, yet implementing the latter set of practices in a more developed country will not increase establishment-level productivity.

This paper decomposes structured management practices into component subsets, and finds that much of the relationship between structured management practices and productivity is accounted for by incentives practices, particularly bonus practices. As such, this paper is related to the large labor economics literature on incentive-based pay schemes. Black and Lynch (2001) used an earlier Census Bureau dataset, the National Employer Survey (NES), to examine the impact of human resource management systems and "Total Quality Management" (TQM) practices on firm performance. They find that adopting TQM systems is not effective in increasing productivity, whereas decentralizing decision-making and introducing incentive-based pay for non-managers does increase productivity, especially at unionized plants.

Because of its focus on the role played by bonus practices, this paper also is linked to the personnel economics literature on incentives. This literature consists of theoretical studies of incentives design to minimize moral hazard and encourage employee effort, as well as empirical studies of how employees respond to incentives. Lazear (2000) uses data from the Safelite Glass Company to show that when the company switched from hourly wages to piece rates for windshield installation, productivity increased by approximately 44%. About half of this increase can be explained by increased effort, while the other half is due to self-selection of more productive workers into Safelite. Other studies show similar results.[31]

There is also a sizeable literature in labor economics on executive pay and compensation. The theoretical strand of this literature examines incentive designs to reduce the impact of the principal-agent problem, while the empirical side examines the relationship between incentive-based pay schemes and firm outcomes.[32] The outcome of interest in this literature is primarily shareholder value, although Tello-Trillo (2015) finds that between 5% and 8% of productivity growth between 1993 and 1998 is due to increased managerial incentives induced by reduced trade costs.

While this paper deals with the impact of incentive-based pay schemes on productivity, it is both more general and more limited than the existing personnel economics literature. The incentives practices surveyed by the MOPS are not defined as specifically as those in the existing personnel economics literature, but the

---

[31] See Lazear and Oyer (2013) for a summary of empirical work on incentives.

[32] See Murphy (2009) for a summary of the executive pay literature.

resulting dataset is larger than much of this related work. Most of the existing work has dealt with single firms implementing piece-rate pay schemes for production workers or on the role of executive compensation, while this paper is the first to examine the impact of general performance-based incentive pay on productivity in manufacturing across the United States.

Bonus payments are a less explicit form of incentive than piece-rate pay. Parent (1999) notes that

> Piece rate or commission contracts are explicit in nature: one gets paid a certain contractually specified amount per unit produced. Bonuses can be explicit as well, such as when workers get rewarded for achieving or surpassing a sales target. But employers can also award bonuses on a more discretionary basis.

That discretion makes detangling the causal relationship between bonus pay and productivity of particular interest. Because of discretion in awarding bonuses, bonuses can be adjusted in response to economic conditions, making bonuses a potential source of wage flexibility.

Thus, this paper is also related to the large literature on downward wage rigidity, particularly in the Great Recession. Elsby, Shin, and Solon (2013) and Fallick, Lettau, and Wascher (2016) find evidence of downward nominal wage rigidity during the Great Recession. The former also find that there is substantial downward wage flexibility reported in employee data, while the latter perform several tests of downward nominal wage rigidity using employer data and find evidence that rigidity may have increased during the Great Recession.

The findings of this paper reflect its aggregate focus. While I find that bonus pay reacts to aggregate shocks which also impact measured productivity, this does not invalidate previous studies finding that performance incentives can increase productivity. Instead, it suggests that during the Great Recession establishments may not have implemented incentive schemes in a way that was immediately productivity-enhancing.

Data

This paper deals primarily with data from the first 16 questions in the MOPS survey, which cover management practices, as discussed in Chapter 2. These questions form three major categories – monitoring (6 questions), targeting (2 questions), and incentives (8 questions). The monitoring questions deal primarily with the quantity of KPIs and the frequency with which those indicators are reviewed by managers and non-managers. Targeting questions have to do with the scope and achievability of production targets. Incentives practices fall into three subcategories: questions related to the basis for and availability of bonuses, questions related to the basis of promotions, and questions related to the speed at which underperforming workers are reassigned or dismissed. Together these questions give a sense of the structure of management practices at the establishment. Respondents are asked to complete each of these questions for the main survey reference year of 2010, and to provide retrospective information for 2005. This recall data enables me to examine the impact of reported changes in management practices on productivity.

Naturally, there is some concern that recall bias will color the results of this paper. Other studies of recall bias (Horvath, 1982; Oyer, 2004) have found that it can

play a significant role in survey data. The MOPS features one question that overlaps with its sister survey, the ASM: respondents are asked to report the number of employees on their payroll for the pay periods including March 12, 2005 and March 12, 2010. To control for the effects of recall bias, I drop responses whose reported 2005 employment differs from their employment reported on the 2005 ASM by more than 33%.[33]

I also hypothesize that the estimates in this chapter are more likely to understate the positive correlation between changes in bonus practices and changes in productivity than to overstate it. Respondents are biased to report increases in structured management practices between 2005 and 2010. However, I show that the relationship between management and productivity over this time period are largely driven by respondents who report decreases in the structure of their bonus practices between 2005 and 2010 and who exhibit decreasing productivity over the period. Respondents biases may cause them to underreport these decreases in structure, biasing the coefficients between bonuses and productivity towards zero. On the other hand, if respondents remember changes in bonuses more accurately than other practice changes, these results may overstate the relative importance of bonuses.

For each of the 16 management questions on the MOPS, responses are ranked from zero to one, with one corresponding to the most structured practice and zero corresponding to the least structured practice. Scores are then assigned to the remaining responses so that each response is uniformly distant from the next highest

[33] For more information on recall bias, see the Data Appendix section at the end of this chapter.

response to the question.[34] See Table 3.17 for the scoring of each of the 16 management questions and responses. An index is then created based on a simple average of these responses. This yields a single structured management score between zero and one, with a score of one indicating implementation of all of the most structured practices and zero being the implementation of the least structured practices. This methodology follows Bloom et al. (2013a) for comparability. As in Bloom et al. (2013a), respondents are required to have answered at least 11 of the sixteen management questions for each year.[35] Since this paper is interested in the role that different types of management practices play in establishment-level productivity, the sample is restricted to respondents that answered at least one question of each type (monitoring, targeting, bonuses, promotions, and reassignment/dismissal) in each year.

The MOPS survey was mailed to all establishments in the 2015 ASM mail sample, and received about 37,000 responses. Because this paper focuses on within-establishment changes in management practices, the sample is restricted to establishments that were active in 2005 and for which respondents provided data about the establishment's practices in both 2005 and 2010. This requirement biases the sample by excluding plants that were active in 2005, but closed prior to 2010, as

[34] For example, a question having five possible responses would have scores of 0, ¼, ½, ¾, and 1 allocated among the responses.

[35] To ensure that respondents with the least structured practices are included in the sample, I impute responses for questions that were left blank due to skip patterns on the form. If a question is answered in a way that would generate the skip pattern, responses for the skipped questions are set to zero. Bloom et al. (2013a) do not adjust for non-response due to survey skip patterns. The results of this paper are robust to using the same methodology as Bloom et al. (2013a)

well as by failing to account for establishments that are less than five years old. Furthermore, only establishments with data on revenue total factor productivity (RTFP), as well as positive employment, real value added, and imputed capital stock from the ASM are included in the sample.

RTFP is measured using a gross output measure constructed by the Collaborative Micro-Productivity Project (CMP), a joint project from the Census Bureau and the Bureau of Labor Statistics. The measures of capital stock and output used for this paper are also drawn from the CMP dataset. The CMP dataset is constructed following the methodology described in Foster, Haltiwanger, and Grim (2014). Finally, only establishments that are also included in the Longitudinal Business Database (LBD) are included in the baseline sample.

Because the ASM is resampled every five years, two years after the preceding Economic Census years, the samples for the 2005 and 2010 ASMs are not identical. Since larger establishments (based on employment, cost of fuel, cost of electricity, and inventories) are sampled with certainty in each ASM sample, this biases the sample toward larger establishments.[36]

The primary sample for this paper consists of approximately 12,000 establishments. Descriptive statistics for this sample can be found in the data appendix at the end of this chapter. Table 3.17 gives descriptive statistics for the size, age, and productivity of the establishments in the sample. The mean establishment in

[36] See "How the Data are Collected" on the Census Bureau's ASM website for more information on sample methodology for the ASM.
http://www.census.gov/manufacturing/asm/how_the_data_are_collected/index.html

this sample had about 236 employees in 2010 and was about 27 years old.[37] The mean establishment was slightly larger in 2005 in terms of employment, which is to be expected due to the Great Recession.

Figure 3.1 shows Kernel Density Estimations for the distributions of structured management practice scores at the establishments in the sample for 2005 and 2010. In both years, there is significant dispersion in management scores, with negative skew. The mean reported management score increased slightly from 2005 to 2010, from 0.56 to 0.65, with the variance of responses decreasing slightly over the same period. The negative skew is larger in 2010 than in 2005.

Figure 3.2 illustrates the percentage change in management score within establishments from 2005 to 2010. While there is a high level of net inactivity, in which establishments' overall management score does not change from 2005 to 2010, the distribution exhibits strong positive skewness, with many establishments having a net increase in their management score over the period. The average establishment increased its management score approximately 16% between 2005 and 2010. Figure 3.3 decomposes these changes into the three main subcategories of questions: monitoring, targeting, and incentives. The distribution of percentage changes in the monitoring score also displays high levels of net inactivity, but the mean percentage change is higher than for the other categories at approximately 28%. The distributions of changes in targeting and incentive scores are somewhat more symmetric, with

[37] For reference, in the larger MOPS sample used in Bloom et al. (2013a), which does not require that establishments have data for 2005 on the MOPS or the ASM, the mean establishment had 167 employees and was 22 years old in 2010. The average management score for these establishments was 0.64.

lower mean changes of 14% and 8%, respectively, but still display high levels of net inactivity and positive skewness.

Decomposing incentive practices further into subcategories of questions related to bonus availability and time to reassign/dismiss workers (ignoring questions about the basis of promotions) yields the result that the positive skewness in the incentives distribution is driven almost entirely by changes in reassignment/dismissal practices. That is, many establishments report that the time taken to dismiss an underperforming worker was less in 2010 than it was in 2005. In fact, there is a sizeable density at a 200% increase in the structure of reassignment/dismissal practices, which consists of those respondents who report that they did not reassign or dismiss underperforming workers in 2005, but reassigned or dismissed underperformers in less than six months in 2010.[38] This change may be due in part to changing economic conditions, rather than the implementation of more structured practices.

Bonus practices, on the other hand, have a relatively symmetric distribution, with high net inactivity. The distribution of changes in bonus practices has a fundamentally different shape relative to distributions of changes in other types of management practices, which all exhibit varying degrees of positive skewness. This difference is likely due to the fact that bonus practices may be procyclical. That is, the ability of a plant to pay bonuses is constrained by the financial performance of the

[38] In fact, this tail density at 200% is under-reported to ensure that no confidential data is disclosed. Note that the responses to questions 15 and 16 do not include an option for "no underperforming non-managers [managers] were identified."

plant. While the questions on the MOPS are designed to ask the respondent about her plant's hypothetical *ceteris paribus* bonus practices, linguistically and cognitively this may not have been realized. In the subsequent sections, I examine the particular role bonus practices play in the relationship between firm performance and structured management practices.

In this chapter, I examine an additional subset of the data in order to isolate the causal relationship between bonus practices and productivity. To study this effect, I first show that bonus decisions are made largely at the firm level, particularly when compared to decisions related to other management practices. Thus, I consider the subset of approximately 6,800 establishments in the baseline sample which are part of a multi-unit firm, have at least one sibling establishment in the baseline sample, and have at least one sibling establishment in the baseline sample whose MOPS data was filled out by a different individual. The third criterion ensures that when analyzing the locus of decision-making regarding bonuses, I am not incorrectly assessing respondent fixed effects.

Identification Challenges

Identifying a causal relationship between management practices and plant-level outcomes is complicated by certain features of the data. First, both of the measures of productivity used in this paper, labor productivity and total factor productivity, are revenue-based measures. Thus, changes in these measures incorporate changes in mark-ups (prices), which may be affected by demand shocks that also affect the plant's ability to pay bonuses. Furthermore, even if the productivity measures were quantity measures rather than revenue measures,

measured physical productivity may reflect changes in demand, which may also be correlated with changes in bonuses.

To address these challenges, I use instrumental variable methods to show that the demand-driven component of changes in bonuses is strongly positively correlated with changes in labor productivity, while there is limited evidence that bonus changes for other reasons are positively correlated with labor productivity. I use three different instruments for bonus changes at the plant level. The first is a measure of local demand based on Bartik (1991). The construction of this measure is discussed at length in the Data Appendix section of this chapter. The measure utilizes changes in employment at all manufacturing establishments in the LBD from 2005 to 2010.

I also utilize a question from the "Background Characteristics" section of the MOPS on the share of unionized workers at the establishment in 2005 as an instrument for changes in bonus practices. Bloom et al. (2016a) show that "Right-to-Work" status, which is a proxy for the state business environment including reduced influence of labor unions, is strongly positively correlated with increased structure in incentives practices related to promotions and reassignment and dismissal. Interestingly, they do not find that "Right-to-Work" status is correlated with increased structure in bonus practices. As will be discussed in Chapter 4, the unionization question was added to the MOPS survey based on cognitive testing. Respondents during the pretesting period noted that unionized plants are less able to give discretionary bonuses and are less structured in their incentives practices more broadly. Unionized plants are likely unable to adjust the availability of bonuses in response to demand shocks. I find evidence that plants that were more highly

unionized in 2005 have less structured bonus practices in 2010 than less unionized plants.

Finally, I utilize the aforementioned sample of establishments of multi-unit firms with siblings in the MOPS data to examine firm-level changes in bonus practices. I use changes in bonus practices at the rest of the firm as an instrument for changes in plant-level bonus practices. I control for rest-of-firm changes in employment in order to create a measure of bonus changes that are dictated to the establishment by the firm but are not due to firm-level demand shocks.

Decomposition of Management Practices and Plant Performance

In this section, I seek to establish that the management score utilized by Bloom et al. (2013a) is not unidimensional. That is, the 16 management questions may actually measure several different constructs rather than one single concept of structured management. Having established this fact, I show that the correlation between management scores and outcomes is primarily driven by the behavior of practices related to bonuses. In particular, within-plant changes in bonus practices are the only practices that are positively and significantly correlated with changes in RTFP. The next section builds on the findings of this section by testing the causal relationship between bonus practices and productivity.

The decompositions presented in Figures 3.1 through 3.4 provide insight into the behavior of the overall structured management index created by Bloom et al. (2013a). Because this measure is a composite of different conceptual practices, it is important to consider how decomposing the management score into sub-indices impacts the relationship between management and plant-level outcomes.

In this section, I perform a series of regressions aimed at evaluating the relationship between within-plant changes in management and within-plant changes in outcomes between 2005 and 2010. I decompose the management index using the broad question categories that were the basis of the MOPS and its predecessor, the WMS: monitoring, targeting, and incentives (Bloom et al., 2016a). I also consider the distinct subcategories of the incentive questions, which are grouped in a way that allows for easy classification.[39] To validate these conceptual groupings, I utilize two variable selection techniques: principal component analysis (PCA) and the Least Absolute Shrinkage and Selection Operator (LASSO). Together, these methods show that (a) the management questions on the MOPS survey are not unidimensional, but in fact measure several distinct concepts, and (b) the statistical relationship between within-plant changes in management practices and within-plant changes in productivity is largely explained by responses to questions related to bonus practices.

This finding could be consistent with the interpretation that bonuses are productivity-enhancing, consistent with Lazear (2000). Consider a model where bonus practices are a productive input into the production function consistent with Bloom et al. (2016c):

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} e^{\delta BONUS_{it}},$$

[39] Question 9 is a screener question for Question 10. Questions 11 and 12 ask about the same broad concepts as Questions 9 and 10, with the former pair referring to non-managers and the latter pair referring to managers. Questions 13 and 14 ask the same question with reference to non-managers and managers, respectively. Questions 15 and 16 ask the same question with reference to non-managers and managers, respectively. See Table 3.17 for the text of the MOPS management questions and associated structure scores.

where Y_{it} is plant-level value added and L_{it} is employment in the pay period including March 12. A_{it} is the part of productivity that cannot be explained by the degree of structure in bonus practices, K_{it} is the plant's capital stock, and $BONUS_{it}$ is the degree of structure in bonus practices. Setting the structure of bonus practices is an endogenous decision that will depend on the plant's realization of A_{it}.

Bloom et al. (2016c) assume that structured management practices face convex adjustment costs and are irreversible. However, the distribution of bonus practices in Figure 3.4 is inconsistent with that interpretation. Bonus practices are better interpreted, as per Parent (1999), as flexible. The discretionary nature of bonuses suggests that bonuses are likely a function of several environmental factors including demand, business/regulatory environment, and managers' preferences. Since demand and regulatory environment can conceivably affect productivity through channels other than bonuses, interpreting the productive impact that bonuses have on output requires isolating changes in bonuses due to factors that are exogenous to productivity. This section focuses on establishing the importance of bonuses in studies of management, and the next section attempts to disentangle the causal relationship between bonuses and productivity.

Reduced-Form Relationship between Management Categories and Outcomes

Table 3.1 displays the results for several reduced-form first-difference regressions of management practices and labor productivity. The baseline specification for the regressions is

$$\Delta \log\left(\frac{Y_i}{L_i}\right) = \beta_0 + \beta_1 \Delta M_i + \varepsilon_i,$$

where Y_i is annual value-added at the plant, L_i is total employment at the plant in the pay period including March 12, and M_i is the measure of plant-level management practices. I also consider the reduced-form relationship between management practices and other outcome variables including total factor productivity (Table 3.2) and total employment (Table 3.3), as well as the impact of decomposing M_i into several management practice subcategories.

Column (1) is consistent with the finding in Bloom et al. (2013a) that within-plant changes in management practices are positively correlated with labor productivity as measured by value-added per worker. In column (1) of Table 3.2, I find that the overall management score is positively correlated with a gross output measure of total factor productivity from the CMP at the 10% significance level.[40] I also find that the management score is significantly correlated with employment growth between 2005 and 2010 in column (1) of Table 3.3. Roughly speaking, a one standard deviation greater increase in the management score is associated with a 0.03 log point increase in labor productivity, a 0.01 log point increase in total factor productivity, and a 0.026 log point increase in plant employment from 2005 to 2010.

Columns (2) through (5) in Tables 3.1 through 3.3 display the effects of decomposing the management score into three component sub-indices: monitoring, targeting, and incentives. Columns (2) through (4) regress change in outcomes on each of these sub-indices separately, while column (5) regresses the outcomes on the

[40] Management scores are positively correlated with total factor productivity when the regression is weighted using propensity score weights. See the data appendix for more information about the propensity score-weighted analysis.

sub-indices which span the domain of the management index. Focusing on column (5) in each of these tables, I find that for both labor and total factor productivity, only the incentives measure has a statistically significant relationship with plant-level outcomes, and this measure is positively correlated with productivity. A one standard deviation greater increase in the incentives score is associated with a 0.037 log point increase in labor productivity and a smaller increase of 0.013 log points in total factor productivity.

On the other hand, changes in monitoring and incentives practices are both positively correlated with employment growth at the establishment level. Changes in incentives practices have roughly double the impact on employment growth of changes in monitoring practices, with a one standard deviation greater increase in the monitoring score being associated with approximately a 0.008 log point increase in employment, and a one standard deviation increase in the incentives score being associated with a 0.016 log point increase between 2005 and 2010.

Columns (6) through (9) in Tables 3.1 through 3.3 further decompose the incentives score into components relating to bonuses, promotions, and reassignment/dismissal practices, since Figure 3.4 suggests that the incentives measure is itself multi-dimensional. Columns (6) through (8) regress changes in outcomes on each of these incentives sub-indices separately, while column (9) regresses outcomes on the monitoring, targeting, bonuses, promotions, and reassignment indices simultaneously. Again, I focus my interpretation on the results of the regressions on the full span of the management practices. After decomposing the incentives score into subcomponents, I find that the primary driver of the positive

relationship between management practice scores and productivity is the plants' scores on questions related to bonus practices. A one standard deviation greater increase in the bonus score is associated with a 0.055 log point increase in labor productivity and a smaller but still significant (at the 5% level) 0.012 log point increase in total factor productivity.

I find that promotion scores are actually significantly negatively correlated with labor productivity; a one standard deviation greater increase in the promotion score is associated with a 0.025 log point drop in value added per worker. This could suggest that promoting workers exclusively on performance is not optimal for plant productivity.

This decomposition raises important questions about causality. Basu and Fernald (2001) provide an overview of the procyclicality of both labor productivity and total factor productivity. Incentives practices may also be plausibly cyclical; bonus payments are likely procyclical based on the cash flow of the plant or firm. In the next section, I address the causal relationship between bonuses and the Great Recession more directly. Furthermore, as discussed above, the measures of productivity in this paper are revenue measures. Mark-ups will be sensitive to all manner of demand shocks, not just aggregate demand shocks, and are reflected in these measures of productivity. The model of bonuses outlined above suggests that bonuses are also sensitive to the same demand shocks, making disentangling causality difficult.

In Table 3.3, columns (6) through (9) show the relationship between these decomposed dimensions of the management score and employment growth between

2005 and 2010. Bonus practices are also positively correlated with employment growth. Focusing on column (9), a one standard deviation greater increase in bonus practices is associated with a 0.031 log point increase in employment from 2005 to 2010. Additionally, a one standard deviation greater increase in the monitoring score is associated with a 0.018 log point increase in employment, while a one standard deviation greater increase in the targeting score is associated with a 0.008 log point increase in employment, although the latter is only statistically significant at the 10% level.

Why might the adoption of more structured monitoring practices be positively correlated with employment growth? The monitoring score consists primarily of questions related to the quantity of data reviewed at the plant and the frequency at which that data is reviewed. Perhaps monitoring causally increases employment by giving the plant prompt feedback about its production processes. However, there are plausible non-causal interpretations. For example, perhaps larger plants mechanically must gather more data to monitor performance, while smaller plants do not need as "structured" data gathering processes, or perhaps having more employees at a plant enables the plant to gather more data.

The results of Tables 3.1 through 3.3 are robust to weighting the establishments using propensity scores that measure the likelihood that a manufacturing establishment that existed from 2005 to 2010 is in the baseline sample. Thus, there is some evidence that bonus practices are the primary driver of the relationship between management practices and plant-level outcomes in the population of continuing manufacturing establishments, rather than simply for this

sample. For more information on the weighted regressions, see the data appendix at the end of this chapter.

As noted above, the results of Tables 3.1 and 3.2 raise questions about the direction of causality in the relationship between bonus practices and productivity. The use of revenue productivity measures means that the productivity measures in this study will be particularly sensitive to demand shocks. As such, I take efforts to control for demand shocks that may impact both measures of bonuses and measures of revenue productivity. Tables 3.4 through 3.6 introduce a measure of local demand shocks as measured by an instrument based on Bartik (1991). I expand the baseline regression to

$$\Delta \log\left(\frac{Y_i}{L_i}\right) = \beta_0 + \beta_1 \Delta M_i + \beta_2 Bartik_i + \varepsilon_i,$$

where $Bartik_i$ is the predicted change in employment in the plant's commuting zone from 2005 to 2010, based on historical industry employment shares, as in Bartik (1991).[41] As anticipated, this measure is positively and significantly correlated with changes in employment and positively but weakly significantly correlated with changes in labor productivity. The results of Tables 3.1 through 3.3 are robust to the introduction of this control, with little meaningful difference in the size or significance of the regression coefficients.

The only exception is the coefficient relating reassignment and dismissal scores to changes in employment, which is negative and significant at the 10% level,

[41] For more information on this instrument, see the data appendix.

after controlling for the effects of the Bartik shock. A one standard deviation increase the reassignment score is associated with a 0.009 log point drop in employment between 2005 and 2010. Because an increase in this score means that the establishment reassigns or dismisses employees more rapidly in 2010 than in 2005, perhaps it is unsurprising that this score would be negatively associated with employment changes after controlling for expected changes in local employment.

Because the outcome variables and various management sub-indices are likely to be correlated with demand, I also regress the outcome variables on a full slate of interactions between the Bartik measure of demand shocks and the management sub-indices. The goal of these exercises is to examine whether any of the relationships between management practices and outcomes are dependent on local demand. To simplify interpretation, I de-mean the Bartik measure in these exercises.

Table 3.7 revisits the last columns of Tables 3.4 through 3.6 with added interaction terms. Naturally, the coefficients on the management sub-indices in Table 3.7 are consistent in magnitude and significance with the results from the regressions in Tables 3.4 through 3.6. Generally, the interaction terms are not significant, with one exception. In column (1) of Table 3.7, monitoring scores exhibit a weakly significant negative correlation with labor productivity when interacted with the demand measure. That is, plants in commuting zones that are subject to less severe demand shocks than the average commuting zone display a negative relationship between changes in monitoring practices and labor productivity.

Table 3.8 shows the *F* statistics associated with Wald's test for the null hypotheses that the regression coefficients for the management sub-indices and the

coefficients of the corresponding interaction terms are jointly equal to zero. In column (1), it is clear that the bonus score and the corresponding interaction term are highly jointly significant. Turning to column (2) of Table 3.8, bonus scores and their associated interaction term are jointly significant at the 10% level with respect to total factor productivity. In column (3), bonuses and their associated interaction term are jointly significant with respect to employment growth. Bonus scores remain positively correlated with outcomes. Monitoring scores and their associated interaction term are also jointly significant with respect to employment growth. Monitoring structure remains positively correlated with employment size.

Management Categories as Inputs into Production

Table 3.9 considers a more structural interpretation of the role that management practices play in plant performance. Suppose that the plant-level production function is given as

$$Y_{it} = A_{it}K_{it}^{\alpha}L_{it}^{\beta}e^{\delta_1 MONITOR_{it}}e^{\delta_2 TARGET_{it}}e^{\delta_3 BONUS_{it}}e^{\delta_4 PROMOTION_{it}}e^{\delta_5 REASSIGN_{it}},$$

where, as above, Y_{it} is plant-level value added and L_{it} is employment in the pay period including March 12. A_{it} is the part of productivity that cannot be explained by structured management practices, K_{it} is the plant's capital stock, and $MONITOR_{it}$, $TARGET_{it}$, $BONUS_{it}$, $PROMOTION_{it}$, and $REASSIGN_{it}$ are the plant's scores on the management sub-indices. This model builds on the "management as a technology" model of Bloom et al. (2013a) and Bloom, Sadun, and Van Reenen (2016b) by treating different management practices as distinct inputs into the production function.

Dividing by labor and taking logs yields

$$\log\left(\frac{Y_{it}}{L_{it}}\right) = \alpha \log\left(\frac{K_{it}}{L_{it}}\right) + (\beta + \alpha - 1)\log L_{it} + \delta_1 MONITOR_{it} + \delta_2 TARGET_{it}$$
$$+ \delta_1 BONUS_{it} + \delta_1 PROMOTION_{it} + \delta_1 REASSIGN_{it} + f_i + Z_{it} + \varepsilon_{it},$$

where the productivity term A_{it} has been replaced with plant-level fixed effects, f_i, industry-state level exogenous factors, Z_{it}, and a stochastic residual, ε_{it}.[42]

Since I am interested in the impact of changes in management practices on outcomes between 2005 and 2010, I again take first differences, to obtain

$$\Delta \log y_i = \alpha\, \Delta \log k_i + (\beta + \alpha - 1)\Delta \log L_i + \delta_1 \Delta MONITOR_i + \delta_2 \Delta TARGET_i$$
$$+ \delta_3 \Delta BONUS_i + \delta_4 \Delta PROMOTION_i + \delta_5 \Delta REASSIGN_i + \gamma Bartik_i$$
$$+ \varepsilon_i.$$

The establishment-level fixed effects are eliminated by taking first differences, and the state-level expected change in employment, $Bartik_i$, is used to proxy for exogenous factors that may impact plant-level productivity.

This regression is based explicitly on the model in Bloom et al. (2013a), with several key differences. First, I do not include the measure of education from the MOPS that they include on the right-hand side, although my results are robust to including that measure. Similarly, I do not include additional noise controls in the model. Naturally, as the focus of this section is on the importance of decomposing the management index constructed by Bloom et al. (2013a), I decompose the management practice score. Finally, I include the Bartik measure of local demand

[42] Dividing instead by $K_{it}^{\alpha} L_{it}^{\beta}$ would make the left-hand side of the equation equal to a measure of TFPR, which, under the assumption that the productivity term A_{it} was similarly replaced with fixed effects, exogenous factors, and the residuals, would return the reduced-form TFPR regression from section A.

shocks in an effort to control for the impact that demand has on revenue-based productivity measures and likely has on certain management practices, namely bonuses. It should be noted that the coefficients of this model, particularly those on labor and capital, cannot be interpreted as elasticities, since labor appears on both the left- and right-hand sides of the equation and the regression is estimated using OLS. Instead, this specification should serve two purposes: to benchmark the results of this paper against Bloom et al. (2013a) and to articulate a possible model of management in the plant production function.

Table 3.9 displays the results of this regression as well as regressions considering alternative decompositions of the management score. The results of Table 3.4 are robust to introducing controls for employment and the capital stock. In fact, the magnitudes of the coefficient on the management score and its subsequent decompositions are slightly larger than in the previous reduced form regressions. A one standard deviation greater increase in capital per worker is associated with a 0.044 to 0.047 log point increase in labor productivity, depending on the decomposition of the management index considered. A one standard deviation increase in employment growth is associated with a 0.024 to 0.030 log point decrease in labor productivity.

In column (1), I find that a one standard deviation greater increase in the overall management score is associated with a 0.032 log point increase in labor productivity. This relationship is primarily driven by the incentives score, a one standard deviation greater increase in which is associated with a 0.039 log point increase in value added per worker. Decomposing the index further in column (3),

one standard deviation greater increases in bonuses and promotions yield a 0.06 log point increase and 0.026 log point decrease in labor productivity, respectively.

Alternative Methods of Variable Selection

The decompositions in Figures 3.3 and 3.4, as well as Tables 3.1 through 3.9, are based on conceptual constructs in the MOPS instrument, and the results discussed above suggest that the overall management score is not constructed from a unidimensional test of structured management practices, but rather reflects several different concepts. It is possible, however, that these decompositions do not accurately reflect the dimensionality of the first 16 questions on the MOPS. I perform several additional tests in this section, including PCA and double LASSO analysis as methods of explanatory variable selection. In order to perform these variable selection methods, I require that respondents have data for all 16 management questions. As a result, the analysis in this subsection utilizes a subsample of approximately 11,400 establishments from the baseline sample.

Principal Component Analysis

PCA is a tool that is used to reduce the number of observed variables to a smaller number of uncorrelated constructed variables, called "components." These components are optimally-weighted linear combinations of the observed variables such that the first component accounts for the maximum amount of variance in the data, the second component accounts for the maximum amount of variance in the data not accounted for by the first component, and so on. For the MOPS, the observed data consists of the scores on each of the 16 management questions.

The changes in score for each of the 16 management questions are standardized prior to computing the PCA. In other words, I first compute the change in question score between 2005 and 2010 for each question and each establishment. Then, these changes are standardized so that the "change in score" has mean zero and standard deviation one for each question.

Table 3.10 displays the rotated factor pattern for the PCA. Four factors were retained having eigenvalues of 1.09 or greater, while the 12 factors that were not retained had eigenvalues below 0.98. The retained factors account for 56% of the total variance in the management dataset. Items are said to be loaded on a given component if the factor loading for that item is 0.4 or greater for that component and less than 0.4 for all other components. The first component has seven items loaded to it: questions 1-6 and question 8, which corresponds to the monitoring and targeting portion of the survey. The second component has four items loaded: the four items relating to bonus practices. The third and fourth components correspond to reassignment and promotions practices, respectively, each having two items loaded.

Table 3.11 displays the relationship between management practices and outcomes using these four principal components instead of the indices constructed based on conceptual subcategories of questions. Although the magnitudes are different due to the fact that the changes in management scores were normalized prior to constructing the principal components, the results are consistent with what I found with the original data. Component 2, which is the component that is analogous with bonus practices, is the primary driver of the relationship between productivity and management practices. The coefficient on component 2 can be interpreted as follows:

a plant that was one standard deviation above the mean change in bonus practices from 2005 to 2010 experiences about a 0.05 log point greater change in value added per worker, a 0.01 log point greater change in TFP, and a 0.029 percentage point greater change in employment versus the respondent with the mean change in bonus practices. These results are largely in line with the findings of Tables 3.4, 3.5, 3.6, and 3.9.

Component 1, which corresponds to monitoring and targeting practices, is positively and significantly correlated with labor productivity, but the coefficient has less than half of the magnitude of the coefficient corresponding to component 2. Thus, a plant that was one standard deviation above the mean change in monitoring and targeting practices from 2005 to 2010 experiences about a 0.016 log point greater change in value added per worker versus the respondent with the mean change in monitoring and targeting practices. Component 1 is not significantly correlated with TFP, but a one standard deviation greater change in monitoring/targeting practices is associated with a 0.019 point greater change in total employment versus the plant with the mean change in monitoring/targeting practices. As before, this may be because larger plants must gather more data to monitor conditions or because their larger workforce enables them to gather more data.

Component 3 roughly corresponds to reassignment/dismissal practices, and is not significantly correlated with outcomes. Component 4 is associated with promotion practices and is negatively and significantly correlated with labor productivity, though at a small magnitude, roughly equivalent in size to the positive effects of component 1. That is, an establishment with one standard deviation greater

change in promotion score will have roughly 0.019 log points less growth in labor productivity than a respondent with the mean change in promotion score.

Double LASSO

Belloni, Chernozhukov, and Hansen (2014) introduce an alternative method of variable selection, a two-step application of the LASSO regression. Given a standard linear regression equation

$$Y_i = \beta_0 + \sum_{k=1}^{K} \beta_k X_{ik} + \varepsilon_i,$$

the LASSO estimator is the solution to

$$\min_{\beta} \sum_{i} \left(Y_i - \beta_0 - \sum_{k=1}^{K} \beta_k X_{ik} \right)^2 + \lambda \sum_{k} |\beta_k|.$$

The introduction of the penalty term results in the potential for some regression coefficients being set to zero as a form of variable selection. The benefit of this selection method over PCA is that the selection takes into account the relationship of the independent variables with the dependent variable, rather than selecting only on within-sample variation of the independent variables.

This selection, however, can result in omitted variable bias by eliminating regressors with small but significant coefficients. To overcome this issue, Belloni et al. (2014) propose a variable selection procedure, the double LASSO, which applies the LASSO regression technique twice: once to select covariates that predict the dependent variable and once to select covariates that predict a key independent variable. Then, the covariates selected in each stage are utilized in a standard linear regression with the key independent variable to predict the dependent variable.

Belloni et al. (2014) refer to this final stage as the post-double-LASSO regression. Urminsky, Hansen, and Chernozhukov (2016) provide a useful summary of this process, with examples of applications to relevant economics literature.

Selection of the key independent variable is essential for application of the double LASSO technique. In a true differences-in-differences regression, this might be the treatment variable. For the case of my first-differences regression, I consider the Bartik instrument as the key independent variable, where the other independent variables include the scores on each of the 16 management questions, change in capital stock, and change in employment. The Bartik instrument is a logical key independent variable, as the relationship between economic conditions and the management scores is a focus of this paper.

The choice of penalty parameter λ is also important for this technique, as λ sufficiently high will result in the selection of no covariates and λ sufficiently low will result in the selection of all covariates. Following Belloni et al. (2014), I select

$$\lambda = 2.2\sigma_R\sqrt{N}\Phi^{-1}\left(1 - \frac{\alpha}{2K\log(N)}\right),$$

where N is the sample size, K is the number of independent variables, Φ^{-1} is the inverse CDF of the standard normal distribution, and σ_R is the standard deviation of the residuals. To implement selection of this optimal λ, I use code provided by Hansen on his webpage.[43]

[43] http://faculty.chicagobooth.edu/christian.hansen/research/

I begin by applying this double LASSO technique to the structural regression from part B above. The first LASSO regression solves

$$\min_{\alpha} \sum_{i} \left(\Delta y_i - \alpha_0 - \sum_{j=1}^{16} \alpha_j \Delta QSCORE_{ij} - \alpha_{17} \Delta L_i - \alpha_{18} \Delta k_i \right)^2 + \lambda \sum_{j=1}^{18} |\alpha_j|,$$

where $\Delta QSCORE_{ij}$ is the change in score for the j^{th} question for respondent *i* between 2005 and 2010. The LASSO regression returns non-zero coefficients for the change in capital per worker and the change in employment, as well as for question 12, which asks, "In 2005 and 2010, when production targets were met, what percent of **managers** at this establishment received performance bonuses?"

The second lasso regression solves

$$\min_{\gamma} \sum_{i} \left(Bartik_i - \gamma_0 - \sum_{j=1}^{16} \gamma_j \Delta QSCORE_{ij} - \gamma_{17} \Delta L_i - \gamma_{18} \Delta k_i \right)^2 + \lambda \sum_{j=1}^{18} |\gamma_j|,$$

which returns a non-zero coefficient only on the change in total employment. Thus, the post-double LASSO regression is simply to perform ordinary least squares on the regression equation

$$\Delta y_i = \beta_0 + \beta_1 \Delta QSCORE_{i,12} + \beta_2 \Delta k_i + \beta_3 \Delta L_i + \beta_4 Bartik_i + \varepsilon_i.$$

The results of this post-double-LASSO regression are displayed in column (1) of Table 3.12. The question that asks what share of managers receive bonuses (Question 12) is strongly and positively correlated with labor productivity. A one standard deviation greater increase the score on this question is associated with a 0.052 log point increase in value added per worker, which is consistent with the general finding for bonus scores in Tables 3.4, 3.7, and 3.9.

The fact that the double LASSO procedure only selects the question related to the percentage of managers who received bonuses as a covariate from the full set of 16 management scores reinforces the finding that responses to questions about bonus practices are the primary driver of the positive correlation between changes in management practices and changes in plant-level labor productivity. Because this question asks about the actual allocation of bonuses, not the basis on which bonuses are awarded, as in questions 9 and 11, this is suggestive that bonus outcomes are correlated with practices, but more general bonus practices are not correlated with productivity.

I also perform the double LASSO procedure for the reduced form regressions where the dependent variable is the change in RTFP. For RTFP, none of the management question scores receive non-zero coefficients in either the first or second stages of the LASSO, and so the results are not reported.

Three management questions are found to be predictors of change in employment. In addition to the question regarding the share of managers who received bonuses, they are the question that asks where production display boards showing these KPIs were located at the plant (Question 5) and the question that asks the basis for managers' performance bonuses. (Question 11) No variables receive non-zero coefficients in the second stage of the LASSO.

Responses to each of the questions selected in the first stage are positively and significantly correlated with employment growth in the post-double-LASSO regression. A one standard deviation increase in the score on the question regarding display boards is associated with a 0.019 log point increase in employment, while one

standard deviation increases in the two questions regarding managers' bonuses are each associated with approximately 0.02 log point increases in employment.

Again, these results reinforce the findings that precede them. While responses to bonus practices are the primary driver of the relationship between management scores and productivity, monitoring practices seem to be correlated with changes in employment. The fact that the LASSO procedure selects the display board question as the monitoring question associated with changes in employment suggests that the relationship between monitoring and employment may be mechanical. Although the presence of one or more display boards may be a proxy for other more structured monitoring practices, which may in turn lead to higher employment, it is also possible that larger plants necessitate the use of display boards, with the number of display boards increasing in the number of employees at the plant. A very small plant with employees who are all aware of the status of their work is less likely to require a display board, while a very large plant with multiple processes running simultaneously will similarly facilitate the use of multiple display boards.

Because the LASSO allows me to select from a large number of potential covariates, I repeat this process for a series of variables that correspond to each possible *response* on the MOPS form, rather than focusing on question scores. This allows me to examine whether or not changing particular practices in very specific ways impacts outcomes. Furthermore, the interpretation of the impact of changing a response between 2005 and 2010 depends on the sign of the change, so I analyze the direction of changes in each possible response to the 16 management questions on the MOPS. The direction of a change in response may particularly impact the

interpretation of the results due to the impact of the Great Recession. For example, becoming more structured in bonus practices may be readily interpreted as a management change, while becoming less structured in bonus practices, particularly through the share of workers receiving bonuses, may more likely be a response to the pressures of the Great Recession.

For example, a plant that did not offer bonuses to managers when targets were met in 2005, but did offer them to some share of managers in 2010, more likely introduced that practice due to a conscious decision to increase structured management practices than did a plant which removed the same practice over the same period. The reasons for this interpretation are two-fold: First, the availability of bonuses is likely impacted by revenues, which fell precipitously over this period. Second, there is a sizeable literature to suggest that monetary incentives for performance improve performance (e.g. Lazear, 2000), and the person making the decision about whether or not to implement a performance bonus program is likely aware of that fact, at least informally. While it is possible that a plant tried a performance bonus program in 2005 and found it to be unsuccessful, the incentives literature would suggest this is a less likely explanation. Of course, this interpretation is not guaranteed to be correct, and I pursue some techniques for considering causality more directly in the next section.

I use the double LASSO selection tool again to select from a large number of potential covariates. I introduce a pair of dummy variables for each possible response. A response is said to be switched "on" if it was selected in 2010 but not in 2005, and a corresponding "on" dummy variable is created for that response, equal to one for a

respondent who switched the response "on" and zero otherwise. Conversely, a response is said to be switched "off" if it was selected in 2005 but not in 2010, and a similar dummy variable is created. This increases the number of potential covariates from the first 16 questions of the MOPS to 148, two for each of the 74 potential responses to the questions.

The first-stage LASSO regression solves

$$\min_{\alpha} \sum_{i} \left(\Delta y_i - \alpha_0 - \sum_{j=1}^{74} \alpha_j RESPONSE\_ON_{ij} - \sum_{l=75}^{148} \alpha_l RESPONSE\_OFF_{i,l-74} - \alpha_{149} \Delta L_i - \alpha_{150} \Delta k_i \right)^2 + \lambda \sum_{j=1}^{150} |\alpha_j|,$$

where $RESPONSE\_ON_{ij}$ is equal to one if respondent *i* turns "on" response *j* and equal to zero otherwise, and $RESPONSE\_OFF_{ij}$ is equal to one if respondent *i* switches "off" response *j* and equals zero otherwise. This process results in the selection of only two predictors of labor productivity from the set of management dummies. First, the process selects the dummy that indicates that the respondent offered performance bonuses to managers on some basis in 2005 but did not offer them in 2010. (Question 11, Response 5, "on") Second, the first stage of the LASSO selects the dummy that indicates that the respondent offered all managers bonuses when targets were met in 2005 and did not offer them to all managers in 2010. (Question 12, Response 5, "off") Change in capital per worker also a receives non-zero coefficient in the first stage of the LASSO.

The second stage of the LASSO is similarly

$$\min_{\gamma} \sum_{i} \left(\Delta Bartik_i - \gamma_0 - \sum_{j=1}^{74} \gamma_j RESPONSE\_ON_{ij} - \sum_{l=75}^{148} \gamma_l RESPONSE\_OFF_{i,l-74} - \gamma_{149} \Delta L_i - \gamma_{150} \Delta k_i \right)^2 + \lambda \sum_{j=1}^{150} |\gamma_j|.$$

This selection process again returns a non-zero coefficient on change in employment.

When change in labor productivity is the dependent variable, the post-double-LASSO regression equation includes the Bartik instrument, change in capital per worker, and the dummies for the two aforementioned responses. The results for this regression are given in Table 3.13, column (1). Switching from offering performance bonuses for managers on some basis in 2005 to not offering performance bonuses in 2010 was associated with approximately a 0.198 log point decline in labor productivity, while changing from offering bonuses to 100% of managers when targets were met to offering those bonuses to a smaller share of managers was associated with a 0.142 log point decline in value added per worker.

These results suggest that the primary drivers of the relationship between changes in management responses and changes in plant-level labor productivity are the plants' reducing the availability of bonuses. This suggests that the adoption of structured bonus practices over this period did not have a positive causal impact on labor productivity. Shocks that affect plants' liquidity and ability to pay bonuses are associated with changes in productivity, but it seems unlikely that changes in management practices are actually driving changes in productivity.

As before, I repeat the exercise where total factor productivity is the dependent variable. As before, none of the management response dummies are

selected as predictors of RTFP or of the Bartik instrument. Thus, I do not perform the post-double-LASSO regression in which TFP is the dependent variable.

Finally, I perform the double LASSO analysis with employment growth as the dependent variable. The first stage of the LASSO results in the selection of four response dummies as predictors of changes in employment. These include having targets that became possible to achieve without much effort (Question 7, Response 1, "on"), no longer offering bonuses to managers (Question 11, Response 5, "on"), no longer offering promotions to non-managers (Question 13, Response 4, "on"), and changing to rarely or never reassigning under-performing non-managers (Question 15, Response 3, "on").

Interestingly, no monitoring practices are selected in the first stage of the LASSO, despite such practices being correlated with employment outcomes in Tables 3.3, 3.6, 3.7, 3.11, and 3.12. I hypothesize that this is due to the magnitudes of the coefficients associated with the dummies for the directions of changes in incentive practices. Although I find that monitoring practices are positively correlated with employment elsewhere, the LASSO will select only those covariates that are most correlated with the outcome variable and will exclude other correlates due to the penalty associated with inclusion of additional dependent variables. Because decreasing structure in incentive practices is very strongly negatively correlated with changes in employment, the directional changes in monitoring practices are excluded.

All of the aforementioned response dummies are found to be significantly correlated with changes in employment at the 1% significance level in the post-double-LASSO regression, results of which can be found in column (2) of Table 3.13.

For targeting practices, targets being achievable without much effort in 2010 (versus requiring more effort to achieve targets in 2005) was associated with approximately a 0.177 log point drop in employment. This suggests that establishments' targets becoming less stringent was correlated with decreasing employment between 2005 and 2010. For incentive practices, performance bonuses no longer being available to managers on any basis was associated a 0.181 log point decline in employment, and no longer offering opportunities for promotion to non-managers was associated with an extremely large 0.361 log-point decline in employment.

Curiously, respondents who reported changing to rarely or never reassigning or dismissing under-performing non-managers exhibit a 0.291 log point decline in employment. Given the very small share of respondents who reported becoming less structured in their reassignment and dismissal practices (see Figure 3.4), this effect is likely driven by outliers.

Taken together, the results of this section present a cohesive, if somewhat speculative, picture of the relationship between within-plant changes in management practices and within-plant changes in outcomes over the period from 2005 to 2010. Whether using intuitive categories or more advanced variable selection techniques such as PCA or double LASSO, I find that incentives practices, particularly those related to the availability of bonuses, drive the relationship between changes in management practices and changes in measures of productivity. Specifically, making bonuses less available over the Great Recession was associated with an establishment displaying declines in productivity, suggesting that outside cyclical forces drove changes in management practices and productivity, rather than management practices

causing the changes in productivity. This suggests a more complicated causal relationship between management and outcomes than that presented by Bloom et al. (2013b), at least for manufacturing establishments in the United States over this period.

Bonus Practices and Productivity

Having established that the primary driver of the relationship between within-establishment changes in adoption of structured management practices and within-establishment changes in productivity is the availability of performance bonuses, I now turn to addressing the issue of the causal link between bonuses and the Great Recession. The relationship between the realization of performance bonuses and productivity is potentially a case of reverse causality: Do bonuses drive higher productivity by incentivizing workers or do negative productivity shocks reduce the ability of the establishment to pay performance bonuses? This question is of interest not only within the empirical management literature. If bonus practices are a channel by which financial conditions causally drive decreases in productivity, this is a potential amplifier of macroeconomic shocks. If, on the other hand, bonus practices are merely a symptom of macroeconomic conditions, this would suggest that for U.S. manufacturing plants, removing performance bonuses is not necessarily productivity reducing. One possible hypothesis that is consistent with both the traditional principal-agent model, where bonuses are productivity-enhancing during periods of economic growth, and the finding that removing bonuses is not productivity-reducing during recessions is that the penalty associated with exerting low effort during recessions (e.g. being laid off) is sufficiently high as to render bonuses unnecessary

for aligning the incentives of workers and firms. Lazear, Shaw, and Stanton (2016) provide some evidence for this hypothesis showing that for a single firm with no incentive pay scheme, workers increased labor productivity in response to the Great Recession.

I start by using instrumental variables to isolated how difference components of changes in bonus practices are related to changes in productivity. By using the Bartik shock measure as an instrument for the bonus score, I first show that a portion of bonuses that can be explained by demand shocks is very strongly positively correlated with labor productivity. I then use unionization at the start of the period as an instrument for later bonus practices to show that a part of bonus practices that is exogenous to changes in demand is not significantly correlated with outcomes.

Finally, I utilize the unique mailing strategy of the MOPS discussed in Chapter 2 to attempt to address causality. As I discussed, the MOPS is fairly unique amongst Census surveys in that the survey instrument is mailed directly to the physical address of the respondent plant rather than the business address of the parent firm. This yields significant within-firm heterogeneity in responses from plants with siblings in the MOPS sample. Using responses from multi-unit firms with multiple establishments in the MOPS sample, I show that bonus practices are determined, at least partially, at the firm level. After showing this, I attempt to isolate the relationship between productivity and the portion of changes in bonus practices that are made at the firm-level based on factors other than demand.

Demand-Driven Bonus Changes

I begin by using the Bartik shock measure as an instrument for changes in bonus practices. In the top panel of Table 3.14, I display the results for the first-stage IV regression in which I regress the change in bonus scores from 2005 to 2010 on the Bartik shock. In the case where the dependent variable in the second stage is change in labor productivity, I control for the change in log capital per worker and change in log employment in the first stage.

Local demand is positively and significantly correlated with changes in bonus practices. Depending on the specification of the regression, a one standard deviation increase in the Bartik measure is associated with a small increase of 0.005 to 0.006 log points in the bonus score, or about 3% of a standard deviation for the bonus measure. The *F*-statistic associated with the first-stage is 7.374 in the model that also includes capital and labor. This value is low, but significant. In the model without capital and labor, the *F*-statistic is significant and greater than 10.

In the second stage, the portion of bonuses that is explained by local demand shocks is positively and significantly correlated with labor productivity and employment changes, although the former correlation is significant only at the 10% level. However, the magnitudes of the coefficients on the local demand-driven portion of bonus changes are much larger than the coefficients associated with changes in bonus practices in previous specifications. Even the very small 0.005 log point increase in bonus scores described above is associated with a 0.019 log point increase in labor productivity and a 0.023 log point increase in employment. Note that

the share of bonus practices explained by changes in local demand is not significantly correlated with changes in RTFP.

Although the Bartik shock measure is a measure of plausibly exogenous demand changes, the two-stage least squares estimates should not be interpreted as describing a causal relationship between bonuses and outcomes. Rather, because both employment and revenue value-added are themselves correlated with demand, this result suggests that the correlation between bonuses and outcomes may reflect the influence that demand has on each of these measures rather than any causal role for management. On the other hand, the local demand-driven portion of bonuses is negatively, but not significantly correlated with RTFP, which would suggest that bonuses are related to RTFP through channels other than local demand.

This approach displays some limitations. The Bartik measure is a plausibly exogenous measure of local demand, but for manufacturing industries, which are generally considered tradable, local demand may not be the most appropriate measure of demand. At the very least, this local measure captures only a portion of the demand shocks that buffeted manufacturing plants during the Great Recession, and these estimates provide some insight into the role that demand played in changes in bonus practices and outcomes over the period.

Changes in Bonus Practices for Reasons Other than Demand

As noted in the preceding chapter, the MOPS was subjected to a rigorous pretesting procedure prior to being fielded to respondents. In Chapter 4, I discuss this process in more detail. One finding of this pre-testing, for which Bloom et al. (2016a) provide empirical support, is that respondents reported that their answers to the

questions on incentives practices depended greatly on whether or not their plant was unionized. As a result, a question was added to the MOPS asking respondents what share of workers were unionized at the plant in 2005 and 2010.

I use the share of unionized workers at the plant at the start of the period as an instrument for changes in bonus practices. Because approximately 95% of the respondents in the sample report no change in unionization between 2005 and 2010, I perform this analysis on levels of bonus practice adoption in the cross section. Based on respondents' information shared during cognitive testing, plants that are more unionized in 2005 are expected to have less structure in their bonus practices. That is, plants are less likely to base bonuses on individual performance and fewer workers are likely to be eligible for performance bonuses.

As expected, in the top panel of Table 3.15, unionization is negatively and significantly correlated with changes in bonuses. A one standard deviation increase in unionization is associated with a 0.017 to 0.021 log point decrease in the availability of bonuses, depending on the specification of the model. The *F*-statistics for the first-stage regression in all specifications are very large.

In the bottom panel of Table 3.15, the share of bonus scores explained by unionization is not significantly correlated with labor or total factor productivity. Thus, although unionized plants have less structured bonus practices, the differences in bonus practices due to unionization are not correlated with productivity. This provides some evidence that increasing performance pay schemes is not necessarily a productivity-enhancing behavior.

Interestingly, reduced bonus practice structure due to unionization is negatively and significantly correlated with employment in 2010. This may indicate that establishments that could not adjust labor costs by changing bonus practices were forced to lay off more workers during the Great Recession. This is indicative of a possible drawback of the instrument: unionization may have reduced productivity as a result of the Great Recession through channels other than the availability of bonus practices, such as by affecting employment flexibility. This would invalidate the use of unionization as an instrument for bonus practices.

Finally, I hypothesize that bonus decisions are sometimes dictated to the plants of multi-unit firms by headquarters. These changes in bonus practices may be made in response to financial conditions at the firm. That is, firms facing negative demand or financial shocks may reduce bonuses throughout their networks of plants as a means of reducing costs. This hypothesis is consistent with findings from Lamont (1997) and Giroud and Mueller (2016) that multi-unit firms allocate the effects of negative shocks through their networks of establishments. On the other hand, firms may introduce structured bonus practices throughout their networks based on the desires of management without influence from demand or financial shocks, perhaps in hopes of increasing productivity. I focus my analysis on these firm-level management changes made for reasons other than demand shocks.

In order to test this hypothesis, I must first show that bonus practices are determined, at least partially, at the firm level. If bonuses are determined entirely at the establishment level, then conditions elsewhere in the parent firm's network will have no impact on bonus practices. If, on the other hand, bonus practices are in part

consistent across units of the firm, the firm's bonus decisions may be partially external to establishment-specific conditions.

I regress the change in bonus score on firm fixed effects for the set of establishments in the baseline sample that are part of a multi-unit firm, have at least one peer establishment in the baseline sample, and have at least one peer establishment whose MOPS instrument was filled out by a different individual. The last criterion ensures that I am not picking up respondent-level fixed effects. These criteria together yield a subsample of approximately 6,800 establishments.

I find that approximately 31% of changes in bonus practices can be explained by firm-level fixed effects. I find that the firm fixed effects remain significant when controlling for changes in establishment-level output. Taking the estimate of 45.4% measurement error in the MOPS from Bloom et al. (2016a), the true variation in changes in bonus practices accounted for by firm-level fixed effects is approximately 57% (0.31/(1-0.454)). I experiment with including state- and subsector-level fixed effects to ensure that the firm identifier is not merely a proxy for geographic or industry correlations in the availability of bonus practices. The R^2 values associated with state and subsector fixed effects are 0.8% and 1.5%, respectively. Bonus practices are almost as correlated across plants within the same firm as employment or output. Regressing employment and output on firm fixed effects for this sample of 6,800 establishments returns R^2 values of 39% and 37%, respectively.

Furthermore, the *F*-statistic associated with the null hypothesis that the firm-level fixed effects are jointly uncorrelated with changes in bonus scores is approximately 1.89, which is significant at the 1% level. Thus, the firm seems to play

at least some role in decisions related to bonus practices. Following Bertrand, Duflo, and Mullainathan (2004),[44] I verify this finding using a bootstrap evaluation. I randomly assign firm identifiers to the subsample of establishments that are part of a multi-unit firm, have at least two peer establishments in the baseline sample, and have at least one peer establishment whose MOPS instrument was filled out by a different individual in the same proportions that the firm identifiers occur in the dataset. Estimating the impact of firm fixed effects on bonus scores using these randomized identifiers, the p-value associated with the joint significance test is less than 0.05 in only 10.5% of 200 trials and is less than 0.01 in only 6 trials. The highest *F*-statistic produced over those 200 trials is 1.13. Thus, changes in bonus practices are likely determined to a significant degree at the firm level.

Having established that bonus practices are determined in part at the firm level, I use this fact to examine the causal relationship between bonus practices and labor productivity. I use changes in bonus practices at sibling establishments within the sample as an instrument for changes in bonus practices at the establishment. I include rest-of-firm changes in employment to control for firm-level demand shocks as well as the Bartik measure to control for local demand shocks.[45] The firm-level measures of employment and change in bonus practices are discussed in more detail in the data appendix section.

---

[44] And a helpful suggestion from Emek Basker.

[45] The results are robust to using firm-level measures of changes in revenue from the revenue-enhanced LBD in lieu of the firm-level change in employment.

Table 3.16 displays the results of two-stage least squares regressions using the change in bonuses at the rest of the firm as an instrument for change in establishment bonuses. Regressing the change in establishment-level bonuses on the employment-weighted measure of the average change in bonuses at the rest of the firm yields a positive and significant coefficient on the change in rest-of-firm bonuses. A one standard deviation change in the rest-of-firm bonus measure is associated with a 0.037 log point increase in establishment-level bonuses, or 20% of a standard deviation. The *F*-statistics associated with the first stage regression are very large and significant. The change in within-establishment employment is positively correlated with the change in bonuses in the specification where it is included, while the change in rest-of-firm employment is positively correlated with the change in bonuses in the specification that does not include labor or capital.

In the second panel of Table 3.16, the share of bonuses explained by managerial changes in bonuses at the firm level is positively and significantly correlated with both changes in labor productivity and changes in employment. This suggests that changes in bonus practices for reasons other than demand can have a positive impact on outcomes. In conjunction with the results from Table 3.14, this would suggest that changes in bonus practices can serve as an amplification method for negative demand shocks. A plant that is hit with a negative demand shock reduces bonuses, which in turn reduces effort by workers, reducing productivity, revenues, and ultimately employment beyond the first-order effects that the shocks have on measured productivity and employment.

However, caution should be maintained when interpreting the results of Table 3.16. Although I attempt to account for demand-related changes in bonuses in this specification by controlling for both the change in firm-level employment and local demand conditions, it is possible that I am not fully controlling for demand. In particular, there is the possibility that the exclusion restriction does not hold. Consider a plant that experiences a negative shift in productivity. This could force the plant in question to reduce bonuses and encourage the firm to decide to cut bonuses at sibling plants as well. The productivity shock experienced by the first plant may not be fully captured by changes in firm-level employment or the Bartik measure.[46] Such a scenario is fully compatible with the results presented in Table 3.16.

This final IV specification suggests that while some of the relationship between productivity and bonuses can be explained by the impact of demand on each, there may still be a causal relationship between bonuses and productivity. This provides evidence that bonuses may amplify negative demand shocks during downturns. Plants hit with negative demand shocks reduce their productivity and the availability of bonuses in response to that shock. The reduction in bonuses leads to reduced worker effort and thus a further reduction in productivity. In the last section of this chapter, I conclude and discuss future avenues for this research.

[46] The results of Table 3.16 are robust to not including the control for establishment-level changes in employment. This suggests that establishment-level changes in employment do not contribute strongly to the relationship between the share of bonus changes determined at the firm level and labor productivity.

Conclusions and Future Research

This paper suggests that during the period between 2005 and 2010, manufacturing establishments in the United States did not successfully use the structured management practices measured by the MOPS as a means by which to increase performance. A key driver of the positive correlation between changes in the adoption of structured management practices and changes in within-establishment changes in productivity is a decrease in the availability of bonuses. Because the Great Recession likely impacted the ability of plants to pay bonuses as well as productivity, at least some of the correlation between bonuses and productivity is likely not causal. However, there is evidence that between 2005 and 2010, changing bonus practices for reasons other than demand did generate changes in productivity at the plant level.

Instead, this paper suggests that bonuses are an important channel of adjustment for plants adversely affected by aggregate conditions. The cyclical adjustment of wages is a topic of clear interest to researchers in both labor and macroeconomics (e.g. Bewley, 2002; Pissarides, 2009). Bonus practices may be a channel by which plants adjust wages even if base wages are sticky during cyclical downturns. Since there is evidence of a causal relationship between changes in bonuses and changes in productivity, bonuses may therefore serve as an amplification channel for cyclical shocks. Because the categorical variables in the MOPS provide an imperfect picture of actual changes in bonus practices, a logical next step would be to try to generate a useful dataset on bonus payments that could be used to analyze cyclical adjustment. The Longitudinal Employer Household Database (LEHD) developed by the U.S. Census Bureau is a logical place to begin trying to construct

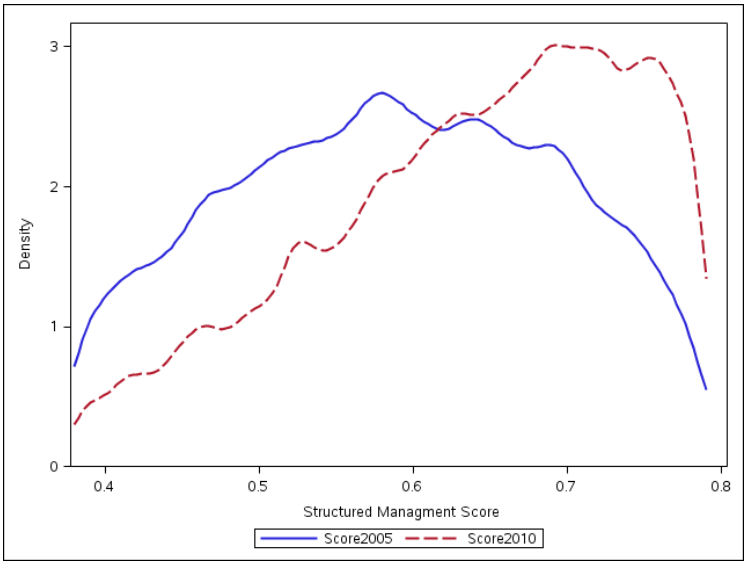
such a dataset. The Bureau of Labor Statistics also has an Employment Cost Trends Program which is part of the National Compensation Survey and includes some data on bonus pay. (Bishow, 2009) In particular, these measures should allow for more timely measures of bonuses, which will help in evaluating causal effects. The LEHD in particular will allow me to produce a high-frequency measure of bonuses for an extremely large set of U.S. businesses, which I will validate using the MOPS data. This paper has established the importance of bonuses in measuring management practices. Studying bonuses in more detail is a logical next step.

Alternatively, a structural approach to assessing the role of bonuses would also serve as an important contribution. Once could test the implications of this chapter by constructing a simple macroeconomic model that includes bonuses and worker effort as choice variables.

This paper also suggests that a single measure of "management" is insufficient for understanding the role that management decisions play in firm and plant outcomes. The finding that the causal relationship between within-plant changes in this set of structured management practices and within-plant changes in productivity cannot be strongly established during the Great Recession does not refute the long-held belief that management has an important role to play in explaining productivity heterogeneity. To the contrary, a more nuanced approach to measuring management would be a welcome addition to this growing literature. It is logical to ask whether or not specific management practices or sets of practices are determinants of outcomes for certain classes of businesses. Examining which practices are correlated with outcomes for young, small businesses or for particular industries would be a valuable

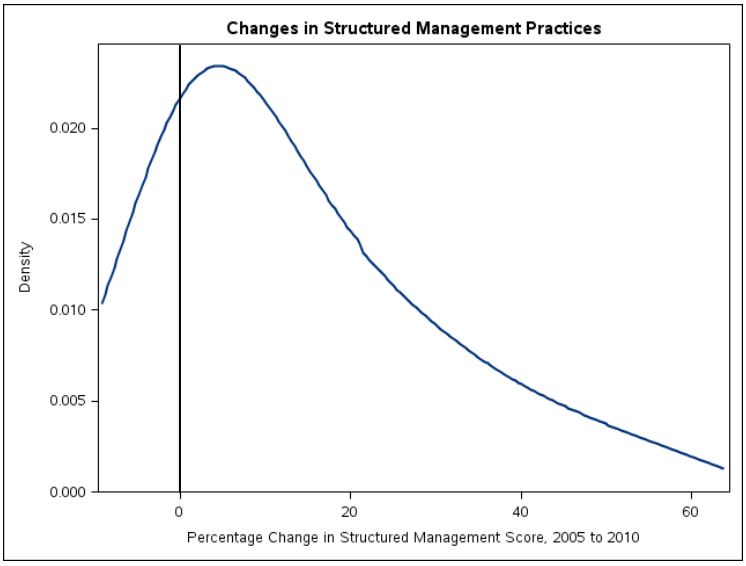
contribution to the firm dynamics literature. Several questions on management have been included on the 2015 Annual Survey of Entrepreneurs, which could aid in examining these relationships (Foster and Norman, 2016).

Figure 3.1: Distribution of Structured Management Practice Scores, 2005 and 2010



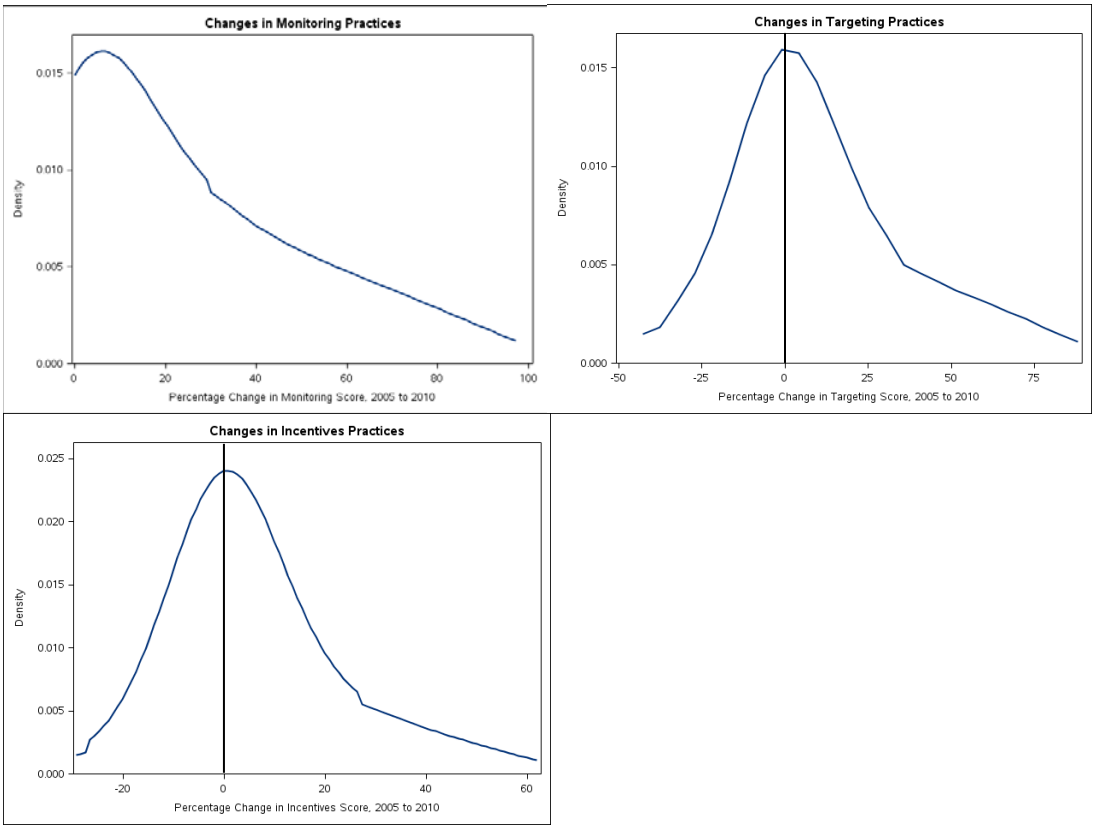
Note: Kernel density estimations. Top and bottom tails have been truncated to prevent disclosure of confidential information.

Figure 3.2: Distribution of Changes in Structured Management Practice Scores within Establishments, 2005 to 2010



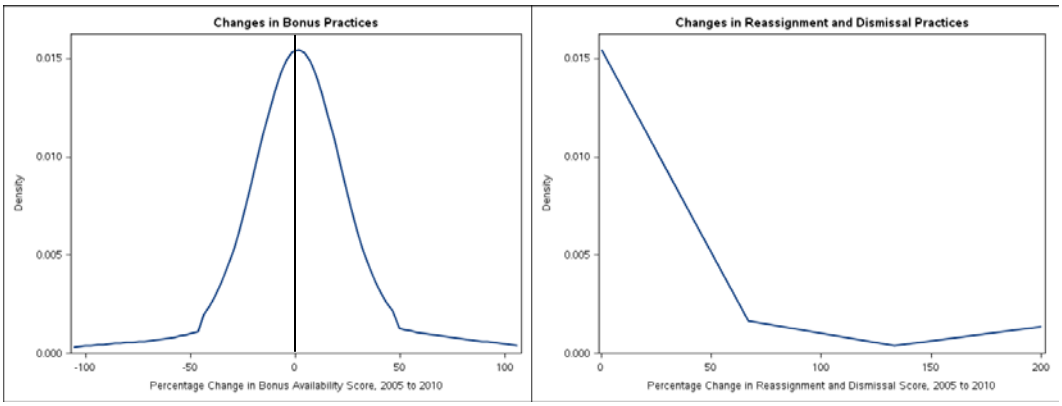
Note: Kernel density estimation. Top and bottom tails have been truncated to prevent disclosure of confidential information.

Figure 3.3: Distributions of Changes in Monitoring, Targeting, and Incentives Practice Scores within Establishments, 2005 to 2010



Note: Kernel density estimations. Top and bottom tails have been truncated to prevent disclosure of confidential information.

Figure 3.4: Distributions of Changes in Bonus and Reassignment and Dismissal Practice Scores within Establishments, 2005 to 2010



Note: Kernel density estimations. Top and bottom tails have been truncated to prevent disclosure of confidential information.

Table 3.1: First-Difference Regressions of Management Practices and Labor Productivity

Dependent Variable	**Δ Log (Value Added Per Worker)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.242***								
	(0.067)								
Δ Monitoring		0.071			-0.031				0.025
		(0.048)			(0.055)				(0.055)
Δ Targeting			0.072**		0.045				0.058
			(0.035)		(0.037)				(0.037)
Δ Incentives				0.280***	0.278***				
				(0.063)	(0.070)				
Δ Bonuses						0.297***			0.299***
						(0.048)			(0.049)
Δ Promotions							-0.089		-0.179***
							(0.056)		(0.062)
Δ Reassignment								0.027	0.022
								(0.029)	(0.032)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.2: First-Difference Regressions of Management Practices and Total Factor Productivity

Dependent Variable	**Δ Log (Productivity)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.076*								
	(0.041)								
Δ Monitoring		0.018			-0.016				-0.010
		(0.030)			(0.035)				(0.036)
Δ Targeting			0.020		0.012				0.013
			(0.020)		(0.022)				(0.022)
Δ Incentives				0.093**	0.096**				
				(0.037)	(0.041)				
Δ Bonuses						0.068**			0.065**
						(0.029)			(0.029)
Δ Promotions							0.045		0.032
							(0.045)		(0.048)
Δ Reassignment								0.015	0.006
								(0.017)	(0.019)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.3: First-Difference Regressions of Management Practices and Employment

Dependent Variable	**Δ Log (Total Employment)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.205***								
	(0.039)								
Δ Monitoring		0.111***			0.062*				0.099***
		(0.028)			(0.032)				(0.032)
Δ Targeting			0.064***		0.027				0.034*
			(0.020)		(0.021)				(0.021)
Δ Incentives				0.166***	0.123***				
				(0.033)	(0.034)				
Δ Bonuses						0.176***			0.166***
						(0.024)			(0.023)
Δ Promotions							0.004		-0.054
							(0.031)		(0.034)
Δ Reassignment								-0.001	-0.032
								(0.015)	(0.017)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.4: First-Difference Regressions of Management Practices and Labor Productivity with Bartik Instrument

Dependent Variable	**Δ Log (Value Added Per Worker)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.238***								
	(0.067)								
Δ Monitoring		0.069			-0.034				0.023
		(0.048)			(0.055)				(0.055)
Δ Targeting			0.073**		0.046				0.059
			(0.035)		(0.037)				(0.037)
Δ Incentives				0.277***	0.275***				
				(0.063)	(0.070)				
Δ Bonuses						0.295***			0.297***
						(0.048)			(0.049)
Δ Promotions							-0.088		-0.177***
							(0.056)		(0.062)
Δ Reassignment								0.026	0.022
								(0.029)	(0.032)
Bartik Shock	0.360	0.372*	0.381*	0.356	0.361	0.338	0.378*	0.378*	0.331
	(0.224)	(0.372)	(0.225)	(0.224)	(0.224)	(0.225)	(0.225)	(0.225)	(0.225)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.5: First-Difference Regressions of Management Practices and Total Factor Productivity with Bartik Shock

Dependent Variable	**Δ Log (Productivity)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.078*								
	(0.041)								
Δ Monitoring		0.019			-0.015				-0.009
		(0.030)			(0.035)				(0.036)
Δ Targeting			0.020		0.011				0.012
			(0.021)		(0.022)				(0.022)
Δ Incentives				0.095**	0.098**				
				(0.037)	(0.041)				
Δ Bonuses						0.070**			0.066**
						(0.028)			(0.029)
Δ Promotions							0.045		0.030
							(0.044)		(0.048)
Δ Reassignment								0.015	0.006
								(0.017)	(0.019)
Bartik Shock	-0.202	-0.198	-0.196	-0.204	-0.202	-0.206*	-0.195	-0.197	-0.204
	(0.125)	(0.125)	(0.124)	(0.124)	(0.125)	(0.124)	(0.124)	(0.124)	(0.124)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.6: First-Difference Regressions of Management Practices and Employment with Bartik Shock

Dependent Variable	**Δ Log (Total Employment)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.199***								
	(0.039)								
Δ Monitoring		0.107***			0.058*				0.094***
		(0.028)			(0.032)				(0.032)
Δ Targeting			0.064***		0.029				0.036*
			(0.020)		(0.021)				(0.021)
Δ Incentives				0.160***	0.119***				
				(0.032)	(0.034)				
Δ Bonuses						0.171***			0.161***
						(0.023)			(0.023)
Δ Promotions							0.005		-0.051
							(0.031)		(0.034)
Δ Reassignment								-0.003	-0.033*
								(0.015)	(0.017)
Bartik Shock	0.624***	0.628***	0.641***	0.626***	0.624***	0.616***	0.640***	0.640***	0.609***
	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.089)	(0.089)	(0.090)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.7: First-Difference Regressions of Management Practices and Outcomes with Bartik Shock and Interactions

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(1)	(2)	(3)
Δ Monitoring	0.027	-0.007	0.092***
	(0.055)	(0.036)	(0.032)
Δ Targeting	0.059	0.012	0.036*
	(0.037)	(0.022)	(0.020)
Δ Bonuses	0.294***	0.066**	0.161***
	(0.048)	(0.029)	(0.023)
Δ Promotions	-0.181***	0.030	-0.049
	(0.062)	(0.048)	(0.034)
Δ Reassignment	0.023	0.007	-0.033*
	(0.032)	(0.019)	(0.017)
Bartik Shock	0.693**	-0.060	0.481***
	(0.309)	(0.167)	(0.141)
Bartik * Δ Monitoring	-2.465*	-0.930	0.715
	(1.387)	(0.757)	(0.626)
Bartik * Δ Targeting	0.219	0.290	0.559
	(1.000)	(0.553)	(0.464)
Bartik * Δ Bonuses	-0.936	-0.252	0.139
	(1.099)	(0.647)	(0.527)
Bartik * Δ Promotions	-0.751	0.490	-0.360
	(1.457)	(1.256)	(0.761)
Bartik * Δ Reassignment	0.048	-0.413	-0.0185
	(0.884)	(0.551)	(0.363)
Observations	12,000	12,000	12,000

Notes: The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is the de-meaned measure detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.8: Joint Hypothesis Tests for First-Difference Regressions of Management Practices and Outcomes with Bartik Shock and Interactions

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(1)	(2)	(3)
$\boldsymbol{\beta_{\Delta Monitoring} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Monitoring} = 0}$	1.63	0.79	4.46**
$\boldsymbol{\beta_{\Delta Targeting} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Targeting} = 0}$	1.31	0.30	1.90
$\boldsymbol{\beta_{\Delta Bonuses} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Bonuses} = 0}$	18.99***	2.58*	23.97***
$\boldsymbol{\beta_{\Delta Promotions} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Promotions} = 0}$	4.34**	0.27	1.15
$\boldsymbol{\beta_{\Delta Reassignment} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Reassignment} = 0}$	0.26	0.33	1.93
Observations	12,000	12,000	12,000

Notes: Reported values are the *F*-statistics of the Wald's *F* test for the associated joint hypothesis. The denominator degrees of freedom are the number of firm clusters in the sample. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information.

Table 3.9: Structural First-Difference Regressions of Management Practices and Labor Productivity

Dependent Variable	**Δ Log (Value Added Per Worker)**								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.257***								
	(0.067)								
Δ Monitoring		0.076			-0.035				0.028
		(0.048)			(0.055)				(0.055)
Δ Targeting			0.080**		0.052				0.066*
			(0.035)		(0.037)				(0.037)
Δ Incentives				0.295***	0.292***				
				(0.063)	(0.070)				
Δ Bonuses						0.320***			0.322***
						(0.048)			(0.049)
Δ Promotions							-0.091		-0.184***
							(0.056)		(0.062)
Δ Reassignment								0.023	0.016
								(0.029)	(0.032)
Δ Log (Capital per Worker)	0.097***	0.099***	0.101***	0.099***	0.099***	0.100***	0.102***	0.101***	0.100***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.028)
Δ Log (Employment)	-0.070**	-0.065**	-0.064*	-0.070**	-0.069**	-0.075**	-0.062*	-0.062*	-0.078**
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Bartik Shock	0.419*	0.429*	0.438**	0.415*	0.420*	0.399*	0.434**	0.434**	0.393*
	(0.219)	(0.220)	(0.220)	(0.219)	(0.220)	(0.220)	(0.221)	(0.220)	(0.220)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.10: Rotated Factor Pattern and Final Communality Estimates from Principal Component Analysis of Management Question Scores

MOPS Question Number	Components 1	2	3	4	Communality
1	**0.65 ***	0.03	0.11	0.10	0.44
2	**0.69 ***	0.03	0.01	0.14	0.49
3	**0.75 ***	0.04	0.07	0.13	0.58
4	**0.76 ***	0.05	0.06	0.10	0.59
5	**0.65 ***	0.04	0.11	-0.01	0.44
6	**0.61 ***	0.04	0.11	0.10	0.39
7	0.14	0.03	0.05	0.12	0.04
8	**0.72 ***	0.07	0.18	0.11	0.56
9	0.03	**0.72 ***	0.05	0.01	0.52
10	0.09	**0.79 ***	0.05	-0.01	0.64
11	0.00	**0.65 ***	-0.04	0.06	0.43
12	0.10	**0.78 ***	0.02	0.06	0.62
13	0.18	0.06	0.09	**0.85 ***	0.76
14	0.16	0.03	0.14	**0.84 ***	0.76
15	0.22	0.03	**0.88 ***	0.15	0.84
16	0.21	0.02	**0.89 ***	0.14	0.85
Observations:					**11,400**

Notes: Communality is the percent of variance for the given question that is accounted for in the four retained components. Question scores are the difference in 2010 and 2005 scores, which are then normalized to have mean zero and standard deviation one. Question loads are considered significant if the factor loading was greater than 0.4 for the given component and less than 0.4 for all others. Questions are detailed in Table 3.17. Number of observations rounded to prevent the disclosure of confidential information.

Table 3.11: Principal Components' Effect on Establishment Outcomes

Dependent Variable	**Δ Log (Value Added Per Worker)**		**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(1)	(2)	(3)	(4)
Component 1	0.014	0.016*	0.007	0.018***
(Monitoring & Targeting)	(0.009)	(0.009)	(0.005)	(0.005)
Component 2	0.049***	0.053***	0.011**	0.028***
(Bonuses)	(0.009)	(0.009)	(0.005)	(0.004)
Component 3	0.003	0.002	0.001	-0.004
(Reassignment)	(0.008)	(0.008)	(0.005)	(0.004)
Component 4	-0.019**	-0.019**	0.006	-0.003
(Promotions)	(0.008)	(0.008)	(0.006)	(0.004)
Δ Log (Capital per Worker)		0.097***		
		(0.030)		
Δ Log (Employment)		-0.079**		
		(0.035)		
Bartik Shock	0.354	0.418*	-0.197	0.634***
	(0.236)	(0.230)	(0.126)	(0.092)
Observations	11,400	11,400	11,400	11,400

Notes: Components are weighted averages of normalized changes in question score. Questions are loaded onto components as in Table 3.10. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.12: Post-Double-LASSO by Question

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Total Employment)**
	(1)	(2)
Δ "Production Display Boards" Score		0.047***
		(0.011)
Δ "Basis of Managers' Bonuses" Score		0.086***
		(0.021)
Δ "Percent of Managers who Received Bonuses" Score	0.186***	0.071***
	(0.031)	(0.016)
Δ Log (Capital per Worker)	0.098***	
	(0.030)	
Δ Log (Employment)	-0.076**	
	(0.035)	
Bartik Shock	0.422**	0.622***
	(0.230)	(0.093)
Observations	11,400	11,400

Notes: Questions are detailed in Table 3.17. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.13: Post-Double-LASSO by Direction of Response

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Total Employment)**
	(1)	(2)
Q: "How easy or difficult was it to achieve production targets?"		-0.177***
A: "Possible to achieve without much effort" in 2010, not 2005		(0.040)
Q: "What were managers' bonuses based on?"	-0.198***	-0.181***
A: "No performance bonuses" in 2010, not 2005	(0.045)	(0.021)
Q: "What percentage of managers received bonuses?"	-0.142***	
A: "100%" in 2005, not 2010	(0.045)	
Q: "What was the primary way non-managers were promoted?"		-0.361***
A: "Non-managers are normally not promoted" in 2010, not 2005		(0.069)
Q: "When was an under-performing non-manager reassigned or dismissed?"		-0.291***
A: "Rarely or never" in 2010, not 2005		(0.061)
Δ Log (Capital per Worker)	0.100**	
	(0.030)	
Δ Log (Employment)	-0.083**	
	(0.035)	
Bartik Shock	0.394*	0.609***
	(0.230)	(0.092)
Observations	11,400	11,400

Notes: Questions and responses are detailed in Table 3.17. The dummy variable is equal to 1 if the response is selected in the years as described and equal to zero otherwise. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.14: Bartik Shock as an Instrument for Bonus Practices

First Stage

Dependent Variable	**Δ Bonuses**		
	(1.1)	(1.2)	(1.3)
Bartik Shock	0.116***	0.141***	0.141***
	(0.040)	(0.040)	(0.040)
Δ Log (Capital per Worker)	0.003		
	(0.007)		
Δ Log (Employment)	0.041***		
	(0.006)		
First-stage F-value	7.374***	10.962***	10.962***

Second Stage

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(2.1)	(2.2)	(2.3)
Δ Bonuses	3.770*	-1.384	4.528***
	(2.289)	(0.961)	(1.481)
Δ Log (Capital per Worker)	0.089***		
	(0.034)		
Δ Log (Employment)	-0.217**		
	(0.102)		
Observations	12,000	12,000	12,000

Notes: The sample consists of all establishments in the baseline sample with are part of a multi-unit firm with establishments in at least one other state in 2005. The bonus score is the mean score on questions 9-12, instrumented by the commuting zone-level Bartik shock. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.15: Unionization as an Instrument for Bonus Practices

First Stage

Dependent Variable	**2010 Bonuses**		
	(1.1)	(1.2)	(1.3)
Unionization, 2005	-0.067***	-0.055***	-0.055***
	(0.009)	(0.009)	(0.009)
Log (2010 Capital per Worker)	0.030***		
	(0.004)		
Log (2010 Employment)	0.037***		
	(0.003)		
Bartik Shock	0.097	0.075	0.075
	(0.066)	(0.066)	(0.066)
First-stage F-value	49.000***	32.365***	32.365***

Second Stage

Dependent Variable	**Log (2010 Value Added Per Worker)**	**Log (2010 Productivity)**	**Log (2010 Total Employment)**
	(2.1)	(2.2)	(2.3)
2010 Bonuses	0.418	0.312	-4.773***
	(0.400)	(0.248)	(0.996)
Log (2010 Capital per Worker)	0.254***		
	(0.016)		
Log (2010 Employment)	-0.008		
	(0.017)		
Bartik Shock	-0.008	-0.044	0.900***
	(0.187)	(0.100)	(0.165)
Observations	12,000	12,000	12,000

Notes: The sample consists of all establishments in the baseline sample with are part of a multi-unit firm with establishments in at least one other state in 2005. The bonus score is the mean score on questions 9-12, instrumented by the share of unionized workers at the plant in 2005. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Table 3.16: Firm-level Bonus Decisions as an Instrument for Bonus Practices

First Stage

Dependent Variable	**Δ Bonuses**		
	(1.1)	(1.2)	(1.3)
Δ Rest-of-Firm Bonuses	0.425***	0.430***	0.430***
	(0.035)	(0.034)	(0.034)
Δ Log (Capital per Worker)	-0.005		
	(0.007)		
Δ Log (Employment)	0.016**		
	(0.008)		
Δ Log (Rest-of-Firm Employment)	0.010	0.016**	0.016**
	(0.008)	(0.007)	(0.007)
Bartik Shock	0.053	0.060	0.060
	(0.045)	(0.045)	(0.045)
First-stage F-value	85.654***	89.411***	89.411***

Second Stage

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(2.1)	(2.2)	(2.3)
Δ Bonuses	1.144***	0.072	0.588***
	(0.400)	(0.277)	(0.214)
Δ Log (Capital per Worker)	0.048		
	(0.045)		
Δ Log (Employment)	-0.165***		
	(0.054)		
Δ Log (Rest-of-Firm Employment)	0.080	-0.031	0.324***
	(0.055)	(0.034)	(0.025)
Bartik Shock	0.539*	-0.130	0.356***
	(0.300)	(0.152)	(0.112)
Observations	6,800	6,800	6,800

Notes: The sample consists of all establishments in the baseline sample with are part of a multi-unit firm with establishments in at least one other state in 2005. The bonus score is the mean score on questions 9-12, instrumented by the employment-weighted change in bonus scores at other plants in the same firm within the MOPS sample. The commuting zone-level Bartik shock is detailed in the data appendix section of this chapter. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level.

Appendix: MOPS Management Scores

For the purpose of this chapter, management practices are measured according to the first sixteen questions on the MOPS instrument. The overall "management index" is, as in Bloom et al. (2013a), a simple average of the min-max normalized responses to these sixteen questions.[47] I decompose the Bloom et al. (2013a) index into several sub-indices: monitoring, a simple average of the min-max normalized responses to questions one through five and eight; targeting, a simple average of the min-max normalized responses to questions six and seven; and incentives, a simple average of the responses to questions nine through 16. The incentives index is further decomposed into three subsets of questions: questions pertaining to bonus practices (nine through 12), questions pertaining to promotions (13 and 14), and questions pertaining to re-assignment and dismissal practices (15 and 16). The text of these sixteen questions and associated responses, along with the min-max normalized scores assigned to each response according to Bloom et al. (2013a) can be found in Table 3.17. Information on the development of the MOPS survey can be found in Buffington et al. (2016a)

[47] Min-max normalization normalizes the responses to each question to have the range [0,1] with equal distance between the values of each response within each item. (OECD, 2008) For the MOPS, min-max normalization is performed by first ranking the responses from least- to most-structured. The min-max normalized score would then be the response ranking minus the lowest ranking (one) divided by the difference between the highest and lowest rankings (number of responses minus one).

As noted in the section on the decomposition of management scores, the results of this paper are robust to several different treatments of the data, including the use of these constructed indices, principal component analysis, and LASSO techniques. The data appendix to this chapter includes additional robustness checks, including propensity score weighting, controls for recall bias, and a discussion of alternative specifications of the Bartik shock

Table 3.17: MOPS Survey Questions, Responses, and Min-Max Normalized Scores

Question Number	Question Text	Response	Min-Max Normalized Ranking	Category
1	In 2005 and 2010, what best describes what happened at this establishment when a problem in the production process arose? Examples: Finding a quality defect in a product or a piece of machinery breaking down. *Check one box for each year*	We fixed it but did not take further action	1/3	Monitoring
		We fixed it and took action to make sure that it did not happen again	2/3	
		We fixed it and took action to make sure that it did not happen again, and had a continuous improvement process to anticipate problems like these in advance	1	
		No action was taken	0	
2	In 2005 and 2010, how many key performance indicators were monitored at this establishment? Examples: Metrics on production, cost, waste, quality inventory, energy, absenteeism and deliveries on time. *Check one box for each year*	1-2 key performance indicators	1/3	Monitoring
		3-9 key performance indicators	2/3	
		10 or more key performance indicators	1	
		No key performance indicators (If no key performance indicators in both years, SKIP to (6))	0	
3	During 2005 and 2010, how frequently were the key performance indicators **reviewed** by **managers** at this establishment? ***Mark all that apply*** A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and	Yearly	1/6	Monitoring
		Quarterly	1/3	
		Monthly	1/2	
		Weekly	2/3	
		Daily	5/6	

Question Number	Question Text	Response	Min-Max Normalized Ranking	Category
	promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.	Hourly or more frequently	1	
		Never	0	
4	During 2005 and 2010, how frequently were the key performance indicators **reviewed** by **non-managers** at this establishment? ***Mark all that apply*** Non-managers are all employees at the establishment who are not managers as defined in (3).	See question 3	See question 3	Monitoring
5	During 2005 and 2010, where were the production display boards showing output and other key performance indicators located at this establishment? *Check one box for each year*	All display boards were located in one place (e.g. at the end of the production line)	1/2	Monitoring
		Display boards were located in multiple places (e.g. at multiple stages of the production line)	1	
		We did not have any display boards	0	
6	In 2005 and 2010, what best describes the time frame of production targets at this establishment? *Check one box for each year* Examples of production targets are: production, quality, efficiency, waste, on-time delivery.	Main focus was on short-term (less than one year) production targets	1/3	Targeting
		Main focus was on long-term (more than one year) production targets	2/3	
		Combination of short-term and long-term production targets	1	
		No production targets (If no production targets in both years, SKIP to (13))	0	

Question Number	Question Text	Response	Min-Max Normalized Ranking	Category
7	In 2005 and 2010, how easy or difficult was it for this establishment to achieve its production targets? *Check one box for each year*	Possible to achieve without much effort	0	Targeting
		Possible to achieve with some effort	1/2	
		Possible to achieve with normal amount of effort	3/4	
		Possible to achieve with more than normal effort	1	
		Only possible to achieve with extraordinary effort	1/4	
8	In 2005 and 2010, who was aware of the production targets at this establishment? *Check one box for each year*	Only senior managers	0	Monitoring
		Most managers and some production workers	1/3	
		Most managers and most production workers	2/3	
		All managers and most production workers	1	
9	In 2005 and 2010, what were **non-managers'** performance bonuses usually based on? ***Mark all that apply***	Their own performance as measured by production targets	1	Incentives, Bonuses
		Their team or shift performance as measured by production targets	3/4	
		Their establishment's performance as measured by production targets	1/2	
		Their company's performance as measured by production targets	1/4	
		No performance bonuses (If no performance bonuses in both years, SKIP to (11))	0	
10	In 2005 and 2010, when production targets were met, what percent of **non-managers** at	0%	1/5	Incentives, Bonuses
		1-33%	2/5	

Question Number	Question Text	Response	Min-Max Normalized Ranking	Category
	this establishment received performance bonuses? *Check one box for each year*	34-66%	3/5	
		67-99%	4/5	
		100%	1	
		Production targets not met	0	
11	In 2005 and 2010, what were **managers'** performance bonuses usually based on? ***Mark all that apply***	See question 9 (If no performance bonuses in both years, SKIP pattern directs respondent to SKIP to (13))	See question 9	Incentives, Bonuses
12	In 2005 and 2010, when production targets were met, what percent of **managers** at this establishment received performance bonuses? *Check one box for each year*	See question 10	See question 10	Incentives, Bonuses
13	In 2005 and 2010, what was the primary way **non-managers** were promoted at this establishment? *Check one box for each year*	Promotions were based solely on performance and ability	1	Incentives, Promotions
		Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	2/3	
		Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	1/3	
		Non-managers are normally not promoted	0	

Question Number	Question Text	Response	Min-Max Normalized Ranking	Category
14	In 2005 and 2010, what was the primary way **managers** were promoted at this establishment? *Check one box for each year*	See question 13 (Replace “non-managers” with “managers”)	See question 13	Incentives, Promotions
15	In 2005 and 2010, when was an under-performing **non-manager** reassigned or dismissed? *Check one box for each year*	Within 6 months of identifying non-manager under-performance	1	Incentives, Reassignment/ Dismissal
		After 6 months of identifying non-manager under-performance	1/2	
		Rarely or never	0	
16	In 2005 and 2010, when was an under-performing **manager** reassigned or dismissed? *Check one box for each year*	See question 15 (Replace “non-manager” with “manager”)	See question 15	Incentives, Reassignment/ Dismissal

Data Appendix

Recall Bias

The analysis in this paper relies on survey data which includes a recall component. For all management questions on the MOPS survey, respondents are asked about their practices in 2010 (reference period) and 2005 (recall). In order to exploit the within-establishment changes in practices to examine the impact of the Great Recession on those practices, I use reported changes between the reference period and the recall data.

Naturally, this raises concerns about the impact of recall bias on the results herein. Recall bias in economic survey data can impact empirical results (Horvath, 1982; Oyer, 2004). To control for recall bias, I utilize two additional questions from the MOPS instrument.

First, the respondent is asked to report her first year worked at the establishment. This variable may be correlated with recall bias, but its effects are unclear. A respondent who worked at the establishment in 2005 may provide more accurate recall data than someone who did not work there if the latter person guesses at the data. On the other hand, the latter person may check paper records or otherwise verify recall data since she otherwise would not have any recollection of the management practices at the establishment, which may be more accurate than the memory of a person who did work at the establishment in 2005. As will be discussed in the next chapter, in cognitive testing of the survey, respondents inconsistently reported whether or not they could provide accurate recall data. I generate a tenure

flag equal to one if the respondent reported starting work at the establishment in 2005 or earlier and equal to zero if she reported that she started working at the establishment in 2006 or later.

Second, respondents are asked to report their March 12 pay period employment for 2005. The same question appears on the 2005 ASM survey form. For the samples in this paper, I require that all establishments have employment data in the 2005 ASM. This allows me to calculate the following measure of recall bias

$$Bias_i = \frac{\left|TE_{ASM,2005,i} - TE_{MOPS,2005,i}\right|}{TE_{ASM,2005,i}}.$$

If the difference between the two employment measures is of mod 10, I assume that the respondent had the correct employment but accidentally added too many or two few zeros, and I manually set the bias to zero. Regression results are robust to including the tenure flag and the bias estimate as additional controls.

Table 3.20 shows that the bias measure is decreasing in establishment employment size. This is particularly true for the mass of establishments which have discrepancies between their MOPS and ASM employment of greater than 33%. This result is robust to the inclusion of the tenure flag and the tenure flag interacted with employment size. Neither the tenure flag nor the interaction term are significantly correlated with the bias measure.

This correlation between employment size and recall bias becomes an issue when weighting the regressions using propensity scores. One of the major criteria for inclusion in the ASM sample is employment size. Thus, when weighting responses based on their likelihood of inclusion in the baseline sample, small establishments are

likely to be over weighted. Additionally, the requirement that all establishments in the baseline sample be continuing establishments further biases this sample towards large establishments.

Thus, if small establishments in terms of number of employees exhibit higher recall bias, weighting the sample will amplify the effects of recall bias. Table 3.21 compares the weighted and unweighted reduced form regressions of labor productivity on measures of management for the baseline sample plus all establishments meeting the baseline sample criteria with the exception of the requirement that recall bias be less than 33%. Although the point estimates are quite similar between columns (1) and (2) and between columns (3) and (4), the standard errors are much higher in the weighted regressions than in the unweighted regressions.

In response, I restrict my baseline sample to be drawn only from the set of respondents who have recall bias less than 33%. Results are robust to using a more lenient cutoff of recall bias less than 100%.

Propensity Score Weighting

The U.S. Census Bureau weights survey data to create population estimates. For the purpose of this paper, I do not weight results. Thus, the results contained herein do not refer to the population of continuing U.S. manufacturing establishments between 2005 and 2010, but rather to the subset of approximately 12,000 establishments which fit the criteria for inclusion in the baseline sample outlined in the data section above.

It is natural to ask whether or not these results can be extended to the general population, so I provide limited evidence that these results are robust weighting the data to reflect the population of continuing manufacturers. After controlling for measurement error as described in above, I generate propensity scores to weight the regressions. I take the set of establishments that appear in both the 2005 and 2010 LBD as the potential sample population. I create a dummy variable for this population equal to one if the establishment is in the baseline sample and zero otherwise. I run a logistic regression to measure the likelihood that an establishment is in the sample based on payroll, multiunit/single unit, NAICS subsector, and employment class. The weights are the equal to one over the p-values of this regression. To control for changes in industry classification, I utilize the Fort-Klimek time-consistent NAICS dataset. (Fort and Klimek, 2016)

Table 3.22 displays the results of the weighted regression equivalent to the unweighted regression results in Table 3.1. Note that the signs and significances of variables are quite similar when comparing between these two tables. The coefficients are generally larger, and the weighted standard deviations are larger than the unweighted standard deviations. This suggests that in the broader population of manufacturers management is more strongly correlated with outcomes, although bonuses still dominate this relationship.

Because this weighting gives relatively more weight to establishments that are small in terms of employment, it seems that management practices at small establishments are more closely tied to size. This effect could be due to small establishments being more susceptible to the macroeconomic shocks that link bonus

practices and outcomes, or due to the fact that small establishments are more likely to fall lower on the management distribution. (Bloom et al., 2013a)

Table 3.23 is the weighted analog to Table 3.7. Interestingly, changes in bonus practices are strongly positively correlated with value added per worker in column (1), suggesting that for small establishments bonuses are more closely tied to labor productivity than local economic conditions.

Like in Table 3.7, we see that in Table 3.23 bonus scores and their associated interaction term are jointly significant with respect to labor productivity, total factor productivity, and employment growth. As in Table 3.7, bonus scores are positively correlated with employment. Unlike in Table 3.7, in Table 3.23 monitoring scores and their associated interaction term are jointly significant with respect to labor productivity, total factor productivity, and employment growth.

These results are largely robust to using the ASM sample weights and adjusted MOPS score weights which are available as part of the datasets used to produce this research.

Bartik Shock

As a measure of local labor market conditions, I construct a measure of expected changes in local employment based on historical industry shares. This

instrument was first developed by Bartik (1991). For commuting zone *z*,[48] the Bartik shock is given by

$$Bartik_z = \sum_{i \in I} \frac{L_{i,z,2005}}{\sum_{j \in I} L_{j,z,2005}} \left[\log\left(\sum_{q \neq z} L_{i,q,2010} \right) - \log\left(\sum_{q \neq z} L_{i,q,2005} \right) \right],$$

where $L_{i,s,t}$ is period *t* employment in industry *i* and commuting zone *z*. *I* is the set of manufacturing subsectors. As with the propensity score weighting, I utilize the Fort-Klimek time consistent NAICS industry dataset to minimize issues of changes in industry classifications over time.

Firm-Level Measures of Bonuses and Employment

The firm-level measure of change in bonuses is constructed according to

$$\Delta Rest\ of\ Firm\ Bonus_{i,f} = \frac{\sum_{j \neq i} L_{j,f,2010} \Delta Bonus_{j,f}}{\sum_j L_{j,f,2010}},$$

where $\Delta Rest\ of\ Firm\ Bonus_{i,f}$ is the measure of changes in bonuses at firm *f* for all establishments other than establishment *i*. This measure gives more weight to bonus decisions made at larger plants, which are likely to have more weight in firms' bonus-setting decisions. The firm is identified as the parent firm in 2010. That is, this measure includes all establishments were part of the firm in 2010, regardless of whether or not the plants were part of that firm in 2005. This measure is constructed using only the establishments that are in the MOPS multi-unit sample. The set of

[48] Commuting zones are defined by the 2000 Commuting Zones produced by the U.S. Department of Agriculture's Economic Research Service. For documentation, see https://www.ers.usda.gov/data-products/commuting zones-and-labor-market-areas/documentation/

establishments $j \in J$ that belong to firm f does not include the full set of establishments of the firm, but rather the set of establishments of the firm that are in the MOPS baseline sample, have at least one sibling in the MOPS baseline sample, and have at least one sibling whose MOPS questionnaire was filled out by a different respondent.

Constructing the firm-level measure of employment follows a similar procedure. For firm *f*, employment in 2010 is the sum of employment at all establishments that share the identifier of firm *f* in 2010. Firm *f*'s employment in 2005 is the sum of employment at all establishments that share the identifier of firm *f* in 2010 plus all employment at establishments that share that identifier in 2005 but were not in business in 2010. That is, the measure includes births of new establishments in firm *f* between 2005 and 2010, continuing establishments that were a part of firm *f* in both 2005 and 2010, continuing establishments that were a part of firm *f* in 2010 but not in 2005, and establishments that were part of firm *f* in 2005 but closed before 2010. The rest-of-firm change in employment measure is the change in firm-level employment between 2005 and 2010 minus the change in employment at the establishment in question over the period. All employment data for this measure comes from the LBD.

Table 3.18: Descriptive Statistics for Baseline Sample

Variable	Mean	S.D.	Minimum	Maximum
Total Employment, 2010	235.66	392.89		
Total Employment, 2005	271.36	452.67		
Establishment Age in 2010	26.87	9.45		
Log Total Factor Productivity, 2010	1.827	0.589		
Log Total Factor Productivity, 2005	1.873	0.585		
Bartik Shock	-0.241	0.043	-0.479	-0.037
Unionization, 2005	0.176	0.317		

Table 3.19: Descriptive Statistics for Management Variables, Baseline Sample

Variable	Mean	S.D.	Skewness	Weighted Mean	Weighted S.D.
Management Score, 2010	0.653	0.143	-0.793		
Management Score, 2005	0.564	0.154	-0.425		
Percentage Change in Management Score	15.77	24.38	1.497		
Percentage Change in Monitoring Score	27.64	34.26	1.195		
Percentage Change in Targeting Score	13.95	40.15	0.985		
Percentage Change in Incentives Score	7.78	30.64	1.110		
Percentage Change in Bonus Practices Score	0.55	54.79	-0.239		
Percentage Change in Reassignment/Dismissal Practices Score	28.02	70.03	1.376		
Change in Management Score	0.089	0.125		0.064	0.355
Change in Monitoring Score	0.158	0.179		0.123	0.501
Change in Targeting Score	0.090	0.230		0.071	0.647
Change in Incentives Score	0.037	0.132		0.020	0.389
Change in Bonus Practices Score	0.002	0.185		-0.013	0.568
Change in Promotion Practices Score	0.031	0.139		0.022	0.411
Change in Reassignment/Dismissal Practices Score	0.112	0.273		0.082	0.739

Table 3.20: Recall Bias and Employment Size

Dependent Variable	**Recall Bias**	
	(1)	(2)
Intercept	34.922***	109.224***
	(1.436)	(5.339)
2010 Reported Employment	-0.007***	-0.016***
	(0.002)	(0.005)
Observations	15,700	3,700

Notes: Column (1) is the full untrimmed sample. Column (2) removes establishments with recall bias less than 33%. Recall bias is defined as the 100*|Recall Employment – Reported Employment|/Reported Employment, where recall employment is the number of employees as of the March 12, 2005 pay period reported on the MOPS 2010 and reported employment is the equivalent value reported on the 2005 ASM.

Table 3.21: Unweighted v. Weighted First-Difference Regressions of Management Practices and Labor Productivity, Uncorrected for Recall Bias

Dependent Variable	**Δ Log (Value Added Per Worker)**			
	(1)	(2)	(3)	(4)
Δ Management	0.235***	0.252		
	(0.060)	(0.162)		
Δ Monitoring			0.087*	0.048
			(0.053)	(0.143)
Δ Targeting			0.020	0.044
			(0.035)	(0.078)
Δ Bonuses			0.256***	0.255*
			(0.047)	(0.137)
Δ Promotions			-0.185***	-0.012
			(0.058)	(0.134)
Δ Reassignment			0.024	-0.035
			(0.030)	(0.059)
Observations	15,700	15,700	15,700	15,700
Weighted	No	Yes	No	Yes

Notes: Sample is not trimmed for recall bias. Weights are propensity score weights as described in the data appendix above.

Table 3.22: Propensity Score Weighted First-Difference Regressions of Management Practices and Outcomes

Dependent Variable	**Δ Log (Value Added Per Worker)**			**Δ Log (Productivity)**			**Δ Log (Total Employment)**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Management	0.427***			0.180**			0.638***		
	(0.142)			(0.083)			(0.100)		
Δ Monitoring		-0.027	0.052		-0.016	0.008		0.318***	0.354***
		(0.163)	(0.170)		(0.073)	(0.072)		(0.101)	(0.104)
Δ Targeting		0.053	0.068		0.053	0.057		0.066	0.073
		(0.085)	(0.083)		(0.048)	(0.047)		(0.060)	(0.060)
Δ Incentives		0.476***			0.158**			0.217**	
		(0.132)			(0.080)			(0.086)	
Δ Bonuses			0.447***			0.142**			0.200***
			(0.090)			(0.059)			(0.050)
Δ Promotions			-0.072			0.019			-0.032
			(0.114)			(0.082)			(0.080)
Δ Reassignment			-0.027			-0.023			-0.011
			(0.058)			(0.035)			(0.051)
Observations	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level. Regressions weighted by propensity scores as described in data appendix.

Table 3.23: Propensity Score Weighted First-Difference Regressions of Management Practices and Outcomes with Bartik Shock and Interactions

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(1)	(2)	(3)
Δ Monitoring	0.061	0.012	0.359***
	(0.164)	(0.072)	(0.102)
Δ Targeting	0.071	0.058	0.063
	(0.082)	(0.048)	(0.056)
Δ Bonuses	0.432***	0.135**	0.191***
	(0.090)	(0.058)	(0.050)
Δ Promotions	-0.073	0.020	-0.028
	(0.112)	(0.082)	(0.077)
Δ Reassignment	-0.027	-0.023	-0.003
	(0.057)	(0.035)	(0.049)
Bartik Shock	1.337**	0.639	0.801*
	(0.643)	(0.397)	(0.417)
Bartik * Δ Monitoring	-8.292**	-2.591	-2.444
	(3.548)	(1.621)	(2.335)
Bartik * Δ Targeting	1.845	0.613	3.516*
	(1.839)	(1.025)	(1.846)
Bartik * Δ Bonuses	-0.195	0.458	0.743
	(2.107)	(1.372)	(1.168)
Bartik * Δ Promotions	2.032	1.765	2.290
	(2.574)	(1.734)	(2.152)
Bartik * Δ Reassignment	1.515	-0.075	-2.667*
	(1.465)	(0.988)	(1.437)
Observations	12,000	12,000	12,000

Notes: The management score is the mean score for all 16 management questions, where responses are scored on a 0-1 scale. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix. Number of observations rounded to prevent the disclosure of confidential information. Standard errors are clustered at the firm level. Regressions weighted by propensity scores as described in the data appendix.

Table 3.24: Joint Significance Test for Propensity Score Weighted First-Difference Regressions of Management Practices and Outcomes with Bartik Shock and Interactions

Dependent Variable	**Δ Log (Value Added Per Worker)**	**Δ Log (Productivity)**	**Δ Log (Total Employment)**
	(1)	(2)	(3)
$\boldsymbol{\beta_{\Delta Monitoring} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Monitoring} = 0}$	3.86**	1.29	8.83***
$\boldsymbol{\beta_{\Delta Targeting} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Targeting} = 0}$	0.74	1.00	1.86
$\boldsymbol{\beta_{\Delta Bonuses} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Bonuses} = 0}$	11.68***	2.76*	7.32***
$\boldsymbol{\beta_{\Delta Promotions} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Promotions} = 0}$	0.62	0.52	0.62
$\boldsymbol{\beta_{\Delta Reassignment} = 0}$, $\boldsymbol{\beta_{Bartik*\Delta Reassignment} = 0}$	0.83	0.21	1.76
Observations	12,000	12,000	12,000

Notes: Reported values are the *F*-statistics of the Wald's *F* test for the associated joint hypothesis. The denominator degrees of freedom are the number of firm clusters in the sample. The monitoring score is the mean score on questions 1-5 and 8. The targeting score is the mean score on questions 6 and 7. The incentives score is the mean score on questions 9-16. The bonus score is the mean score on questions 9-12. The promotions score is the mean score on questions 13 and 14. The reassignment score is the mean score on questions 15 and 16. The commuting zone-level Bartik shock is detailed in the data appendix. Number of observations rounded to prevent the disclosure of confidential information. Regressions weighted by propensity scores as described in the data appendix.

Chapter 4: The Management and Organizational Practices Survey: Cognitive Testing[49]

(with Cathy Buffington and Kenny Herrell)

Introduction

As discussed in Chapter 2, the U.S. Census Bureau uses quality standards to guide all stages of data collection. One such quality standard requires that each data collection instrument must be tested and refined to ensure that the instrument can be understood and answered and does not cause undue burden for the respondents.[50] One method of pre-testing a survey instrument is via cognitive interviews. Cognitive interviews are used to understand the respondents' thought processes as they work through the instrument and to use that knowledge to improve the survey questions. (Pick and Brennan; 2015a, b) These thought processes include comprehension of the question, retrieval of the relevant information, and mapping the information to the provided responses. When working with business surveys, information retrieval often relies on gathering data from administrative records or other members of the business, and cognitive interviews can be used to evaluate how respondents will gather data to complete the instrument.

---

[49] This paper is adapted from a working paper co-authored with Cathy Buffington and Kenny Herrell and issued as part of the Center for Economic Studies (CES) Working Paper series. (Buffington, Herrell, and Ohlmacher; 2016b)

[50] For more information on the Census Bureau's quality standards, see http://www.census.gov/about/policies/quality/standards.html

The MOPS, an overview of which was provided in Chapter 2, and results of which were covered in Chapter 3, was tested and refined based on the results of cognitive interviews. Because the MOPS measures non-traditional concepts, namely the eponymous management and organizational practices, respondent interpretations have an outsized impact on the results of the survey relative to more traditional Census surveys that measure concrete concepts such as employment and sales. This chapter provides insight into interpretation of the MOPS data that will be valuable to all researchers who wish to use the data. Copies of the final MOPS 2010 and MOPS 2015 instruments can be found in the appendices.

This paper provides a brief overview of the cognitive testing process and subsequent refinement of the survey instruments for both the MOPS 2010 and the MOPS 2015. In this chapter, I first review the process of refinement for the MOPS 2010, and then follow with the process for the MOPS 2015. The findings detailed in this chapter illuminate the respondents' interpretation of the MOPS questions and provide additional insight into the results presented in the previous chapter.

MOPS 2010

As discussed in Chapter 2, the MOPS is a joint project between the Census Bureau and an external research team including Nick Bloom (Stanford), Erik Brynjolfsson (MIT), and John Van Reenen (MIT). Bloom and Van Reenen proposed questions related to management practices for the original MOPS instrument. These questions were based on their experiences developing and conducting the first cross-country survey of firm management practices, the World Management Survey

(WMS). Brynjolfsson helped develop content for the MOPS related to organizational practices and the adoption of data-driven decision making. The MOPS was subject to internal Census Bureau expert review, two rounds of pretesting interviews, and a round of usability testing.

Expert Review

The expert review of the MOPS was conducted by the Census Bureau (Response Improvement Research Staff (RIRS) in the Office of Economic Planning and Innovation) early in the development of the MOPS instrument. Gerver and Thomas (2009) wrote a report on the expert review of the MOPS instrument that includes both general and question-specific recommendations, which are summarized in this subsection. Many of the standardized aspects of the MOPS instrument were introduced in response to the recommendations of this expert review, including.

- Formatting each item as a direct question,
- Explicitly stating that estimates are acceptable in numerical response questions,
- Referring to the sample period in each question,
- Placing negative responses and responses that generate a skip pattern at the end of response lists, and
- Grouping like questions together.

Placing the responses that generate a skip pattern at the end of response lists encourages respondents to read to the end of the list and limits the degree to which respondents might answer inaccurately to complete the survey more quickly.

The expert review also suggested considering the "social desirability bias" inherent in certain questions. According to Gerver and Thomas (2009), "Social desirability bias is the tendency for respondents to reply in a manner that is viewed as more favorable." For example, question one asks "what best describes what happened at this establishment when a problem in the production process arose" with possible responses "We fixed it but did not take further action"; "We fixed it and took action to makes sure that it did not happen again"; "We fixed it and took action to make sure that it did not happen again, and had a continuous improvement process to anticipate problems like these in advance"; and "No action was taken." The expert review identified the third option as being most favorable, with the fourth option being clearly undesirable. No changes were made to the instrument for this particular question, however.

Question two asks "how many key performance indicators were monitored at this establishment?" At the time of the expert review, there were three possible responses: "1-2 production performance indicators"; "3 or more production performance indicators"; and "None." The expert review suggested that "3 or more…" was clearly most socially desirable of these options. In response, the granularity of responses was increased to include "3-9 key performance indicators" and "10 or more key performance indicators." This provides an option for respondents who monitor more than two indicators but who do not feel that monitoring a great number of indicators would be warranted. This change was believed to address the issue of social desirability bias since it may not be appropriate for some businesses to track 10 or more key performance indicators. As such, this

response is not clearly more desirable than other options, although respondents may still identify the null response as undesirable.

Initially, question six, which asks respondents "what best describes the time frame of production targets at [their] establishment," had four options: "No production targets"; "Main focus short term (less than one year) production targets"; "Main focus long term (more than three years) production targets"; and "Balanced focus on both short term and long term production targets." The expert review suggested that using the phrase "balanced focus" made that response socially desirable. Thus, the language was altered to read "Combination of short-term and long-term production targets."

The expert review also recommended removing the recall component of each question to reduce respondent burden, but since examining changes in management practices within establishments over time was a key goal of the MOPS, this recommendation was not incorporated into the instrument. The recall data is a focal point of the analysis in Chapter 3. Recommendations from the expert review that were not used immediately to update the survey instrument were subsequently evaluated in light of further evidence from pretesting interviews with prospective respondents. Table 4.1 includes all recommendations from the expert review by question number from the final MOPS 2010 instrument.

Cognitive Interviews

Two rounds of cognitive interviews were conducted to further review the MOPS 2010 instrument. The first round covered 9 respondents in the San Jose, CA

metropolitan area and 5 respondents in the Chicago, IL area, while the second round consisted of 8 interviews in the San Francisco, CA area and 5 interviews in the Philadelphia, PA area. Lucia Foster from the Census Bureau's Center for Economic Studies (CES) and members of the research team observed a subsample of these interviews. Locations for the cognitive interviews were chosen based on the concentration of manufacturing in metro areas, mix of manufacturing industries in metro areas, availability of sponsor(s) to observe the cognitive interviews, and budgetary concerns.

The MOPS is somewhat unique among Census surveys, in that instruments for establishments of multi-unit firms are mailed to the plant address from the Business Register (BR) for the attention of the "plant manager."[51] Most Census surveys are sent to the business address, usually headquarters, for distribution among the plants. Because the sample frame for the cognitive interviews was the Annual Survey of Manufacturing (ASM), cognitive interviews were generally held at that headquarters or an administrative unit for multi-unit firms.

Kristin Stettler of RIRS produced internal Census Bureau documentation of the cognitive testing process, which is summarized in this subsection. Stettler (2011) states, "The goals of the cognitive interviewing were to determine whether respondents understood and answered the draft questionnaire in a manner that meets the questionnaire's intent, identify likely respondents and data retrieval strategies, and

[51] Forms that are returned as "undeliverable as addressed" are re-mailed to the administrative unit address.

identify any other related reporting issues or concerns." The documentation by Stettler (2011) is not as formal as later cognitive testing documentation, largely due to time constraints when the MOPS 2010 survey instrument was developed. Some changes to the instrument were made based on oral reports, and written documentation is not available for some changes and recommendations. Table 4.2 reflects the known recommendations from cognitive testing of the MOPS 2010.

While some respondents stated that they would be unable to provide recall data, generally respondents felt that they could reasonably provide the data based on either their own experiences or information from a co-worker. The data appendix of Chapter 3 discusses a measure of recall bias in the MOPS data. In order to clarify that respondents could provide estimates and thereby limit respondent burden, the following language was included on the letter that accompanied the MOPS 2010 instrument in the mail: "Estimates are acceptable when responding to questions on this report form."

Although some respondents exhibited signs of social desirability bias in response to certain questions during the cognitive interviews, the response options were not changed since the evidence for social desirability bias was inconclusive. In particular, some evidence of social desirability bias was expressed with respect to questions 13 and 14. These questions ask respondents about the primary bases for promotion of non-managers and managers, respectively, at the establishment. Two of the responses for each of these questions include the option that promotions are based at least in part on "other factors (for example, tenure or family connections)." Some respondents expressed that they recognized that promoting based on family

connections was undesirable. Because the social desirability bias was not consistently displayed among respondents, those items were not substantially altered. Evidence from the results of the MOPS 2010 indicates that establishments did select responses that could be considered less socially desirable than other options.

The definition of "manager," clearly a key concept for this survey, was clarified based on the results of cognitive testing. In earlier drafts of the MOPS, a manager was defined as "someone who is involved in pay and promotions for employees who work for them." However, interviewees indicated that many managers do not necessarily have a say in pay and promotions, particularly where union influence is strong. This definition was extended to "someone who has employees reporting directly to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with."

Additionally, in response to the finding from the cognitive testing that unionization plays an important role in the determination of management practices at the establishment, a question was added to the MOPS after the first round of testing asking respondents, "what percent of all employees at the establishment were members of a labor union?" This question is used as an instrument for changes in bonus practices in Chapter 3, and is supported by empirical evidence from Bloom et al. (2016a) that incentives practices are more structured in "Right-to-Work" states than in non-"Right-to-Work" states.

Question 10 (12) asks "when production targets were met, what percentage of non-managers (managers) at this establishment received performance bonuses?" During cognitive interviews, respondents expressed confusion about the term

"performance," noting that "it was not clear whether 'performance' referred to individual performance or to plant/company performance." (Stettler, 2011) The draft of the MOPS instrument that was used during testing followed the aforementioned questions with a question asking "what were non-managers' performance bonuses usually based on?" with responses including "Their own performance as measured by production targets," "Their team or shift performance as measured by production targets," "Their establishment's performance as measured by production targets," and "Their company's performance as measured by production targets." This question, with some slight language modifications and the addition of a response for "No performance bonuses," was moved to appear immediately preceding the question on what share of non-managers received bonuses in order to clarify that "performance" could refer to performance of the business on several levels. A version of the question asking about the basis of bonuses for managers was also added immediately preceding the question on what share of managers received performance bonuses.

Question 7, which asks "how easy or difficult [it was for the] establishment to achieve its production targets," originally had responses such as "Somewhat easy (we hit our targets 90% to 99% of the time)," "Neither easy nor difficult (we hit our targets 50% to 89% of the time)," and "Somewhat difficult (we hit our targets 10% to 49% of the time)." Participants in the cognitive interviews noted that they could set targets that were not "somewhat easy" but still achieve 90-99% of those targets. Thus, the responses were changed to a scale that could more easily be translated to a Likert scale, with the "normal" effort exerted by workers at the firm serving as a baseline. The new responses include "Possible to achieve with some effort," "Possible to

achieve with normal amount of effort," and "Possible to achieve with more than normal effort."

Other changes made in response to cognitive interview observations include adding the word "production" to the question "who prioritized or allocated tasks to production workers at this establishment" and using boldfaced font for the phrase "Mark all that apply" for each of the five questions having that instruction.[52] The former change addressed confusion expressed by participants in cognitive interviews, while the latter change differentiates questions where respondents are encouraged to mark all that apply from the rest of the checkbox survey questions which specify that respondents should "Check one box for each year."

Not all suggested changes were implemented. For example, question 1 requires respondents to "Check one box for each year" in response to the question "what happened …when a problem in the production process arose?" Participants in the cognitive interviews noted that production problems are not always met with the same response. Similarly, question 5 asks where "production display boards showing output and other key performance indicators" were located at the establishment. Respondents noted that it was possible to use alternative means to disseminate information without having display boards.

It should be noted that questions 27 and 28 on the MOPS 2010, which ask about the availability and use of data to support decision making, were written and

[52] Questions 3, 4, 9, 11, and 29 on the MOPS 2010 instrument.

added to the instrument after the completion of cognitive testing. These two questions were based on existing research by Brynjolfsson on the use of data in decision making and were added because they were believed to be complementary to the other organizational questions on the MOPS 2010. The questions were based on a survey of senior human resource managers at approximately 330 large, publicly traded firms conducted in 2008 by Brynjolfsson, Hitt, and Kim (2011) in conjunction with McKinsey & Company. These questions were later tested as part of the cognitive testing process for the 2015 MOPS, where they are questions 24 and 25, respectively.

Usability Testing

The goal of usability testing is to examine potential issues that a respondent may have when using an electronic instrument; often, there is often validation of any changes made to the instrument after earlier rounds. Because the respondent works through the entire electronic survey instrument during the usability testing, it also allows for cognitive testing that takes into consideration the survey instrument as a whole, rather than focusing on specific questions or sections.

Dave Tuttle of RIRS prepared a report on usability testing for the MOPS 2010. (Tuttle, 2011) He reports that no major problems were encountered during the usability testing phase, although respondents did not always notice instructions that read “select all that apply” for specific questions. Respondents also desired an opportunity to view or print a PDF of their responses when reviewing their responses. Table 4.3 lists all of the recommendations made as part of the usability testing for the MOPS 2010. Because the electronic instrument for the MOPS 2010 was deactivated

after the survey collection ended, we cannot be certain whether or not all recommendations were accepted.

MOPS 2015

The new questions added to the MOPS 2015 instrument were also subject to two rounds of cognitive testing, as well as usability testing for the electronic instrument.[53] As discussed in Chapter 2, the new questions on the MOPS 2015 are concentrated in two sections: "Data in Decision Making" (Section C) and "Uncertainty" (Section D). Section C consists of four new questions and the two questions on this subject that were added to the MOPS 2010 after cognitive interviews were complete. As a result, the full section was tested as part of the cognitive testing process for MOPS 2015. Section D consists of eight new questions. There were also four new questions added to the "Background Characteristics" section of the instrument.

The new questions in Section C were developed in partnership with Brynjolfsson and Kristina McElheran (University of Toronto), who are experts on the use of data and technology in decision making. The new questions in Section D were developed in partnership with Bloom and Steven Davis (University of Chicago), who developed a similar survey with the Federal Reserve Bank of Atlanta.

[53] Unlike the MOPS 2010, the MOPS 2015 did not undergo formal expert review due to time constraints and the fact that most of the content had already undergone this review for 2010. Although the formal expert review was not conducted, the cognitive testing staff provided expert feedback throughout the testing process.

Cognitive Interviews

The first round of cognitive interviews took place in June 2015 in the Washington, DC, Detroit, MI, and Houston, TX metropolitan areas, and the second round took place in September and October 2015 in the San Francisco, CA and Boston, MA metropolitan areas. The first round of interviews "was exploratory in nature and the second round was confirmatory." (Pick and Brennan; 2015a, b) That is, the first round was used to collect information and make changes to the survey instrument. The second round was used to validate those changes to the survey instrument. A total of 32 establishments participated in cognitive testing; 3 in Washington, 8 in Detroit, and 7 each in Houston, San Francisco, and Boston. These participants were drawn from 13 different industries (as measured by 3-digit NAICS codes) and included both single- and multi-unit establishments.

As in 2010, the interviews were conducted in person at each establishment, with interviews taking approximately 45 minutes to complete. Testing was completed by the Census Bureau (Data Collection Methodology and Research Branch (DCMRB))[54] with Buffington or Ohlmacher from CES serving as observers. Members of the research team, including Nick Bloom (Stanford), Erik Brynjolfsson (MIT), and Kristina McElheran (University of Toronto), also each observed one or more testing visit.

[54] This is the same unit that did testing for MOPS 2010, under a new name.

Kenneth Pick and Michael Brennan from DCMRB produced internal Census Bureau documentation of the findings and recommendations from each round of cognitive testing. These findings and the actions taken to develop the MOPS are summarized in this subsection. Table 4.4 includes all recommendations from the two rounds of cognitive interviews conducted for the MOPS 2015.

Establishments for testing were selected from the 2014 ASM mail sample. Participants in both rounds of cognitive testing can be broadly grouped into two categories: establishments that are the sole physical location for their parent firm (single-unit) versus establishments that are part of a firm that has multiple physical locations (multi-unit). The single-unit establishments interviewed "were generally small businesses with family members in numerous positions in upper management," and many performed custom work for their customers, making the generalization necessary to complete the MOPS questionnaire difficult for the respondents. (Pick and Brennan, 2015a)

In the first round of testing, the team visited mostly corporate headquarters locations when interviewing participants from multi-unit firms, while a deliberate effort to visit establishments other than headquarters was made in the second round of testing. As noted above, the MOPS is unique among Census surveys in that it is mailed to the establishment address rather than the firm's headquarters. The MOPS survey utilizes this strategy because the content of the MOPS is often specific to the plant-level operations and may best be answered by managers at the plants. By visiting both headquarters and plant locations of multi-unit firms, the cognitive testing team is able to better understand how respondents will react to completing the MOPS

instrument. Plant-level addresses and respondent contact information for establishments of multi-unit firms were gathered from the "Certification" section of responses to the MOPS 2010 and used to prioritize the selection of cases from the 2014 ASM mail sample for cognitive testing in the second round of interviews.

Participants in the cognitive testing interviews generally held a position related to finance in their firm. Titles for the participants included CFO, plant controller, financial reporting manager, and financial analyst. In single-unit firms, these were often upper managers but were generally not upper management in multi-unit firms. The participants generally felt that they would be the primary respondents for the survey, but would coordinate with other members of the plant or firm as necessary. At single-unit establishments and at the headquarters of multi-unit firms, these respondents were the employees who complete the ASM forms, as well as other Census Bureau surveys. Respondents who had been in their position for five years or more generally had no difficulty with the recall questions, while those with shorter tenures would leave recall questions blank, leave the responses unchanged between 2010 and 2015, or consult with someone who might know the establishment's practices in 2010.

For the MOPS 2015, cognitive testing interviews focused primarily on questions which had not previously been tested as part of the MOPS 2010 testing process. In addition to the new questions, the two questions that were added after testing of the MOPS 2010 and the screener question for the "Organizational Practices" section, question 17, were retested.

As with the 2010 MOPS, many respondents had difficulty understanding question 17, “In 2010 and 2015, was the headquarters for this company at the same location as this establishment?” Respondents incorrectly interpreted this question as asking whether or not the firm had moved between 2010 and 2015, rather than asking about co-location between a plant and headquarters for a multi-unit firm. To address this issue, the language “In 2010 and 2015” was dropped in the MOPS 2015.

As noted above, two questions on the use and availability of data to support decision making were written for the MOPS 2010 after the completion of cognitive testing, and as such were not subject to testing before their inclusion on the survey. Thus they were tested during the cognitive testing of the MOPS 2015. Participants frequently found these questions vague and were unsure about what kind of “data” should be considered. Since participants generally held financial positions in their firms, they frequently considered only financial forms of data. Pick and Brennan (2015a, b) suggest explicitly stating the type of data that interests the survey sponsors. Many respondents also had difficulty differentiating between the “availability” and the “use” of data, but some felt that the latter term referred to the establishment’s “reliance” on data. The recommendations for change were not accepted in order to maintain consistency between the MOPS 2010 and MOPS 2015 instruments.

A similar issue with the term “data” affects the question 26 on the MOPS 2015, which asks “who chose what type of data to collect at this establishment.” Prior to cognitive testing, the list of possible answers to this question included “Managers at other establishments including headquarters” which was modified based on respondent feedback to “Managers at headquarters and/or other establishments” to

clarify that these directives may frequently come from headquarters rather than horizontally across the corporate structure.

The next question in this section asks respondents to "Consider each of the following sources of data and rate how frequently each source was used in decision making at this establishment." This question is followed by a question on how frequently each of three activities, "Design of new products or services," "Demand forecasting," and "Supply chain management" were influenced by data analysis and a question on how frequently the establishment uses predictive analytics. Pick and Brennan (2015a, b) suggest including an option between "monthly" and "yearly" and differentiating between "never" and "not applicable," which could not be done due to space constraints on the paper instrument.

The list of sources of data in question 27 was refined in a fashion similar to question 26. Early drafts included sources such as "Production performance indicators and instruments," "Employee-specific performance indicators," and "Employee input feedback." These terms were not clear to respondents, but based on respondent feedback, these responses were replaced with the clearer options, "Performance indicators from production technology or instruments," "Formal or informal feedback from managers," and "Formal or informal feedback from production workers."

The aforementioned questions on forecasting, including the questions on the frequency of data analysis in "design of new products or services" and "demand forecasting" and on the frequency of predictive analytics, were difficult for many respondents. This was true in particular for those at smaller firms that do not do much

forecasting because they are a “job shop,” where the plant makes custom goods to order according to client specifications rather than consistently producing a steady stream of identical goods. In these cases, the respondents were also unsure as to whether every job would constitute the design of a “new product or service.”

Many participants in cognitive testing were tentative about providing forecasts in Section D – “Uncertainty,” likely due to their reluctance to be inexact on official forms, especially given that their roles frequently involved reporting official financial data. Unless the business had a formal forecasting group, most participants indicated that they were reluctant to forecast beyond the constraints of their available financial system. Some respondents indicated that they would only fill out one to three forecasts for 2017, were unclear about the meaning of the term “scenarios,” or were unclear about the differences between the “High” and “Highest” scenarios or the “Low” and “Lowest” scenarios.

An example was added at the beginning of this section that sought to clarify the reporting of possible outcomes and their associated likelihoods, and text was added to stress that estimates were acceptable. The instructions and example for this section were developed during the confirmatory round of cognitive testing and were tested at a small number of establishments during that round, performing well. Additional validation of these instructions took place during electronic instrument usability testing.

New questions on background characteristics were also tested. Question 43 asks, “what percent of all employees at this establishment could be classified” as “part-time,” “working flexible hours,” working “from home one day or more per

week," and "cross-trained." Some respondents had difficulty classifying the workers at their firms as "working flexible hours" or being "cross-trained," but in general these terms were understood by respondents who utilize these practices. The list of employee classifications was refined based on respondent feedback, as was the list of possible responses for the subsequent question which asks whether the production of the establishment can best be described as "Job shop," "Batch production," "Cellular manufacturing," "Continuous flow (other than cellular manufacturing)," or "Research and development or prototyping."

Question 45 originally asked whether or not the establishment was "owned by a family firm," but many cognitive interview participants were unclear about or misinterpreted the meaning of the term "family firm." The question was clarified to ask if the establishment is "owned 50% or more by its founder(s) or member(s) of a founder's family?"

Similarly, question 46 originally asked if the establishment was "part of a multinational firm which has production establishments in other countries," but the term "multinational" was frequently misinterpreted by participants. Because changing the question to ask if the establishment was "part of a firm which has production establishments in other countries" is a more specific question without this confusing terminology, the word "multinational" was simply dropped from the question.

Usability Testing

In addition to the two rounds of cognitive interviews the MOPS 2015 also underwent usability testing at ten establishments in the Los Angeles metro area and

ten establishments in the New York City metro area in February 2016, spanning nine different 3-digit NAICS codes. Forty percent of interviews were conducted with establishments of multi-unit firms, while sixty percent of interviews involved respondents from single-unit firms. Each interview was scheduled to last for approximately one hour and was conducted by staff from the DCMRB. Buffington and Ohlmacher functioned as observers in New York and Los Angeles, respectively.

Usability testing focused on the functionality and appearance of the web instrument for the MOPS 2015.[55] Respondents were asked to complete the full survey using the web instrument as if they were not being observed, but to verbalize any thoughts that they were having as they responded. The staff from the DCMRB who led the usability testing observed the actions and behaviors of respondents, paying particular attention to their ability to complete the survey successfully.

If respondents observed problems with the survey content or simply desired to discuss the content, they were encouraged to do so, although that was not the explicit purpose of the visits. As a result, the usability testing was able to provide insight in a manner similar to the cognitive interviews. A particular focus was placed on Section D, especially the example at the beginning of the section which was introduced after the second round of cognitive testing.

Herrell and Mesner (2016) produced documentation of the findings and recommendations from the usability testing. This subsection summarizes those

---

[55] See Buffington, Hennessy, and Ohlmacher (forthcoming) for more information on the collection and processing of the MOPS 2015, including internet collection.

findings and recommendations, as well as the actions taken to adjust the MOPS electronic instrument following the usability testing. Complete recommendations are listed in Table 4.5.

In general, respondents did not have major issues with usability of the web instrument. Most respondents found logging into the survey and navigating through the instrument to be straightforward. Many respondents stated that they would print a copy of the survey instrument to use as a worksheet before completing the survey online, and observed that the web instrument provided them that option. Similarly, respondents would generally print a PDF copy of their responses to save for their records after the survey was submitted. Some respondents in Los Angeles noted that they preferred to complete surveys online because they received instant verification that their responses had been successfully submitted after completing the survey.

Although the instrument tested well with respondents, some usability issues were identified and addressed to improve the web instrument before its release into the field. For example, on questions where respondents are instructed to select all that apply and "never" or "none" is among the available options, the web instrument initially prohibited the selection of "never" or "none" with any other option.[56] This was consistent with the web instrument for MOPS 2010. It was determined that selecting "none" or "never" does not necessarily contradict the selection of another option. Specifically, consider question 3, which asks "During 2010 and 2015, how

[56] Questions 3, 4, 9, 11, 27, 28, and 29. Note that for the 2010 MOPS, this restriction was in place.

frequently were key performance indicators reviewed by managers at this establishment?" It is conceivable that certain key performance indicators (KPIs) are reviewed "daily," while another KPI is collected but "never" reviewed.

Many participants reported that they were unsure if their data was being saved as they completed the survey. Because the default programming of Census web survey instruments is to have the respondents' data saved each time she advances to a new screen, the "Next" button at the bottom of each screen that allows respondents to proceed to the next question was changed after usability testing to read "Save & Continue."

When issues occur in responses (such as skipped questions, likelihood values that do not properly sum to 100%, etc.) respondents receive error messages called "edits" to draw their attention to these issues.[57] For example, if the respondent skips all or part of a question, when she presses "Save & Continue," red text will appear at the top of the screen asking her to please respond to all questions. All warnings also include the text "To ignore these problems, press the Save and Continue button again."[58] Some participants in usability interviews did not see this second sentence and believed that they could not proceed to the next question without correcting all of the warnings. To address this concern, white space was placed between the content of the warning and the instruction for how the respondent can ignore the problem.

---

[57] We refer to "edits" as "warnings" for clarity.

[58] Because respondents can choose to ignore the warnings, these warnings are considered "soft edits." For more information on soft edits, see Buffington, Hennessy, and Ohlmacher (forthcoming).

One important change was made to address an item-specific usability issue. The example screen added before question 30 was generally well received from a cognitive standpoint, but from a usability standpoint, many respondents tried to enter data in the example. In order for the example to be accessible under Section 508, it cannot contain a flat image file, as such a file would create a usability issue for a text to voice browser. Thus, the example had to contain a pre-filled table in which the user can place her cursor within the data entry cells, although she cannot edit the pre-entered data. To make the example clearer to respondents, a bolded text box was added at the top of the screen which reads "This screen contains an example. You will be asked to complete this and similar questions on the next four screens."

Other usability concerns were identified during testing but the desired changes could not be implemented due to the time constraints and the need to prioritize changes to the electronic instrument. For example, once respondents have viewed all screens containing survey content, they are presented with a review screen. This review screen has a very basic presentation, with a list of all 47 question screens and the number of errors on each screen in parenthesis next to the names of the screens (Figure 4.1). The ASM, for which the MOPS is a supplement with the same mail sample, has a much richer interface: questions are listed in a table, and the status of each question is listed in the table with clear graphics and color-coding (Figure 4.2). Although a review screen analogous to the ASM review screen was desired for MOPS, the MOPS 2015 instrument was created based on the MOPS 2010 web instrument. At the time that the MOPS 2010 instrument was created, the more developed review screen was unavailable, and once the issues with the MOPS 2015

review screen were discovered during usability testing, it was too late to introduce this feature.

Several cognitive issues were identified during usability testing and later addressed. In particular, the order of parts (a) and (b) within questions 27 and 28 were reversed when compared to the other question in this survey. These questions asked about 2015 before they asked about 2010, whereas the rest of the survey asks about 2010 and then 2015, at least on the electronic instrument. (On the paper instrument, 2010 responses come "first" as they are to the left of 2015 responses.) During usability testing, the different order of these questions confused some interviewees and thus the order was changed in the electronic instrument to create consistency with the rest of the survey; it was too late in the survey development process to change the paper instrument. See Figures 4.3 and 4.5 for a comparison between the paper versions of these questions and their electronic counterparts.

Additionally, the "Frequently Asked Questions" (FAQ) page on the MOPS Business Help Site (BHS) was developed in part based on cognitive findings from the usability testing.[59] Specifically, definitions were introduced for the key terms in questions 30-37 such as "products shipped" and "materials, parts, containers, and packaging." These definitions, like the key terms themselves, are identical to the terminology used on the ASM. In fact, the language used in the FAQ is limited to

[59] https://bhs.econ.census.gov/bhs/mops/faq.html

language that is in use on the MOPS instrument (and therefore tested) or is consistent with the materials (BHS, instruments, instructions) for other Census surveys.

Not all cognitive findings from the usability testing were incorporated into changes in the electronic instrument. For example, respondents at new businesses were unsure how to complete the questions with recall components. If responses were not provided for reference year 2010 questions, then a warning would be generated even if the establishment was not in business in 2010. The staff from DCMRB suggested either dropping the recall component or introducing a screening question (which would not allow responses for 2010 for those establishments that were not active in 2010). Since recall is an important part of the MOPS, dropping was not considered and introducing a screening question was not feasible given time constraints.

Instead, as noted above, the spacing of the warnings was changed to make it clear that respondents have the option of ignoring warnings. Additionally, language was added to the FAQ page on the BHS providing answers to the questions “My establishment was not in business in 2010. What should I do?” and “I was not an employee at this establishment in 2010. What should I do?” This FAQ information was also provided to clerks at the National Processing Center who fielded questions from respondents. However, researchers should be aware that some respondents who responded electronically may have felt compelled to enter recall data even if the establishment was not in business or the quality of the recall data was very low.

Further, DCMRB suggested dropping Section D from the MOPS based on cognitive findings from the usability testing. Because the questions have been shown

to be successful by the Federal Reserve Bank of Atlanta and are considered a key part of the MOPS 2015, this recommendation was declined. Respondents generally found the example at the start of Section D to be helpful during usability testing, except in cases where they did not realize that it was an example. As noted above, a textbox was introduced after testing on the example screen for the electronic instrument to draw respondents' attention to the example and further increase the example's efficacy.

Although not all recommendations gathered from cognitive and usability testing were implemented due to time and space constraints and the preferences of the survey sponsors to generally preserve comparability across statistical periods and with other similar survey instruments, the MOPS 2015 was revised significantly to enhance the quality of responses received when the survey went into the field.

Conclusion

The MOPS instrument was developed over an iterative process. In keeping with the Census Bureau's quality standards, the instruments for the 2010 and 2015 MOPS were each subject to multiple rounds of pretesting. The MOPS 2010 underwent internal expert review and two rounds of cognitive testing before being released into the field. New questions for the MOPS 2015 also underwent two rounds of cognitive testing and the full MOPS 2015 web instrument was tested for usability.

Through these rounds of testing, recommendations from experts, specialists, and respondents were used to hone the survey into the form that would ultimately be mailed to respondents for collection. Not every recommendation was incorporated

into the final survey instruments due to time and resource constraints and incompatibility with the survey content goals. Every effort was made to use the insights provided by the pretesting processes to improve the MOPS instruments.

Figure 4.1: MOPS 2015 Web Review Screen

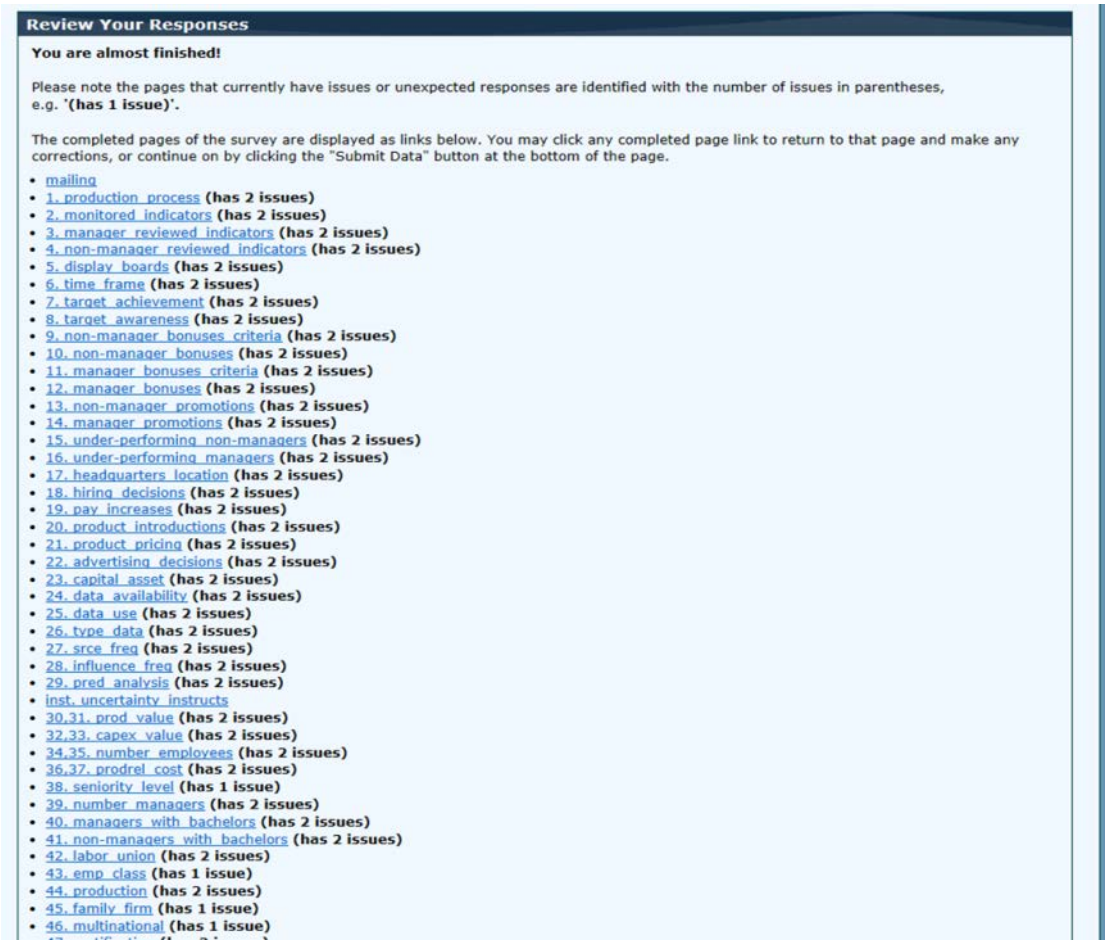


Figure 4.2: ASM 2014 Web Review Screen

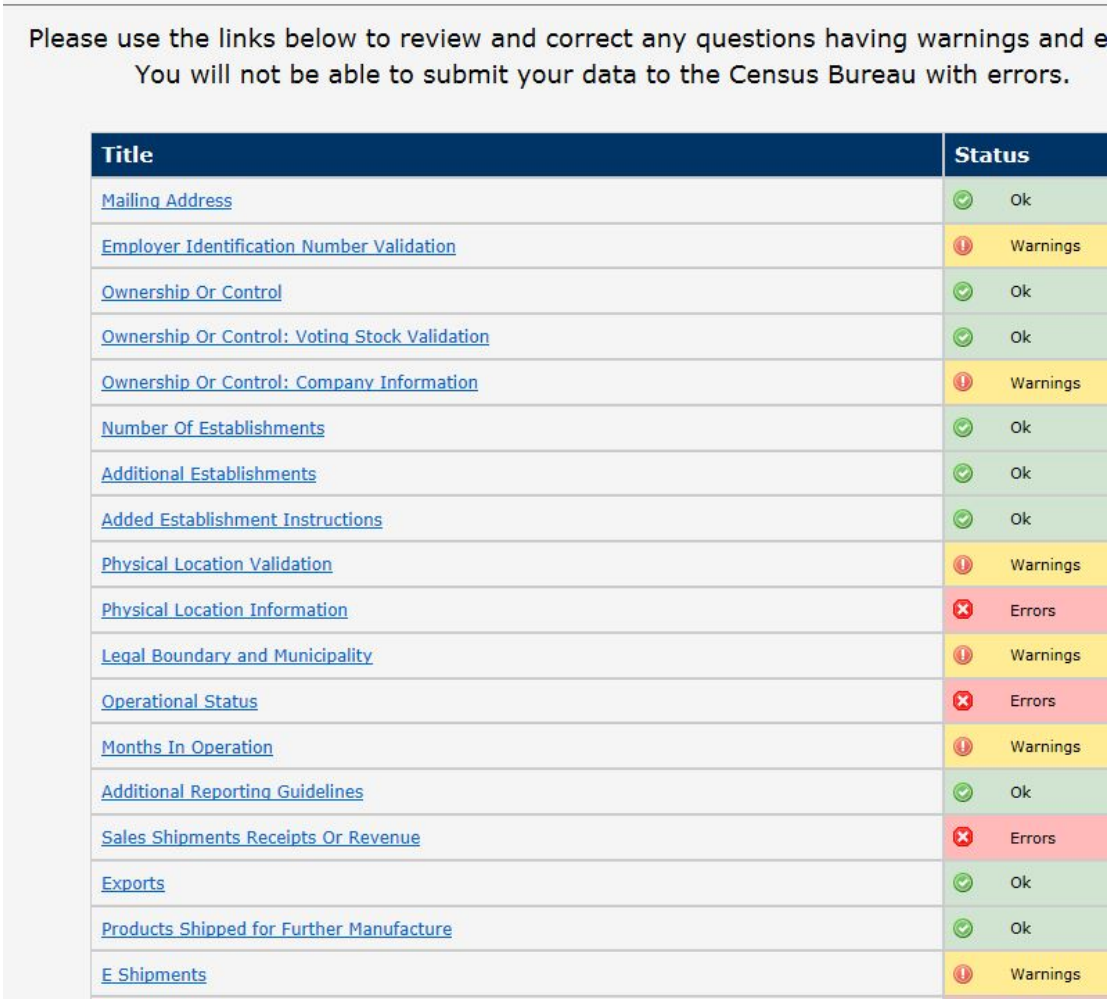
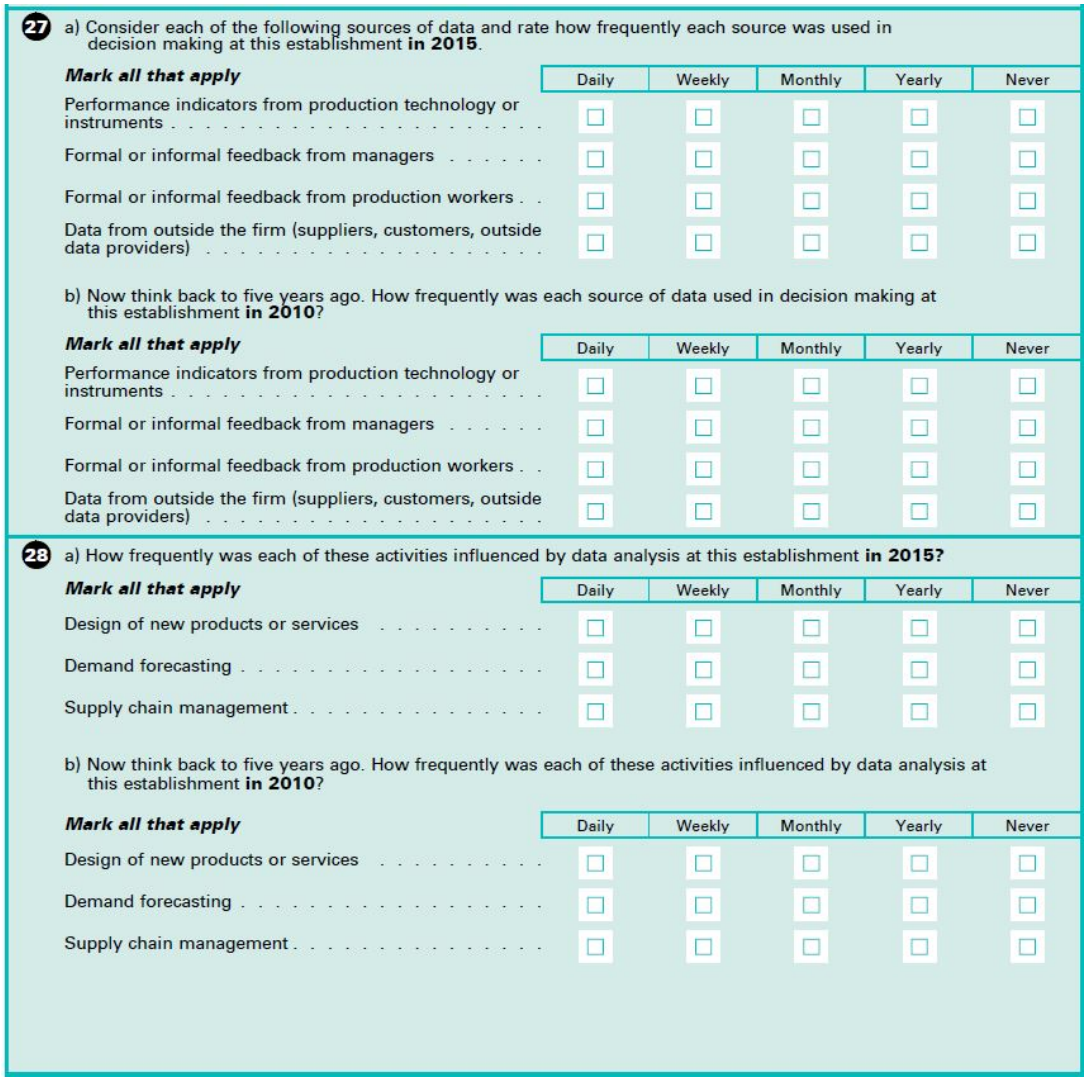


Figure 4.3: MOPS 2015 Questions 27 and 28 - Paper Form



27 a) Consider each of the following sources of data and rate how frequently each source was used in decision making at this establishment **in 2015**.

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

b) Now think back to five years ago. How frequently was each source of data used in decision making at this establishment **in 2010**?

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

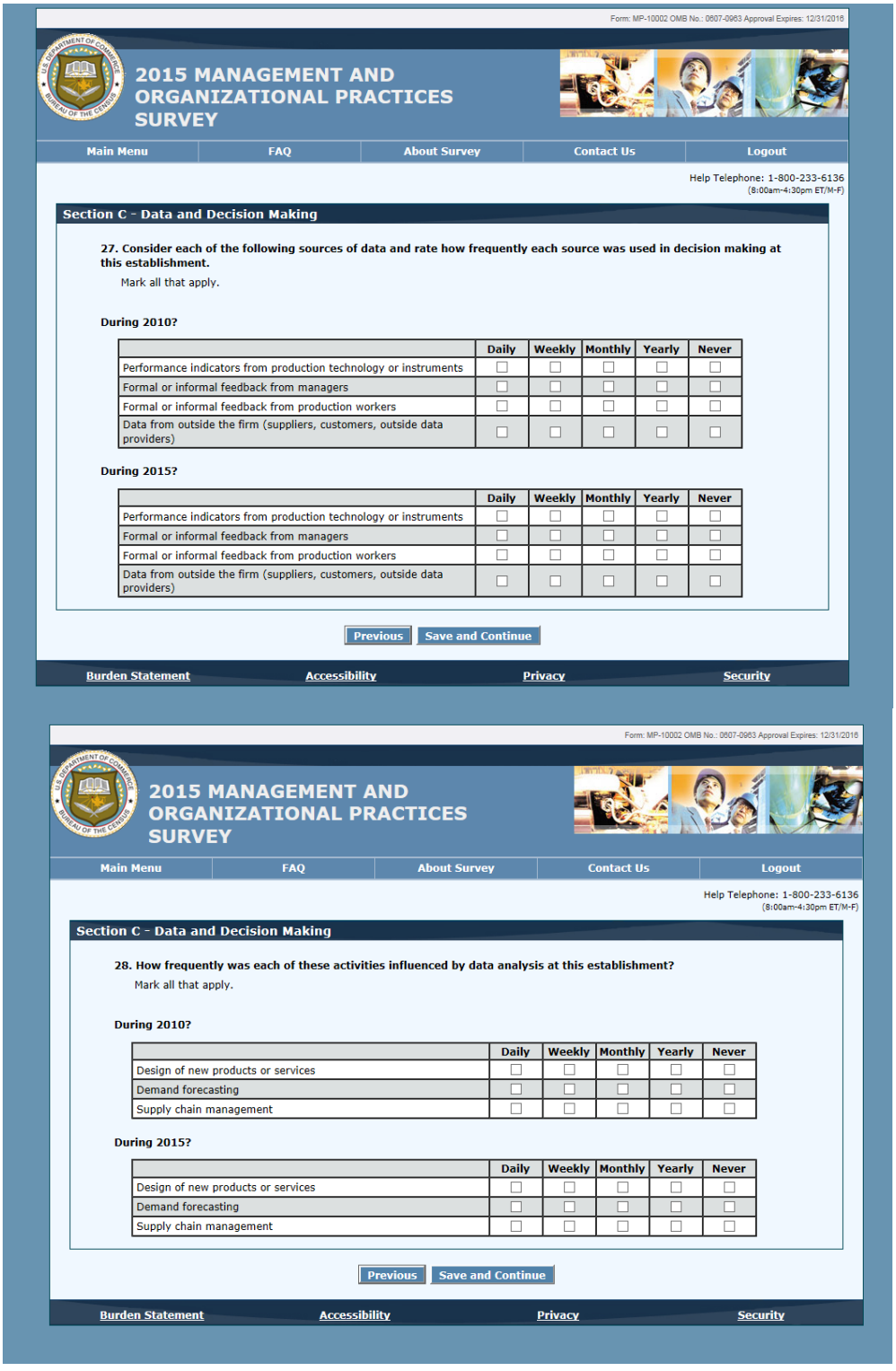
28 a) How frequently was each of these activities influenced by data analysis at this establishment **in 2015?**

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

b) Now think back to five years ago. How frequently was each of these activities influenced by data analysis at this establishment **in 2010**?

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

Figure 4.4: MOPS 2015 Questions 27 and 28 - Electronic Instrument



Form: MP-10002 OMB No.: 0607-0963 Approval Expires: 12/31/2016

2015 MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

Main Menu | FAQ | About Survey | Contact Us | Logout

Help Telephone: 1-800-233-6136 (8:00am-4:30pm ET/M-F)

Section C - Data and Decision Making

27. Consider each of the following sources of data and rate how frequently each source was used in decision making at this establishment.

Mark all that apply.

During 2010?

	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

During 2015?

	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

Previous | Save and Continue

Burden Statement | Accessibility | Privacy | Security

Form: MP-10002 OMB No.: 0607-0963 Approval Expires: 12/31/2016

2015 MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

Main Menu | FAQ | About Survey | Contact Us | Logout

Help Telephone: 1-800-233-6136 (8:00am-4:30pm ET/M-F)

Section C - Data and Decision Making

28. How frequently was each of these activities influenced by data analysis at this establishment?

Mark all that apply.

During 2010?

	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

During 2015?

	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

Previous | Save and Continue

Burden Statement | Accessibility | Privacy | Security

Table 4.1: Recommendations from Expert Review of the MOPS 2010 Survey Instrument

Question Number	Recommendation	Accepted?	Notes
1	Consider rewording to minimize social desirability bias	N	
2	Consider rewording to minimize social desirability bias	N	
3	Consider prefacing this question with an instruction regarding which performance indicator should be used to answer this question if different KPIs could be collected with different frequencies.	N	
4	Consider prefacing this question with an instruction regarding which performance indicator should be used to answer this question if different KPIs could be collected with different frequencies.	N	
5			
6	Remove language "Balanced focus on both short- and long-term production targets" due to social desirability issues.	Y	Changed to "combination"
7	Change to a Likert scale rather than "impossible", "easy", "demanding for some", and "demanding for all."	Y	
8			
9			
10			
11			
12			
13	Include examples other than tenure, including negative factors	Y	Added "family connections"
14	Include examples other than tenure, including negative factors	Y	Added "family connections"

Question Number	Recommendation	Accepted?	Notes
15	Reword to minimize social desirability bias	Y	Changed from "Underperforming employees are rarely or never moved from their position", "Underperforming employees usually stay in their position for at least a year before action is taken", and "Underperforming employees are rapidly helped and re-trained, and then moved out of the company if their performance does not improve"
16	Reword to minimize social desirability bias	Y	See question 15
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Question Number	Recommendation	Accepted?	Notes
32	Use standard measurement term from Federal agencies "pay period that includes March 12."	Y	
33	Use standard measurement term from Federal agencies "pay period that includes March 12."	Y	
34			
35			
36			
General Remarks	Change the “check the box” language into direct questions.	Y	All questions are formatted as direct questions.
	Include a statement about estimates being acceptable for each question that requires a numeric response.	Y	
	Do not ask for recall data. The burden is too high because it requires respondents to do twice the amount of work for nearly every question. If the respondent was not in the same position in 2005, they may attempt to distribute the survey to others who can answer for that year. That leads to having multiple respondents and increased burden. If respondents choose not to distribute the survey, they may report more accurately for 2010 than for 2005, thus resulting in measurement error for the 2005 data.	N	
	Add the phrase "during 2010" to the question to reinforce the reference year.	Y	Added “in 2005 and 2010” to the beginning of each question stem.
	For questions with response options that indicate negation, like “None” or “No…,” place them last in the response option list, particularly those including a skip pattern. This will avoid distracting respondents from reading through the rest of the response options or inaccurately answering in order to move through the form faster	Y	
	Group similar questions together	Y	

Note: This table was developed based on Gerver and Thomas (2009).

Table 4.2: Recommendations from Cognitive Testing of the MOPS 2010 Survey Instrument

Question Number	Recommendation	Accepted?	Notes
1	If different problems have different processes, then that is not captured in these response options. In the example, “finding a quality defect in a product” and “a piece of machinery breaking down” could have two completely different solutions.	N	
2	"Cost" should be added as an example of a KPI	Y	
3	Definition of manager tricky. Some use other terms or define differently. Pay and promotions seemed very limiting – better to say involved in the daily supervision/management of productivity/work.	Y	Changed definition of manager from "A manager is someone who is involved in pay and promotions for employees who work for them. e.g. Plant Manager, Human Resource Manager, Quality Manager)" to "A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager."
	3 out of 5 didn’t realize they could check more than one.	Y	Bold "Mark all that apply."
4			
5	People understood this question and the response options, but pointed out that it does not include other ways of sharing information, such as newsletters and electronic databases.	N	
6			

Question Number	Recommendation	Accepted?	Notes
7	There was a mismatch between the percentages and the easy/difficulty descriptions. That is, respondents could have hit their targets 90-99% of the time, but it was not necessarily “somewhat easy.” People seemed to focus on the percentages, but then didn’t know how to respond once they read the descriptions.	Y	Early versions of this question had response items such as "Neither easy nor difficult (we hit our targets 50% to 90% of the time)." Changed to scale relative to "normal effort." This change tested well during the second round of cognitive testing.
8			
9			Bold "Mark all that apply" based on feedback from Q3, introduced in response to feedback to question 10.
10	It was not clear whether “performance” referred to individual performance or to plant/company performance (the equivalent of being profitable, having a good amount of revenue, year-end results of the company, etc.). Most people understood this to mean “individual performance.”	Y	Introduced question 9 to determine the basis for performance bonuses.
11			Bold "Mark all that apply" based on feedback from Q3, introduced in response to feedback to question 12.
12	See Question 10.	Y	Introduced question 11 to determine the basis for performance bonuses.
13	Add a response for "none."	Y	Added "Non-managers are not normally promoted."
13			In some cases, respondents showed negative social desirability bias in reaction to "family connections."
14	Add a response for "none."	Y	Added "Managers are not normally promoted."

Question Number	Recommendation	Accepted?	Notes
14			In some cases, respondents showed negative social desirability bias in reaction to "family connections."
15			Split from "employee" into "managers" and "non-managers" after second round of cognitive testing.
16			See question 15
17	Some respondents had trouble with this question – they thought that we were asking if the headquarters had moved between 2005 and 2010.	N	This issue was present again in 2015. See Table 3.
18			
19			
20			
21			
22			
23			Options "Authorization required for **all** purchases" and "$1 to $999" were combined into "Under $1,000"
24			"Number of direct reports" was changed to "number of employees reporting directly to the plant manager." Definition still refers to "direct reports." This question did not perform well in the field and was dropped from MOPS 2015.
25	There can be different numbers of levels on the factory floor if there are different departments within a single factory floor. The person who had this assumed that we wanted the chain with the most number of levels.	N	This question did not perform well in the field and was dropped from MOPS 2015.

Question Number	Recommendation	Accepted?	Notes
26	There was some confusion about what the word “workers” meant. They thought that “plant floor workers” or “production workers” would clarify this word.	Y	"Workers" changed to "production workers." This question did not perform well in the field and was dropped from MOPS 2015.
27			Not tested in 2010. Question was added after cognitive testing was complete.
28			Not tested in 2010. Question was added after cognitive testing was complete.
29			"Trade associations or conferences" was added at the suggestion of a participant in cognitive testing interviews. This question did not perform well in the field and was dropped from MOPS 2015.
30			This question was dropped from MOPS 2015.
31			
32			
33			
34			
35			
36	Add 0% as a response and change “20% or less” to “1%-20%”	Y	

Question Number	Recommendation	Accepted?	Notes
36			Unionization was frequently reported as a key component of incentives practices, and this question was introduced after the first round of cognitive testing.
General Remarks	One person missed that we were asking for both 2005 and 2010 data – maybe state that on the front page	N	
	Asking about 2005 and 2010 was generally ok, though respondents would like to be reassured they can estimate or leave blank if they're not comfortable. Some said they weren't there that long ago and couldn't provide it; others said that even if they didn't know the information themselves, they could get it from someone else, for example someone in Operations, Quality Control, or HR.	Y	The following language was included on the letter that accompanied the MOPS 2010 instrument in the mail: "Estimates are acceptable when responding to questions on this report form."
	Should have a brief blurb on the front cover stating what the survey is about.	N	No additional information about the survey was included in the insert, letter, or form. Implemented in letters for 2015.
Cover Letter	Respondents prefer an actual due date to "within 30 days."	N	This change was adopted on the MOPS 2015

Note: This table is based on Stettler (2011), notes from the RIRS staff and observers, and changes in the MOPS instrument. Because Stettler (2011) contains neither an exhaustive list of recommendations nor resolutions to the recommendations, this table may not include all recommendations made as a result of cognitive testing of the MOPS 2010 instrument.

Table 4.3: Recommendations from Usability Testing of the MOPS 2010 Survey Instrument

Question Number	Recommendation	Accepted?	Notes
Login Screen	Enlarge the paper form illustration. Consider adding carriage returns above and below the "time-out/no data lost" instruction to make it more noticeable. Consider enlarging the "warning" text at the bottom of the screen.		
Main Menu			
1			
2			
3			
4			
5			
6			
7			
8			
8			
9			
10			
11			
12			
13			
13			
14			
15			
16			

Question Number	Recommendation	Accepted?	Notes
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
27			
28			
29			
30			
31			
32			
33			
34			
34			
35			
36			

Question Number	Recommendation	Accepted?	Notes
Remarks/ Certification	Add a simple instruction next to the response field labels for "Telephone" and "Fax" to indicate that the cursor will automatically advance, e.g., "Telephone: (auto-tab enabled)" or some other appropriate and concise terminology.	N	
Review Screen	Add a "view/print form as pdf" button to the review screen. Add an instruction adjacent to the button indicating that the pdf will only contain what was reported and will not indicate which items still have problems, and that it should be used in conjunction with the review page.		
General Remarks	Add a list of screens in the form of a drop-down box, between the "next/previous" buttons.	N	
	Consider adding instructions to the log-in page and/or to the frequently-asked-questions (if not already there), indicating that users' browser settings may interfere with page formatting, and that pressing the "control" and "+" keys together will enlarge the appearance of the page.	N	
	Remove the instructions to select only one response. Retain the "select all that apply" instructions but remove the parentheses and place them in a more prominent position on the screens. Ideally, this instruction should be placed within the typical visual path (which it currently is) but surrounded by enough empty space to make it stand out. One way this can be achieved is by adding an extra carriage return above and below the instruction where it is currently located to add space between it and the text above and below it. Also, print the "select all" instruction in bold.	N	The "select all" instructions were printed in bold with additional empty space.

Table 4.4: Recommendations from Cognitive Testing of the MOPS 2015 Survey Instrument

Question Number	Recommendation	Accepted?	Notes
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17	We recommend breaking out the question into two separate constructs. First, ask about 2010: In 2010, was this establishment physically located at the same location as the headquarters for the company? Yes/No. Repeat for 2015.	N	The clause "In 2010 and 2015," was removed to clarify this question.
18			
19			
20			

Question Number	Recommendation	Accepted?	Notes
21			
22			
23			
24	We recommend explicitly clarifying the intent of the question in the question itself. For example, if the survey's authors are asking about operational data, then state "operational data" in the question. If the survey's authors are asking about decision making "in operations", then again state it in the question. As the question is currently worded, and based off the cognitive interviews, the questions will currently collect vague answers skewed towards financial data (as most respondents are accountants).	N	This question was not changed to maintain consistency with MOPS 2010.
25	See question 24	N	See question 24
26	If the type of data is clarified in questions 24 and 25, also clarify it here in Question 26.	N	Because "data" was not clarified in questions 24 and 25, it was not clarified here.
26	Consider breaking out headquarters into a separate response option.	N	"Managers at other establishments including headquarters" changed to "Managers at headquarters and/or other establishments"
27	We recommend clarifying the "Mark all that apply" instructions if only one box should be marked per horizontal response option.	N	More than one mark per horizontal response option is acceptable.
27	Include a quarterly option separating monthly and yearly.	N	Quarterly could not be added due to space constraints on the paper instrument.
27	Add a "not applicable" response option if it is important to differentiate between "never" and "not applicable" in the data analysis.	N	It is not necessary to differentiate between "never" and "not applicable."
27	Consider emphasizing the word "used" in the question stem to emphasize the term. This can be done either by bolding the word or using capital letters.	N	

Question Number	Recommendation	Accepted?	Notes
28	We recommend clarifying the “Mark all that apply” instructions if only one box should be marked per horizontal response option. We also recommend including a quarterly option separating monthly and yearly.	N	More than one mark per horizontal response option is acceptable.
28	Add a “not applicable” response option if it is important to differentiate between “never” and “not applicable” in the data analysis.	N	It is not necessary to differentiate between "never" and "not applicable."
28	The question asks, “How often…” when similar questions ask, “How frequently…” We recommend changing the wording so it is consistent.	Y	
29	We recommend clarifying the “Mark all that apply” instructions if only one box should be marked per vertical response option.	N	More than one mark per vertical response option is acceptable.
29	Add a “not applicable” response option if it is important to differentiate between “never” and “not applicable” in the data analysis.	N	It is not necessary to differentiate between "never" and "not applicable."
29	Include a quarterly option separating monthly and yearly.	N	Quarterly could not be added due to space constraints on the paper instrument.
30	We recommend providing an example to the respondents on how to complete these questions to allay any comprehension concerns.	Y	An example will be provided at the beginning of this section
31	See question 30	Y	See question 30
31	We recommend only asking for one number for 2017, since single-unit establishments seem to be able to make an educated guess and multi-unit establishments do forecast at least one number. Having respondents break it out into multiple scenarios is very confusing, especially for single-unit establishments. If respondents do break it out, we would question the accuracy of the data collected.	N	Sponsors prefer to have 5 point forecasts, which are also being fielded as a survey by the Federal Reserve Bank of Atlanta. Instructions were added to the beginning of the section in order to address these concerns.
32	See question 30	Y	See question 30

Question Number	Recommendation	Accepted?	Notes
33	See questions 30 & 31	Y	See questions 30 & 31
34	See question 30	Y	See question 30
35	See questions 30 & 31	Y	See questions 30 & 31
36	See question 30	Y	See question 30
36	Suggest using the category "Cost of materials, parts, containers, and packaging."	Y	Sponsor is interested in collecting an estimate on cost of intermediate inputs, but respondents are generally not familiar with the term "intermediate inputs." The ASM asks broadly about "Production related costs," with a list of line items that are aggregated to "production related costs." We use the first line item, "Cost of materials, parts, containers, and packaging."
37	See questions 30 & 31	Y	See questions 30 & 31
37	Suggest using the category "Cost of materials, parts, containers, and packaging."	Y	See explanation from question 36.
38			
39			
40			
41			
42			
43	We recommend providing definitions for flexible hours and cross-trained so that respondents know how to interpret these constructs and provide an appropriate response.	N	The term "rotated jobs" was removed from the question, which initially asked about the share of workers who were "cross-trained or rotated jobs," which are two potentially separate categories. The world "all" was added before "employees." A line for "Employees who worked from home one day or more per week" was added after pre-testing was complete.

Question Number	Recommendation	Accepted?	Notes
44	We recommend bolding best to emphasize to respondents that they should select one response.	Y	
44	Consider adding definitions to each term.	N	Cellular manufacturing often incorporates continuous flow, so "continuous flow" was changed to "continuous flow (other than cellular manufacturing)."
45	We recommend changing family firm to "owned by a family," or something similar, if the intent of the question is to capture family-ownership information. We also recommend adding “50% or more” so respondents are able to quantify the level of ownership. For example, the question could read, “Is this establishment owned 50% or more by a family?”	Y	Question text was changed from "Is this establishment owned by a family firm?" because respondents were often unsure about the meaning of "family firm."
46	We recommend dropping the term "multinational."	Y	Question initially read "Is this establishment part of a multinational firm which has production establishments in other countries?" Many respondents were unfamiliar with the term "multinational," and there was confusion about multinational firms that have operations other than production in other countries.
General Remarks	Based off the feedback received from the second round of cognitive testing, we recommend sending the survey invite directly to the plant. It is our opinion that the plant controller will most likely complete the survey, and/or work with the plant manager to complete the survey. Nonresponse follow-up should be directed to the corporate offices if the plant fails to respond.	Y	This is the methodology followed by both the MOPS 2010 and MOPS 2015, which is relatively unique among Census Bureau surveys

Question Number	Recommendation	Accepted?	Notes
	We recommend providing guidance on the form tailored to respondents who were not employed in 2010 at the establishment on how to answer these historical opinion-based questions (i.e., estimates are acceptable, etc.). Having explicit instructions may decrease item nonresponse.	N	"Estimates are acceptable when responding to questions on this report form" will be included on the letter, as with the MOPS 2010.
	We recommended either increasing the burden statement, reducing the number of questions, or rewording questions so that they capture data more readily available in business records.	Y	Burden increased from 30 minutes for MOPS 2010 to 45 minutes for MOPS 2015
			An earlier version of the survey included a question asking respondents to forecast GDP growth for 2017. This question was dropped in response to the first round of pre-testing.
			An earlier version of the survey included a question asking respondents about the change in labor hours associated with design of new products or services, demand forecasting, advertising, supply chain management, and compensation. This question was dropped in response to the first round of pre-testing.
			The language pertaining to the various categories to be forecasted in questions 30-37 is taken directly from the Annual Survey of Manufacturers. Earlier versions of the survey did not use exactly the same language. The change to match the ASM was suggested in the first round of pre-testing.

Note: Table was developed from the recommendations, notes, and resolutions in Pick and Brennan (2015a, b).

Table 4.5: Recommendations from Usability Testing of the MOPS 2015 Survey Instrument

Question Number	Recommendation	Accepted?	Notes
Login Screen	Provide a resource to respondents who lost their username and password, whether by generating a new username and/or password, or simply a link that tells respondents who to call if they lost a password.	Y	Information is available on the FAQ.
Login Screen	Consider emphasizing the sentences discussing the 50 minute time-out feature, perhaps by placing them in closer proximity to the User ID and Password fields or by visually emphasizing the text with a bold and/or red font. They could also be repeated on subsequent screens.	N	
Login Screen	Census survey staff should be aware of the issue with saved login information when fielding calls from respondents who are having difficulty logging in. There should also be a mention of this in the FAQ section.	N	
Main Menu	Allow respondents to modify their company name and/or address information from the Main Menu, consistent with other web surveys.	Y	
1			
2			
3	Allow respondents to select “Never/None” in addition to any of the other answer choices.	Y	MOPS 2010 did not allow for selection of “Never/None” and other answer choices.
4	See question 3		
5			
6			
7			
8	Consider providing a more exhaustive list of answer choices, or an “other, specify” option.	N	Maintain consistency with MOPS 2010.

Question Number	Recommendation	Accepted?	Notes
8	Consider adding the definition of manager to any items where the term is used, or defining it in the help/FAQ section.	Y	Definition added to FAQ.
9			
10	If the survey sponsors are interested in bonuses of any type, and not specifically bonuses given for performance, consider rewording the question to remove the performance clause. If they are only interested in bonuses for performance, do not change the question, but beware that respondents may not answer appropriately	N	Maintain consistency with MOPS 2010.
11			
12			
13	Consider adding a response choice for team performance.	N	Maintain consistency with MOPS 2010.
13	Consider another word for "non-manager," to help visually distinguish between the questions on non-managers that immediately follow questions on managers.	N	Maintain consistency with MOPS 2010.
14	See question 13.		
15	Consider another word for "non-manager," to help visually distinguish between the questions on non-managers that immediately follow questions on managers.	N	Maintain consistency with MOPS 2010.
16	See question 15.		
17	Change the broad word "location" to the more specific version "mailing address" (or something similar). Alternatively, if the word "location" is kept, considering adding the term to the FAQ document and provide a context-specific definition of "location."	N	"Establishment" is defined in the FAQ as "a single physical location where business is conducted." "Location" is the standard language for business surveys.
18			
19			
20			
21			

Question Number	Recommendation	Accepted?	Notes
22			
23			
24			
25			
26			
27	Allow respondents to select “Never/None” in addition to any of the other answer choices.	Y	MOPS 2010 did not allow for selection of “Never/None” and other answer choices.
27	To remain consistent with the rest of the survey, put the 2010 question first, followed by the 2015 question.	Y	The order of these responses could not be reversed on the paper forms due to time constraints.
28	See question 27		
29			
Uncertainty Example	It should be made clearer, via extra text, that the examples on the example section are NOT boxes to be filled out.	Y	A text box with a solid border was added to the top of the screen.
Uncertainty Example	Correct the spelling for the word “judgment.”	Y	
Uncertainty Example	Insert “Report in $1000” above the data entry box	Y	
30	Add an auto-sum feature to show respondents the sum of their numbers as they enter them; alternatively, add a static “100” at the bottom to emphasize that the total must equal 100.	Y	Auto-sum feature was added.
30	Add instructions on how to interpret the variable of interest to the FAQ document, as the examples listed do not seem to clarify the term.	Y	Definitions are identical to the definitions used in the instructions for the 2015 ASM.
30	Insert “Report in $1000” above the data entry box	Y	
31	See question 30.		
32	See question 30.		

Question Number	Recommendation	Accepted?	Notes
33	See question 30.		
34	Add an auto-sum feature to show respondents the sum of their numbers as they enter them; alternatively, add a static "100" at the bottom to emphasize that the total must equal 100.	Y	Auto-sum feature was added.
34	Add instructions on how to interpret the variable of interest to the FAQ document, as the examples listed do not seem to clarify the term.	Y	Definitions are identical to the definitions used in the instructions for the 2015 ASM.
35	See question 34.		
36	See question 30.		
37	See question 30.		
38			
39			
40			
41			
42	In the FAQ, address how to address cases where part-time workers are members of a union from another job.	N	FAQ was developed using definitions and terminology that has been proven successful for other Census products. This issue could not be addressed using existing Census language.
43			
44	Provide brief descriptions to the answer choices, and provide an Other (specify) response option. Consider addressing this in the FAQ document.	N	FAQ was developed using definitions and terminology that has been proven successful for other Census products. This issue could not be addressed using existing Census language.
45			
46			

Question Number	Recommendation	Accepted?	Notes
47	Move this question to the beginning of the survey, so respondents are aware that they are responsible for choosing the timeframe that will be used throughout the questionnaire, and that they should be aware of it and apply it consistently throughout.	N	This certification is standard on Census forms.
47	Remove this question from the survey.	N	This certification is standard on Census forms.
Review Screen	Use a review screen template borrowed from other web surveys, such as the Annual Survey of Entrepreneurs, to more easily identify problematic items.	N	Not possible given time and technology constraints.
General Remarks	Consider making the PDF survey fillable.	N	Not possible given time and technology constraints.
	Add a screener question asking respondents when their establishment opened and do not ask recall questions if the answer is after 2010.	N	Maintain consistency with MOPS 2010 as well as the paper form.
	Provide easy and transparent access to 2010 survey submissions to respondents who completed the 2010 MOPS.	N	Every effort will be made to provide this data to respondents, but because MOPS 2010 was not processed through the usual Census system, this may not be possible.
	The FAQ section should be more exhaustive, and address any concerns that came up frequently during testing.	N	The FAQ was limited to questions and answers that are in use for other Census surveys.
	Change the tab for FAQ to "FAQ/Help."	N	
	Review all questions that allow only one answer selection, and consider if it is possible that more than one option could be selected.	N	Maintain consistency with MOPS 2010.
	Change "Next" button to "Save and Continue" to inform respondents that the survey is saving their answers each time they proceed to the next question.	Y	

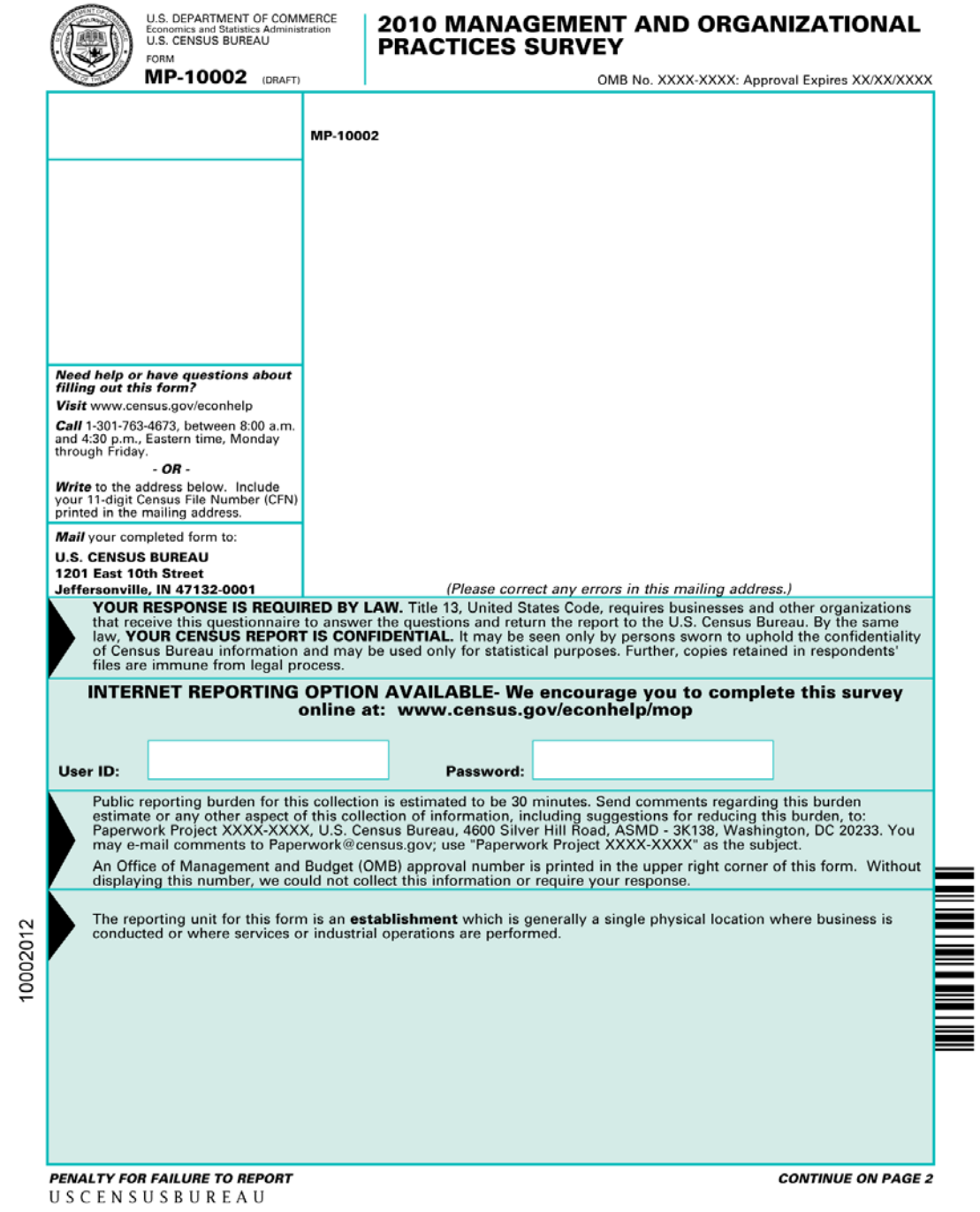
Question Number	Recommendation	Accepted?	Notes
	Make text of error messages more specific and identify the specific location of the problem with an asterisk or highlighting.	N	Not possible given time and technology constraints.
	Rather than suggest that respondents "ignore" the warning, consider changing the warning to read "to continue to the next question and address this issue later, press the Next button again."	N	Maintain standard Census web form language.
	To emphasize the instruction that tells respondents they can proceed to the next question without addressing the error, separate it spatially from the previous sentence.	Y	
	To emphasize a change in the theme of questions as a respondent enters a new section, the survey could have a page serve as a "bumper," showing only the section name and telling respondents to proceed.	N	Maintain consistency with paper instrument and MOPS 2010.
	Add the drop-down box with a list of the screens that would allow respondents to navigate directly to any screen.	N	Not possible given time and technology constraints.
	Ensure that respondents will be provided with a PDF that shows their completed questionnaire.	Y	
	Ensure that respondents who use Google Chrome to complete the survey are able to see their completed answers.	N	Google Chrome is not supported by the U.S. Census Bureau.
	Ensure that the introductory letter tells respondents the benefits of participating in the survey and the purposes of collecting the data.	Y	
	Removing the 2010 questions and removing the Uncertainty questions, both mentioned in other recommendations, would go a long way towards reducing the overall survey burden.	N	Recall questions and Uncertainty questions are both integral to the MOPS instrument.
	Consider using a bold font for emphasis, rather than capitalization.	N	Bold fonts are generally used for question text.

Question Number	Recommendation	Accepted?	Notes
	Explore the possibility of providing respondents with benchmarking data after they submit the survey; if this is not feasible to be provided to them immediately after they complete the survey, consider reaching out to respondents upon publication of the data to make them aware of the publication.	Y	Creation of a benchmarking tool is a goal of the Census Bureau and research partners.
	Add the phrase “estimates are acceptable” to any question asking for numbers to be reported.	N	Maintain consistency with paper instrument. Instruction letter indicates that estimates are acceptable throughout the survey.
	Change the title of Section D from “Uncertainty” to “Forecasting.”	N	Maintain consistency with paper instrument.
	Generate warning if scenarios are not in ascending order for questions 31, 33, 35, and 37	Y	

Note: Table was developed from the recommendations, notes, and resolutions in Herrell and Mesner (2016)

Appendices

Appendix A: MOPS 2010 Instrument



U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

FORM
MP-10002 (DRAFT)

2010 MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

OMB No. XXXX-XXXX: Approval Expires XX/XX/XXXX

MP-10002

Need help or have questions about filling out this form?

Visit www.census.gov/econhelp

Call 1-301-763-4673, between 8:00 a.m. and 4:30 p.m., Eastern time, Monday through Friday.

- OR -

Write to the address below. Include your 11-digit Census File Number (CFN) printed in the mailing address.

Mail your completed form to:

U.S. CENSUS BUREAU
1201 East 10th Street
Jeffersonville, IN 47132-0001

(Please correct any errors in this mailing address.)

YOUR RESPONSE IS REQUIRED BY LAW. Title 13, United States Code, requires businesses and other organizations that receive this questionnaire to answer the questions and return the report to the U.S. Census Bureau. By the same law, **YOUR CENSUS REPORT IS CONFIDENTIAL.** It may be seen only by persons sworn to uphold the confidentiality of Census Bureau information and may be used only for statistical purposes. Further, copies retained in respondents' files are immune from legal process.

INTERNET REPORTING OPTION AVAILABLE- We encourage you to complete this survey online at: www.census.gov/econhelp/mop

User ID: **Password:**

Public reporting burden for this collection is estimated to be 30 minutes. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: Paperwork Project XXXX-XXXX, U.S. Census Bureau, 4600 Silver Hill Road, ASMD - 3K138, Washington, DC 20233. You may e-mail comments to Paperwork@census.gov; use "Paperwork Project XXXX-XXXX" as the subject.

An Office of Management and Budget (OMB) approval number is printed in the upper right corner of this form. Without displaying this number, we could not collect this information or require your response.

The reporting unit for this form is an **establishment** which is generally a single physical location where business is conducted or where services or industrial operations are performed.

10002012

PENALTY FOR FAILURE TO REPORT

USCENSUSBUREAU

CONTINUE ON PAGE 2

Section A - Management Practices

1 In 2005 and 2010, what best describes what happened at this establishment when a problem in the production process arose?

Examples: Finding a quality defect in a product or a piece of machinery breaking down.

Check one box for each year	2005	2010
We fixed it but did not take further action	☐	☐
We fixed it and took action to make sure that it did not happen again	☐	☐
We fixed it and took action to make sure that it did not happen again, and had a continuous improvement process to anticipate problems like these in advance	☐	☐
No action was taken	☐	☐

2 In 2005 and 2010, how many key performance indicators were monitored at this establishment?

Examples: Metrics on production, cost, waste, quality, inventory, energy, absenteeism and deliveries on time.

Check one box for each year	2005	2010
1-2 key performance indicators	☐	☐
3-9 key performance indicators	☐	☐
10 or more key performance indicators	☐	☐
No key performance indicators (If no key performance indicators in both years, SKIP to **6**)	☐	☐

3 During 2005 and 2010, how frequently were the key performance indicators **reviewed** by **managers** at this establishment? ***Mark all that apply***

A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.

	2005	2010
Yearly	☐	☐
Quarterly	☐	☐
Monthly	☐	☐
Weekly	☐	☐
Daily	☐	☐
Hourly or more frequently	☐	☐
Never	☐	☐

10002020

CONTINUE ON PAGE 3

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

4 During 2005 and 2010, how frequently were the key performance indicators **reviewed** by **non-managers** at this establishment? ***Mark all that apply***

Non-managers are all employees at the establishment who are not managers as defined in **3**.

	2005	2010
Yearly	☐	☐
Quarterly	☐	☐
Monthly	☐	☐
Weekly	☐	☐
Daily	☐	☐
Hourly or more frequently	☐	☐
Never	☐	☐

5 During 2005 and 2010, where were the production display boards showing output and other key performance indicators located at this establishment? *Check one box for each year*

	2005	2010
All display boards were located in one place (e.g. at the end of the production line)	☐	☐
Display boards were located in multiple places (e.g. at multiple stages of the production line)	☐	☐
We did not have any display boards	☐	☐

6 In 2005 and 2010, what best describes the time frame of production targets at this establishment?

Check one box for each year

Examples of production targets are: production, quality, efficiency, waste, on-time delivery.

	2005	2010
Main focus was on short-term (less than one year) production targets	☐	☐
Main focus was on long-term (more than one year) production targets	☐	☐
Combination of short term and long term production targets	☐	☐
No production targets (If no production targets in both years, SKIP to **13**)	☐	☐

7 In 2005 and 2010, how easy or difficult was it for this establishment to achieve its production targets?

Check one box for each year	2005	2010
Possible to achieve without much effort	☐	☐
Possible to achieve with some effort	☐	☐
Possible to achieve with normal amount of effort	☐	☐
Possible to achieve with more than normal effort	☐	☐
Only possible to achieve with extraordinary effort	☐	☐

10002038

CONTINUE ON PAGE 4

8 In 2005 and 2010, who was aware of the production targets at this establishment? *Check one box for each year*

	2005	2010
Only senior managers	☐	☐
Most managers and some production workers	☐	☐
Most managers and most production workers	☐	☐
All managers and most production workers	☐	☐

9 In 2005 and 2010, what were **non-managers'** performance bonuses usually based on? ***Mark all that apply***

	2005	2010
Their own performance as measured by production targets	☐	☐
Their team or shift performance as measured by production targets	☐	☐
Their establishment's performance as measured by production targets	☐	☐
Their company's performance as measured by production targets	☐	☐
No performance bonuses (If no performance bonuses in both years, SKIP to **11**)	☐	☐

10 In 2005 and 2010, when production targets were met, what percent of **non-managers** at this establishment received performance bonuses? *Check one box for each year*

	2005	2010
0%	☐	☐
1-33%	☐	☐
34-66%	☐	☐
67-99%	☐	☐
100%	☐	☐
Production targets not met	☐	☐

11 In 2005 and 2010, what were **managers'** performance bonuses usually based on? ***Mark all that apply***

	2005	2010
Their own performance as measured by production targets	☐	☐
Their team or shift performance as measured by production targets	☐	☐
Their establishment's performance as measured by production targets	☐	☐
Their company's performance as measured by production targets	☐	☐
No performance bonuses (If no performance bonuses in both years, SKIP to **13**)	☐	☐

10002046

CONTINUE ON PAGE 5

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

12 In 2005 and 2010, when production targets were met, what percentage of **managers** at this establishment received performance bonuses? *Check one box for each year*

	2005	2010
0%	☐	☐
1-33%	☐	☐
34-66%	☐	☐
67-99%	☐	☐
100%	☐	☐
Production targets not met	☐	☐

13 In 2005 and 2010, what was the primary way **non-managers** were promoted at this establishment?

Check one box for each year	2005	2010
Promotions were based solely on performance and ability	☐	☐
Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	☐	☐
Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	☐	☐
Non-managers are normally not promoted	☐	☐

14 In 2005 and 2010, what was the primary way **managers** were promoted at this establishment?

Check one box for each year	2005	2010
Promotions were based solely on performance and ability	☐	☐
Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	☐	☐
Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	☐	☐
Managers are normally not promoted	☐	☐

15 In 2005 and 2010, when was an under-performing **non-manager** reassigned or dismissed? *Check one box for each year*

	2005	2010
Within 6 months of identifying non-manager under-performance	☐	☐
After 6 months of identifying non-manager under-performance	☐	☐
Rarely or never	☐	☐

10002053

CONTINUE ON PAGE 6

16 In 2005 and 2010, when was an under-performing **manager** reassigned or dismissed? *Check one box for each year*

	2005	2010
Within 6 months of identifying manager under-performance	☐	☐
After 6 months of identifying manager under-performance	☐	☐
Rarely or never	☐	☐

Section B - Organization

17 In 2005 and 2010, was the headquarters for this company at the same location as this establishment?

Check one box for each year	2005	2010
Yes (If yes in both years, SKIP to **24**)	☐	☐
No	☐	☐

18 In 2005 and 2010, where were decisions on **hiring permanent full-time employees** made?

Check one box for each year	2005	2010
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

19 In 2005 and 2010, where were decisions to **give an employee a pay increase of at least 10%** made?

Check one box for each year	2005	2010
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

20 In 2005 and 2010, where were decisions on **new product introductions** made? *Check one box for each year*

	2005	2010
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

10002061

CONTINUE ON PAGE 7

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

21 In 2005 and 2010, where were **product pricing** decisions made? *Check one box for each year*

	2005	2010
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)* _____	☐	☐

22 In 2005 and 2010, where were **advertising** decisions for products made? *Check one box for each year*

	2005	2010
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)* _____	☐	☐

23 In 2005 and 2010, what was the dollar amount that could be used to purchase a fixed/capital asset at this establishment without prior authorization from headquarters? *Check one box for each year*

	2005	2010
Under $1,000	☐	☐
$1,000 to $9,999	☐	☐
$10,000 to $99,999	☐	☐
$100,000 to $999,999	☐	☐
$1 million or more	☐	☐

24 In 2005 and 2010, what was the number of employees reporting directly to the plant manager at this establishment?

A plant manager's direct report is someone in the organizational level directly below them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with.

	2005	2010
Number of direct reports (Estimates are acceptable)		

25 In 2005 and 2010, how many layers of direct reports were there in this establishment from the factory floor to the plant manager, inclusive?

Example: For a site with a factory floor, factory supervisors and a plant manager, the number of layers would be 3.

	2005	2010
Number of layers (Estimates are acceptable)		

10002079

CONTINUE ON PAGE 8

26 In 2005 and 2010, who prioritized or allocated tasks to production workers at this establishment?

Check one box for each year

	2005	2010
Only managers	☐	☐
Mostly managers	☐	☐
Managers and production workers jointly	☐	☐
Mostly production workers	☐	☐
Only production workers	☐	☐
Other (please specify)	☐	☐

27 In 2005 and 2010, what best describes the **availability** of data to support decision making in this establishment?

Check one box for each year

	2005	2010
Data to support decision making are not available	☐	☐
A small amount of data to support decision making is available	☐	☐
A moderate amount of data to support decision making is available	☐	☐
A great deal of data to support decision making is available	☐	☐
All the data we need to support decision making is available	☐	☐

28 In 2005 and 2010, what best describes the **use** of data to support decision making in this establishment?

Check one box for each year

	2005	2010
Decision making does not use data	☐	☐
Decision making relies slightly on data	☐	☐
Decision making relies moderately on data	☐	☐
Decision making relies heavily on data	☐	☐
Decision making relies entirely on data	☐	☐

29 In 2005 and 2010, did the **managers** at this establishment learn about management practices from any of the following?

Mark all that apply

	2005	2010
Consultants	☐	☐
Competitors	☐	☐
Suppliers	☐	☐
Customers	☐	☐
Trade associations or conferences	☐	☐
New employees	☐	☐
Headquarters	☐	☐
Other (please specify)	☐	☐
None of the above	☐	☐

CONTINUE ON PAGE 9

10002087

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

Section C - Background Characteristics

30 What was your level of seniority in 2010?

- ☐ CEO or Executive Officer, e.g., CFO
- ☐ Manager of multiple establishments, e.g., Division Manager
- ☐ Manager of one establishment, e.g., Plant Manager or Controller
- ☐ Non-manager
- ☐ Other *(please specify)*

31 What year did you start working at this establishment? . . . . . Year

32 What was the number of **managers** at this establishment for the pay periods including March 12, 2005 and March 12, 2010?

A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.

	2005	2010
Number of managers at this establishment (Estimates are acceptable)		

33 What was the number of all full and part-time **employees** at this establishment for the pay periods including March 12, 2005 and March 12, 2010?

	2005	2010
Number of employees at this establishment (Estimates are acceptable)		

34 In 2005 and 2010, what was the percent of **managers** at this establishment with a bachelors degree?

Check one box for each year	2005	2010
20% or less	☐	☐
21%-40%	☐	☐
41%-60%	☐	☐
61%-80%	☐	☐
More than 80%	☐	☐

35 In 2005 and 2010, what was the percent of **non-managers** at this establishment with a bachelors degree?

Check one box for each year	2005	2010
0%	☐	☐
1-10%	☐	☐
11-20%	☐	☐
More than 20%	☐	☐

10002095

CONTINUE ON PAGE 10

36 In 2005 and 2010, what percent of all **employees** at this establishment were members of a labor union?

Check one box for each year	2005	2010
0%	☐	☐
1-20%	☐	☐
21-40%	☐	☐
41-60%	☐	☐
61-80%	☐	☐
More than 80%	☐	☐

REMARKS (Please use this space for any explanations that may be essential in understanding your reported data.)

37 CERTIFICATION - This report is substantially accurate and was prepared in accordance with the instructions.

Is the time period covered by this report a calendar year?

☐ Yes ☐ No - Enter time period covered →

	Month	Year		Month	Year
FROM			TO		

Name of person to contact regarding this report	Title

Telephone	Area code	Number	Extension	Fax	Area code	Number
		-				-

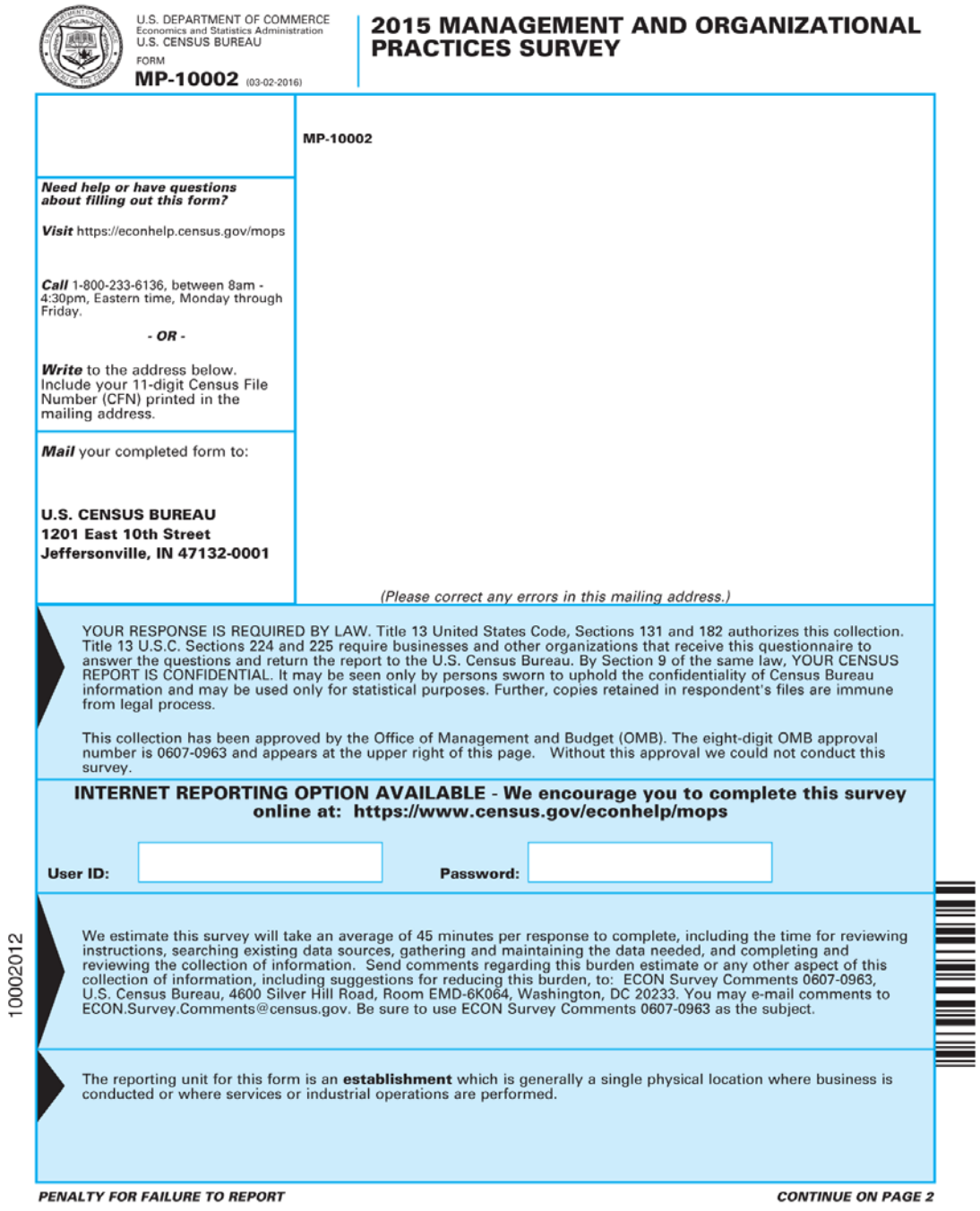
Internet e-mail address	Date completed →	Month	Day	Year

10002103

Thank you for completing your 2010 MANAGEMENT AND ORGANIZATIONAL PRACTICES form.

PLEASE PHOTOCOPY THIS FORM FOR YOUR RECORDS AND RETURN THE ORIGINAL.

Appendix B: MOPS 2015 Instrument



U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

FORM
MP-10002 (03-02-2016)

2015 MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

MP-10002

Need help or have questions about filling out this form?

Visit https://econhelp.census.gov/mops

Call 1-800-233-6136, between 8am - 4:30pm, Eastern time, Monday through Friday.

- OR -

Write to the address below. Include your 11-digit Census File Number (CFN) printed in the mailing address.

Mail your completed form to:

U.S. CENSUS BUREAU
1201 East 10th Street
Jeffersonville, IN 47132-0001

(Please correct any errors in this mailing address.)

YOUR RESPONSE IS REQUIRED BY LAW. Title 13 United States Code, Sections 131 and 182 authorizes this collection. Title 13 U.S.C. Sections 224 and 225 require businesses and other organizations that receive this questionnaire to answer the questions and return the report to the U.S. Census Bureau. By Section 9 of the same law, YOUR CENSUS REPORT IS CONFIDENTIAL. It may be seen only by persons sworn to uphold the confidentiality of Census Bureau information and may be used only for statistical purposes. Further, copies retained in respondent's files are immune from legal process.

This collection has been approved by the Office of Management and Budget (OMB). The eight-digit OMB approval number is 0607-0963 and appears at the upper right of this page. Without this approval we could not conduct this survey.

INTERNET REPORTING OPTION AVAILABLE - We encourage you to complete this survey online at: https://www.census.gov/econhelp/mops

User ID: **Password:**

10002012

We estimate this survey will take an average of 45 minutes per response to complete, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: ECON Survey Comments 0607-0963, U.S. Census Bureau, 4600 Silver Hill Road, Room EMD-6K064, Washington, DC 20233. You may e-mail comments to ECON.Survey.Comments@census.gov. Be sure to use ECON Survey Comments 0607-0963 as the subject.

The reporting unit for this form is an **establishment** which is generally a single physical location where business is conducted or where services or industrial operations are performed.

PENALTY FOR FAILURE TO REPORT ***CONTINUE ON PAGE 2***

Section A - Management Practices

1 In 2010 and 2015, what best describes what happened at this establishment when a problem in the production process arose?

Examples: Finding a quality defect in a product or a piece of machinery breaking down.

Mark one box for each year	2010	2015
We fixed it but did not take further action	☐	☐
We fixed it and took action to make sure that it did not happen again	☐	☐
We fixed it and took action to make sure that it did not happen again, and had a continuous improvement process to anticipate problems like these in advance	☐	☐
No action was taken	☐	☐

2 In 2010 and 2015, how many key performance indicators were monitored at this establishment?

Examples: Metrics on production, cost, waste, quality, inventory, energy, absenteeism and deliveries on time.

Mark one box for each year	2010	2015
1-2 key performance indicators	☐	☐
3-9 key performance indicators	☐	☐
10 or more key performance indicators	☐	☐
No key performance indicators (If no key performance indicators in both years, SKIP to **6**)	☐	☐

3 During 2010 and 2015, how frequently were the key performance indicators **reviewed** by **managers** at this establishment?

Mark all that apply

A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.

	2010	2015
Yearly	☐	☐
Quarterly	☐	☐
Monthly	☐	☐
Weekly	☐	☐
Daily	☐	☐
Hourly or more frequently	☐	☐
Never	☐	☐

10002020

CONTINUE ON PAGE 3

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

4 During 2010 and 2015, how frequently were the key performance indicators **reviewed** by **non-managers** at this establishment?

Mark all that apply

Non-managers are all employees at the establishment who are not managers as defined in **3**.

	2010	2015
Yearly	☐	☐
Quarterly	☐	☐
Monthly	☐	☐
Weekly	☐	☐
Daily	☐	☐
Hourly or more frequently	☐	☐
Never	☐	☐

5 During 2010 and 2015, where were the production display boards showing output and other key performance indicators located at this establishment?

Mark one box for each year	2010	2015
All display boards were located in one place (e.g. at the end of the production line)	☐	☐
Display boards were located in multiple places (e.g. at multiple stages of the production line)	☐	☐
We did not have any display boards	☐	☐

6 In 2010 and 2015, what best describes the time frame of production targets at this establishment?

Mark one box for each year

Examples of production targets are: production, quality, efficiency, waste, on-time delivery.

	2010	2015
Main focus was on short-term (less than one year) production targets	☐	☐
Main focus was on long-term (more than one year) production targets	☐	☐
Combination of short-term and long-term production targets	☐	☐
No production targets (If no production targets in both years, SKIP to **13**)	☐	☐

7 In 2010 and 2015, how easy or difficult was it for this establishment to achieve its production targets?

Mark one box for each year	2010	2015
Possible to achieve without much effort	☐	☐
Possible to achieve with some effort	☐	☐
Possible to achieve with normal amount of effort	☐	☐
Possible to achieve with more than normal effort	☐	☐
Only possible to achieve with extraordinary effort	☐	☐

10002038

CONTINUE ON PAGE 4

8 In 2010 and 2015, who was aware of the production targets at this establishment?

Mark one box for each year	2010	2015
Only senior managers	☐	☐
Most managers and some production workers	☐	☐
Most managers and most production workers	☐	☐
All managers and most production workers	☐	☐

9 In 2010 and 2015, what were **non-managers'** performance bonuses usually based on at this establishment?

Mark all that apply	2010	2015
Their own performance as measured by production targets	☐	☐
Their team or shift performance as measured by production targets	☐	☐
Their establishment's performance as measured by production targets	☐	☐
Their company's performance as measured by production targets	☐	☐
No performance bonuses (If no performance bonuses in both years, SKIP to **11**)	☐	☐

10 In 2010 and 2015, when production targets were met, what percent of **non-managers** at this establishment received performance bonuses?

Mark one box for each year	2010	2015
0%	☐	☐
1-33%	☐	☐
34-66%	☐	☐
67-99%	☐	☐
100%	☐	☐
Production targets not met	☐	☐

11 In 2010 and 2015, what were **managers'** performance bonuses usually based on at this establishment?

Mark all that apply	2010	2015
Their own performance as measured by production targets	☐	☐
Their team or shift performance as measured by production targets	☐	☐
Their establishment's performance as measured by production targets	☐	☐
Their company's performance as measured by production targets	☐	☐
No performance bonuses (If no performance bonuses in both years, SKIP to **13**)	☐	☐

10002046

CONTINUE ON PAGE 5

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

12 In 2010 and 2015, when production targets were met, what percentage of **managers** at this establishment received performance bonuses?

Mark one box for each year

	2010	2015
0%	☐	☐
1-33%	☐	☐
34-66%	☐	☐
67-99%	☐	☐
100%	☐	☐
Production targets not met	☐	☐

13 In 2010 and 2015, what was the primary way **non-managers** were promoted at this establishment?

Mark one box for each year

	2010	2015
Promotions were based solely on performance and ability	☐	☐
Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	☐	☐
Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	☐	☐
Non-managers are normally not promoted	☐	☐

14 In 2010 and 2015, what was the primary way **managers** were promoted at this establishment?

Mark one box for each year

	2010	2015
Promotions were based solely on performance and ability	☐	☐
Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)	☐	☐
Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)	☐	☐
Managers are normally not promoted	☐	☐

15 In 2010 and 2015, when was an under-performing **non-manager** reassigned or dismissed at this establishment?

Mark one box for each year

	2010	2015
Within 6 months of identifying non-manager under-performance	☐	☐
After 6 months of identifying non-manager under-performance	☐	☐
Rarely or never	☐	☐

16 In 2010 and 2015, when was an under-performing **manager** reassigned or dismissed at this establishment?

Mark one box for each year

	2010	2015
Within 6 months of identifying manager under-performance	☐	☐
After 6 months of identifying manager under-performance	☐	☐
Rarely or never	☐	☐

10002053

CONTINUE ON PAGE 6

Section B - Organization

17 Was the headquarters for this company at the same location as this establishment?

Mark one box for each year	2010	2015
Yes (If yes in both years, SKIP to 24)	☐	☐
No	☐	☐

If no, what state (if in the US) or country (if abroad)?

18 In 2010 and 2015, where were decisions on **hiring permanent full-time employees** made for this establishment?

Mark one box for each year	2010	2015
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

19 In 2010 and 2015, where were decisions to **give an employee a pay increase of at least 10%** made for this establishment?

Mark one box for each year	2010	2015
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

20 In 2010 and 2015, where were decisions on **new product introductions** made for this establishment?

Mark one box for each year	2010	2015
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

21 In 2010 and 2015, where were **product pricing** decisions made for this establishment?

Mark one box for each year	2010	2015
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

10002061

CONTINUE ON PAGE 7

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

22 In 2010 and 2015, where were **advertising** decisions for products made for this establishment?

Mark one box for each year	2010	2015
Only at this establishment	☐	☐
Only at headquarters	☐	☐
Both at this establishment and at headquarters	☐	☐
Other *(please specify)*	☐	☐

23 In 2010 and 2015, what was the dollar amount that could be used to purchase a fixed/capital asset for this establishment without prior authorization from headquarters?

Mark one box for each year	2010	2015
Under $1,000	☐	☐
$1,000 to $9,999	☐	☐
$10,000 to $99,999	☐	☐
$100,000 to $999,999	☐	☐
$1 million or more	☐	☐

Section C - Data and Decision Making

24 In 2010 and 2015, what best describes the **availability** of data to support decision making at this establishment?

Mark one box for each year	2010	2015
Data to support decision making are not available.	☐	☐
A small amount of data to support decision making is available	☐	☐
A moderate amount of data to support decision making is available	☐	☐
A great deal of data to support decision making is available	☐	☐
All the data we need to support decision making is available	☐	☐

25 In 2010 and 2015, what best describes the **use** of data to support decision making at this establishment?

Mark one box for each year	2010	2015
Decision making does not use data	☐	☐
Decision making relies slightly on data	☐	☐
Decision making relies moderately on data	☐	☐
Decision making relies heavily on data	☐	☐
Decision making relies entirely on data	☐	☐

10002079

CONTINUE ON PAGE 8

26 In 2010 and 2015, who chose what type of data to collect at this establishment?

Mark all that apply	2010	2015
Managers at this establishment	☐	☐
Managers at headquarters and/or other establishments	☐	☐
Production workers	☐	☐
Engineers	☐	☐
Customers	☐	☐
Government regulations or agencies	☐	☐

27 a) Consider each of the following sources of data and rate how frequently each source was used in decision making at this establishment **in 2015**.

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

b) Now think back to five years ago. How frequently was each source of data used in decision making at this establishment **in 2010**?

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Performance indicators from production technology or instruments	☐	☐	☐	☐	☐
Formal or informal feedback from managers	☐	☐	☐	☐	☐
Formal or informal feedback from production workers	☐	☐	☐	☐	☐
Data from outside the firm (suppliers, customers, outside data providers)	☐	☐	☐	☐	☐

28 a) How frequently was each of these activities influenced by data analysis at this establishment **in 2015?**

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

b) Now think back to five years ago. How frequently was each of these activities influenced by data analysis at this establishment **in 2010**?

Mark all that apply	Daily	Weekly	Monthly	Yearly	Never
Design of new products or services	☐	☐	☐	☐	☐
Demand forecasting	☐	☐	☐	☐	☐
Supply chain management	☐	☐	☐	☐	☐

10002087

CONTINUE ON PAGE 9

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

29 How frequently does this establishment typically rely on predictive analytics (statistical models that provide forecasts in areas such as demand, production, or human resources)?

Mark all that apply

	2010	2015
Daily	☐	☐
Weekly	☐	☐
Monthly	☐	☐
Yearly	☐	☐
Never	☐	☐

Section D - Uncertainty

The following examples illustrate how a plant could complete the type of questions asked in this section. All examples are fictional. If your forecasts do not include the level of detail requested or do not exist, please report according to your best judgment. ***Estimates are acceptable.***

Example A: Jane Doe is filling out this survey for Plant A. In 2015, Plant A had approximately $4,500,000 in products shipped, with a forecast of $4,750,000 in 2016.

For calendar years 2015 and 2016, what are the approximate dollar values of **products shipped**, including interplant transfers, exports and other receipts at this establishment? Exclude freight charges and excise taxes.

	$Bil.	Mil.	Thou.
For 2015 calendar year		4	500
Estimate for 2016 calendar year		4	750

Example B: Jane also knows that business at Plant A is forecasted to grow approximately an additional 5% in 2017, with predicted annual value of products shipped of $5 million. However, Jane knows there is some uncertainty with that forecast and that the value of products shipped next year could be more or less than $5 million depending on consumer demand, price of materials, and other uncertainties in the market. Given this uncertainty, this is how Jane would complete the following uncertainty forecast table for Plant A's value of products shipped for 2017.

Looking ahead to the 2017 calendar year, what is the approximate dollar value of **products shipped** you would anticipate for this establishment in the following scenarios, and what likelihood do you assign to each scenario?

2017 scenarios, from lowest to highest	Approximate dollar value of shipments in 2017			Percentage likelihood (values in this column should sum to 100)	
	$Bil.	Mil.	Thou.		
LOWEST		2	800	5	%
LOW		4	200	10	%
MEDIUM		5	000	60	%
HIGH		6	300	20	%
HIGHEST		7	500	5	%
			Total	100	%

10002095

CONTINUE ON PAGE 10

30 For calendar years 2015 and 2016, what are the approximate dollar values of **products shipped**, including interplant transfers, exports and other receipts at this establishment? Exclude freight charges and excise taxes.

	$Bil.	Mil.	Thou.
For 2015 calendar year			
Estimate for 2016 calendar year			

31 Looking ahead to the 2017 calendar year, what is the approximate dollar value of **products shipped** you would anticipate for this establishment in the following scenarios, and what likelihood do you assign to each scenario?

2017 scenarios, from lowest to highest	Approximate dollar value of shipments in 2017			Percentage likelihood (values in this column should sum to 100)	
	$Bil.	Mil.	Thou.		
LOWEST					%
LOW					%
MEDIUM					%
HIGH					%
HIGHEST					%
Total				100	%

32 For calendar years 2015 and 2016, what are the approximate dollar values of **capital expenditures** for new and used depreciable assets at this establishment? Include buildings and other structures, machinery and equipment. Exclude land.

	$Bil.	Mil.	Thou.
For 2015 calendar year			
Estimate for 2016 calendar year			

10002103

CONTINUE ON PAGE 11

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

33 Looking ahead to the 2017 calendar year, what is the approximate dollar value of **capital expenditures** you would anticipate for this establishment in the following scenarios, and what likelihood do you assign to each scenario?

2017 scenarios, from lowest to highest	Approximate dollar value of capital expenditures in 2017			Percentage likelihood (values in this column should sum to 100)	
	$Bil.	Mil.	Thou.		
LOWEST					%
LOW					%
MEDIUM					%
HIGH					%
HIGHEST					%
			Total	100	%

34 For the following dates, what was the total number of **employees** (full-time plus part-time) on the payroll at this establishment? Exclude full- or part-time leased employees whose payroll was filed by an employee leasing company, temporary staffing obtained from a staffing service, and purchased professional and technical services.

	Number
On March 12, 2015	
On March 12, 2016	

35 Looking ahead, approximately how many **employees** would you anticipate on this establishment's payroll as of March 12, 2017 in the following scenarios, and what likelihood do you assign to each scenario?

2017 scenarios, from lowest to highest	Approximate number of employees on payroll as of March 12, 2017	Percentage likelihood (values in this column should sum to 100)	
LOWEST			%
LOW			%
MEDIUM			%
HIGH			%
HIGHEST			%
Total		100	%

10002111

CONTINUE ON PAGE 12

36 For calendar years 2015 and 2016, what are the approximate dollar expenditures for this establishment on **materials, parts, containers, and packaging**?

	$Bil.	Mil.	Thou.
For 2015 calendar year			
Estimate for 2016 calendar year			

37 Looking ahead to the 2017 calendar year, what are the approximate dollar expenditures on **materials, parts, containers, and packaging** you would anticipate for this establishment in the following scenarios, and what likelihood do you assign to each scenario?

2017 scenarios, from lowest to highest	Approximate dollar cost of materials, parts, containers, and packaging in 2017			Percentage likelihood (values in this column should sum to 100)	
	$Bil.	Mil.	Thou.		
LOWEST					%
LOW					%
MEDIUM					%
HIGH					%
HIGHEST					%
Total				100	%

Section E - Background Characteristics

	Year
38 What year did you start working at this establishment?	

39 What was the number of **managers** at this establishment for the pay periods including March 12, 2010 and March 12, 2015?

A manager is someone who has employees directly reporting to them, with whom they meet on a regular basis, and whose pay and promotion they may be involved with, e.g., Plant Manager, Human Resource Manager, Quality Manager.

	2010	2015
Number of managers at this establishment (Estimates are acceptable)		

10002129

CONTINUE ON PAGE 13

If not shown, please enter your 11-digit Census File Number (CFN) from the mailing address.

40 In 2010 and 2015, what was the percent of **managers** at this establishment with a bachelors degree?

Mark one box for each year

	2010	2015
20% or less	☐	☐
21-40%	☐	☐
41-60%	☐	☐
61-80%	☐	☐
More than 80%	☐	☐

41 In 2010 and 2015, what was the percent of **non-managers** at this establishment with a bachelors degree?

Mark one box for each year

	2010	2015
0%	☐	☐
1-10%	☐	☐
11-20%	☐	☐
More than 20%	☐	☐

42 In 2010 and 2015, what percent of all **employees** at this establishment were members of a labor union?

Mark one box for each year

	2010	2015
0%	☐	☐
1-20%	☐	☐
21-40%	☐	☐
41-60%	☐	☐
61-80%	☐	☐
More than 80%	☐	☐

43 In 2010 and 2015, what percent of all **employees** at this establishment could be classified in the following ways?

Estimates are acceptable.

	2010	2015
Employees who were part-time	___ %	___ %
Employees who were working flexible hours	___ %	___ %
Employees who worked from home one day or more per week	___ %	___ %
Employees who were cross-trained	___ %	___ %

10002137

CONTINUE ON PAGE 14

44 In 2010 and 2015, which of the following **best** described the production of this establishment?

Mark one box for each year

	2010	2015
Job shop	☐	☐
Batch production	☐	☐
Cellular manufacturing	☐	☐
Continuous flow (other than cellular manufacturing)	☐	☐
Research and development or prototyping	☐	☐

45 Is this establishment owned 50% or more by its founder(s) or member(s) of a founder's family?

Mark one box

☐ Yes, founder(s) owns it

☐ Yes, member(s) of a founder's family owns it (e.g., daughter, son, sister, brother)

☐ No

If yes to either of the above, is the CEO of the firm also a founder or a member of a founder's family?

☐ Yes

☐ No

46 Is this establishment part of a firm which has production establishments in other countries?

☐ Yes

☐ No

REMARKS *(Please use this space for any explanations that may be essential in understanding your reported data.)*

47 CERTIFICATION - This report is substantially accurate and was prepared in accordance with the instructions.

Is the time period covered by this report a calendar year?

☐ Yes ☐ No - Enter time period covered → FROM Month Year TO Month Year

Name of person to contact regarding this report	Title

	Area code	Number	Extension		Area code	Number
Telephone	___ -	___ -	___ - ___	Fax	___ -	___ - ___

Internet e-mail address		Month	Day	Year
	Date completed →			

Thank you for completing your 2015 MANAGEMENT AND ORGANIZATIONAL PRACTICES form.

PLEASE PHOTOCOPY THIS FORM FOR YOUR RECORDS AND RETURN THE ORIGINAL.

10002145

Bibliography

Acemoglu, Daron, Philippe Aghion, Claire Lelarge, John Van Reenen, and Fabrizio Zilibotti (2007), 'Technology, Information, and the Decentralization of the Firm,' *Quarterly Journal of Economics*, 122(4), 1759-1799.

Adam, Klaus (2007), 'Optimal Monetary Policy with Imperfect Common Knowledge,' *Journal of Monetary Economics*, 54(2), 267-301.

Aral, Sinan, Erik Brynjolfsson, and Lynn Wu (2012), 'Three-Way Complementarities: Performance Pay, Human Resource Analytics and Information Technology,' *Management Science*, 58(5), 843-859.

Arellano, Cristina, Yan Bai, and Patrick Kehoe (2010), 'Financial Markets and Fluctuations in Uncertainty,' Federal Reserve Bank of Minnesota Research Department Staff Report.

Atrostic, B.K., and Sang V. Nguyen (2005), 'IT and Productivity in US Manufacturing: Do Computer Networks Matter?' *Economic Inquiry*, 43(3), 493-506.

Bachmann, Rudiger, Steffen Elstner, and Eric R. Sims (2013), 'Uncertainty and Economic Activity: Evidence from Business Survey Data,' *American Economic Journal: Macroeconomics*, 5(2), 217-249.

Baker, Scott, Nick Bloom, Brandice Canes-Wrone, Steven Davis, and Jonathan Rodden (2015), 'Why Has U.S. Policy Uncertainty Risen Since 1960?' www.policyuncertainty.com/media/BBCDR_Uncertainty.pdf.

Baker, Scott, Nick Bloom, and Steven Davis (2013), 'Measuring Economic Policy Uncertainty,' www.policyuncertainty.com/media/BakerBloomDavis.pdf.

Baker, Scott, Nick Bloom, and Steven Davis (2015), 'What Triggers Stock Market Jumps?' Presentation at ASSA Meetings, Boston, www.policyuncertainty.com/media/BBD_StockJumps.pdf.

Bansel, Ravi and Amir Yaron (2004), 'Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles,' *Journal of Finance*, 59(4), 1481-1509.

Bartel, Ann, Casey Ichniowski, and Kathryn Shaw (2007), 'How Does Information Technology Affect Productivity? Plant-Level Comparisons of Product Innovation, Process Improvement, and Worker Skills,' *Quarterly Journal of Economics*, 122(4), 1721-1758.

Bartik, Timothy J. (1991), *Who Benefits from State and Local Economic Development Policies?*, Upjohn Institute for Employment Research: Kalamazoo, MI.

Basu, Susanto and John Fernald (2001), 'Why is Productivity Procyclical? Why Do We Care?' in *New Developments in Productivity Analysis*, Charles R. Hulten, Edwin R. Dean, and Michael J. Harper (eds.), University of Chicago Press: Chicago, IL, 225-302.

Belloni, Alexandre, Victor Chernozhukov, and Christian Hansen (2014), 'Inference on Treatment Effects after Selection Amongst High-Dimensional Controls,' *Review of Economic Studies*, 81(2), 608-650.

Ben-David, Itzhak, John R. Graham, and Campbell R. Harvey (2013), 'Managerial Miscalibration,' *Quarterly Journal of Economics*, 128(4), 1547-1584.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan (2004), 'How Much Should We Trust Differences-In-Differences Estimates?' *Quarterly Journal of Economics*, 119(1), 249-275.

Bertrand, Marianne and Antoinette Schoar (2003), 'Managing with Style: The Effect of Managers on Firm Policies,' *Quarterly Journal of Economics*, 118(4), 1169-1208.

Bewley, Truman F. (2002), *Why Wages Don't Fall During a Recession*, Harvard University Press: Cambridge, MA.

Bishow, John L. (2009), 'A Look at Supplemental Pay: Overtime Pay, Bonuses, and Shift Differentials,' *Compensation and Working Conditions Online*.

Black, Sandra and Lisa Lynch (2001), 'How to Compete: The Impact of Workplace Practices and Information Technology on Productivity,' *Review of Economics and Statistics*, 83(3), 434-445.

Bloom, Nicholas (2009), 'The Impact of Uncertainty Shocks,' *Econometrica* 77(3), 623-685.

Bloom, Nicholas (2014), 'Fluctuations in Uncertainty,' *Journal of Economic Perspectives*, 28(2), 153-176.

Bloom, Nicholas, Steve Bond, and John Van Reenen (2007), 'Uncertainty and Investment Dynamics,' *Review of Economic Studies*, 74(2), 391-415.

Bloom, Nicholas, Erik Brynjolfsson, Lucia Foster, Ron Jarmin, Megha Patnaik, Itay Saporta-Eksten, and John Van Reenen (2014a), 'IT and Management in America,' CEP Discussion Paper 1258.

Bloom, Nicholas, Erik Brynjolfsson, Lucia Foster, Ron Jarmin, Megha Patnaik, Itay Saporta-Eksten, and John Van Reenen (2016a), 'What Drives Differences in Management?' Stanford mimeo.

Bloom, Nicholas, Erik Brynjolfsson, Lucia Foster, Ron Jarmin, Itay Saporta-Eksten, and John Van Reenen (2013a), 'Management in America,' CES Working Paper 13-01.

Bloom, Nicholas, Benn Eifert, Aprajit Mahajan, David McKenzie, and John Roberts (2013b), 'Does Management Matter? Evidence from India,' *Quarterly Journal of Economics*, 128(1), 1-51.

Bloom, Nicholas, Luis Garicano, Raffaella Sadun, and John Van Reenen (2009), 'The Distinct Effects of Information Technology and Communication Technology on Firm Organization,' NBER Working Paper 14975.

Bloom, Nicholas, Renata Lemos, Raffaella Sadun, Daniela Scur, and John Van Reenen (2014b), 'The New Empirical Economics of Management,' *Journal of the European Economic Association*, 12(4), 835-876.

Bloom, Nicholas, Renata Lemos, Raffaella Sadun, Daniela Scur, and John Van Reenen (2016b), 'International Data on Measuring Management Practices,' CEP Occasional Paper 46.

Bloom, Nicholas, Renata Lemos, Raffaella Sadun, and John Van Reenen (2014c), 'Does Management Matter in Schools?' LSE mimeo.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2012a), 'Americans Do IT Better,' *American Economic Review*, 102(1), 167-201.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2012b), 'The Organization of Firms across Countries,' *Quarterly Journal of Economics*, 127(4), 1663-1705.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2013c), 'Does Management Matter in Healthcare?' LSE mimeo.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2016c), 'Management as a Technology?' NBER Working Paper 22327.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2015), 'Do Private Equity Owned Firms Have Better Management Practices?' *American Economic Review*, 105(5), 442-46.

Bloom, Nicholas, Helena Schweiger, and John Van Reenen (2012c), 'The Land that Lean Manufacturing Forgot? Management Practices in Transition Countries,' *Economics of Transition*, 20(4), 593-635.

Bloom, Nicholas and John Van Reenen (2007), 'Measuring and Explaining Management Practices across Firms and Countries,' *Quarterly Journal of Economics*, 122(4), 1351-1408.

Bresnahan, Timothy F., Erik Brynjolfsson, and Lorin M. Hitt (2002), 'Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence,' *Quarterly Journal of Economics*, 117(1), 339-376.

Brouillette, Dany and Daniel Ershov (2014), 'Management Practices, Competition, Innovation, and the Performance of Enterprises in Canada,' Industry Canada Economic Research and Policy Analysis Branch Working Paper 2014-02.

Brynjolfsson, Erik and Lorin M. Hitt (1997), 'Information Technology and Organizational Design: Evidence from Firm-level Data,' MIT Sloan School Working Paper.

Brynjolfsson, Erik, Lorin M. Hitt, and Heekyung Hellen Kim (2011), 'Strength in Numbers: How Does Data-Driven Decisionmaking Affect Firm Performance?' SSRN Working Paper 1819486.

Brynjolfsson, Erik, and Kristina McElheran (2016), 'Data in Action: Data-Driven Decision Making in U.S. Manufacturing,' CES Working Paper 16-06.

Brynjolfsson, Erik, and Haim Mendelson (1993), 'Information Systems and the Organization of Modern Enterprise,' *Journal of Organizational Computing*, 3(3), 245-255.

Buffington, Catherine, Lucia Foster, Ron Jarmin, and Scott Ohlmacher (2016a), 'The Management and Organizational Practices Survey (MOPS): An Overview,' CES Working Paper 16-28.

Buffington, Cathy, Andrew Hennessy, and Scott Ohlmacher (forthcoming), 'The Management and Organizational Practices Survey (MOPS): Collection and Processing,' CES Working Paper.

Buffington, Catherine, Kenneth Herrell, and Scott Ohlmacher (2016b), 'The Management and Organizational Practices Survey (MOPS): Cognitive Testing,' CES Working Paper 16-53.

Cappelli, Peter (2001), 'The National Employer Survey: Employer Data on Employment Practices,' *Industrial Relations*, 40(4), 635-647.

Cappelli, Peter and David Neumark (2001), 'Do 'High-Performance' Work Practices Improve Establishment-Level Outcomes?' *Industrial and Labor Relations Review*, 54(4), 737-775.

D'Aurizio, Leandro and S. Iezzi (2010), 'Investment Forecasting with Plans Collected in Business Surveys,' Bank of Italy Temi di Discussione No. 832.

De Mel, Suresh, David McKenzie, and Christopher Woodruff (2014) "Business Training and Female Enterprise Start-up, Growth, and Dynamics: Experimental Evidence from Sri Lanka", *Journal of Development Economics*, 106, 199-210.

Delfgaauw, Josse, Robert Dur, Carol Propper, and Sarah Smith (2011), 'Management Practices: Are Not for Profits Different?' CMPO working paper 11/263.

Dohrmann, Thomas and Gary Pinshaw (2009), *The Road to Improved Compliance: A McKinsey Benchmarking Study of Tax Administrations, 2008-2009*. New York: McKinsey and Company.

Elsby, Michael W., Donggyun Shin, and Gary Solon (2013), 'Wage Adjustment in the Great Recession,' NBER Working Paper 19478.

Fallick, Bruce C., Michael Lettau, and William L. Wascher (2016), 'Downward Nominal Wage Rigidity in the United States During and After the Great Recession,' Finance and Economics Discussion Series 2016-001.

Fort, Teresa C. and Shawn D. Klimek (2016), 'The Effects of Industry Classification Changes on US Employment Composition,' Mimeo.

Foster, Lucia, John Haltiwanger, and Cheryl Grim (2014), ' Reallocation in the Great Recession: Cleansing or Not?' NBER Working Paper 20427.

Foster, Lucia, John Haltiwanger, and Chad Syverson (2008), 'Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?' *American Economic Review*, 98(1), 394-425.

Foster, Lucia and Patrice Norman (2015), 'The Annual Survey of Entrepreneurs: An Introduction,' CES Working Paper 15-40.

Gerver, Miriam and La Toya Thomas (2009), 'Expert Review of ASM Management Practices Supplement,' internal Census Bureau documentation.

Gibbons, Robert and Rebecca Henderson (2013), 'What Do Managers Do? Exploring Persistent Performance Differences Among Seemingly Similar Enterprises,' in *The Handbook of Organizational Economics*, Robert Gibbons and John Roberts (eds.), Princeton University Press: Princeton, NJ, 680-731.

Giroud, Xavier and Holger M. Mueller (2016), 'Redistribution of Local Demand Shocks Through Firms' Internal Networks,' NBER Working Paper 22396.

Haltom, Renee and Nick Bloom (2014), 'Interview: Nicholas Bloom,' *Econ Focus*, Federal Reserve Bank of Richmond, https://www.richmondfed.org/publications/research/econ_focus/2014/q2/interview.cfm.

Herrell, Kenny and Krysten Mesner (2016), 'Findings and Recommendations from Usability Testing for the Management and Organizational Practices Survey,' internal Census Bureau documentation.

Homkes, Rebecca (2011), 'The Missing Management Link: Why Management Matters in Global Public-Private Partnerships,' LSE mimeo.

Hong, Bryan, Lorenz Kueng, and Mu-Jeung Yang (2015), 'Estimating Management Practice Complementarity between Decentralization and Performance Pay,' NBER Working Paper 20845.

Horvath, Francis W. (1982), 'Forgotten Unemployment: Recall Bias in Retrospective Data,' *Monthly Labor Review*, 105(3), 40-43.

Hsieh, Chang-Tai and Peter Klenow (2009), 'Misallocation and Manufacturing TFP in China and India,' *Quarterly Journal of Economics*, 124(4), 1403-1448.

Ichniowski, Casey, Kathryn Shaw, and Giovanna Prennushi (1997), 'The Effects of Human Resource Management: A Study of Steel Finishing Lines,' *American Economic Review*, 87(3), 291-313.

Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng (2015), 'Measuring Uncertainty,' *American Economic Review*, 105(3), 1177-1216.

Karlan, Dean, Ryan Knight, and Christopher Udry (2012), 'Hoping to Win, Expected to Lose, Theory and Lessons on Micro Enterprise Development,' NBER Working Paper 18325.

Knight, Frank H. (1921), *Risk, Uncertainty, and Profit*, Houghton Mifflin Company: New York, NY.

Lamont, Owen (1997), 'Cash Flow and Investment: Evidence from Internal Capital Markets,' *Journal of Finance*, 52(1), 83-109.

Lazear, Edward P. (2000), 'Performance Pay and Productivity,' *American Economic Review*, 90(5), 1346-1361.

Lazear, Edward P. and Paul Oyer (2013), 'Personnel Economics,' in *The Handbook of Organizational Economics*, Robert Gibbons and John Roberts (eds.), Princeton University Press: Princeton, NJ, 479-519.

Lazear, Edward P., Kathryn L. Shaw, and Christopher Stanton (2016), 'Making Do with Less: Working Harder During Recessions,' *Journal of Labor Economics*, 34(S1), S333-S360.

Marris, Robin (1964), *The Economic Theory of 'Managerial' Capitalism*, Macmillan: New York, NY.

McConnell, K. John, Kim Hoffman, Andrew Quanbeck, and Dennis McCarty (2009), 'Management Practices in Substance Abuse Treatment Programs' *Journal of Substance Abuse*, 37(1), 79-89.

McConnell, K. John, Richard C. Lindrooth, Douglas R. Wholey, Thomas M. Maddox, and Nick Bloom (2013), 'Management Practices and the Quality of Care in Cardiac Units,' *JAMA Internal Medicine*, 173(8), 684-692.

McConnell, K. John, Richard C. Lindrooth, Douglas R. Wholey, Thomas M. Maddox, and Nick Bloom (2016), 'Modern Management Practices and Hospital Admissions,' *Health Economics*, 25(4), 470-485.

McCormack, John, Carol Propper, and Sarah Smith (2013), 'Herding cats? Management and University Performance,' *Economic Journal*, 124(578), F534-F564.

McElheran, Kristina (2014), 'Delegation in Multi-Establishment Firms: Evidence from IT Purchasing,' *Journal of Economics and Management Strategy*, 23(2), 225-258.

McKenzie, David and Christopher Woodruff (2012), 'What are We Learning from Business Training and Entrepreneurship Evaluations around the Developing World?' IZA Discussion Paper 6895.

McKinsey and Company (2009), 'Management Matters in Northern Ireland and the Republic of Ireland,' http://www.delni.gov.uk/managementmatters.

Milgrom, Paul and John Roberts (1990), 'The Economics of Modern Manufacturing: Technology, Strategy, and Organization,' *American Economic Review*, 80(3), 511-528.

Organization for Economic Co-operation and Development (2008), *Handbook on Constructing Composite Indicators: Methodology and User Guide*, OECD Publishing.

Oyer, Paul (2004), 'Recall Bias Among Displaced Workers,' *Economics Letters*, 82(3), 397-402.

Parent, Daniel (1999), 'Methods of Pay and Earnings: A Longitudinal Analysis,' *Industrial and Labor Relations Review*, 53(1), 71-86.

Pick, Kenneth and Michael Brennan (2015a), 'Findings and Recommendations from Round One Cognitive Testing for the 2015 Management and Organizational Practices Survey (MOPS),' internal Census Bureau documentation.

Pick, Kenneth and Michael Brennan (2015b), 'Findings and Recommendations from the Second Round of Cognitive Testing for the 2015 Management and Organizational Practices Survey (MOPS),' internal Census Bureau documentation.

Pissarides, Christopher A. (2009), 'The Unemployment Volatility Puzzle: Is Wage Stickiness The Answer?' *Econometrica*, 77(5), 1339-1369.

Radner, Roy (1992), 'Hierarchy: The Economics of Managing,' *Journal of Economic Literature*, 30(3), 1382-1415.

Rahaman, Mohammad M. and Ashraf Al Zaman (2013), 'Management Quality and the Cost of Debt: Does Management Matter to Lenders?' *Journal of Banking and Finance*, 37(3), 854-874.

Rasul, Imran and Daniel Rogger (2013), 'Management of Bureaucrats and Public Service Delivery,' UCL mimeo.

Rasul, Imran and Daniel Rogger (2015), 'The Impact of Ethnic Diversity in Bureaucracies: Evidence from the Nigerian Civil Service,' *American Economic Review*, 105(5): 457-61.

Roberts, John and Garth Saloner (2013), 'Strategy and Organization,' in *The Handbook of Organizational Economics*, Robert Gibbons and John Roberts (eds.), Princeton University Press: Princeton, NJ, 799-849.

Stettler, Kristin (2011), 'Summary of Basic Findings from Expert Review and Cognitive Testing of the Management and Organizational Practices Survey,' internal Census Bureau documentation.

Syverson, Chad (2004), 'Product Substitutability and Productivity Dispersion,' *Review of Economics and Statistics*, 86(2), 534-550.

Syverson, Chad (2011), 'What Determines Productivity?' *Journal of Economic Literature*, 49(2), 326-365.

Tello-Trillo, Cristina (2015), 'The Impact of Trade on Managerial Incentives and Productivity,' Working paper.

Tuttle, A. David (2011), 'Findings and Recommendations from Usability Testing for the Management and Organizational Practices Survey,' internal Census Bureau documentation.

Urminsky, Oleg, Christian Hansen, and Victor Chernozhukov (2016), 'Using Double-Lasso Regression for Principled Variable Selection,' Working paper.

Walker, Francis (1887), 'The Source of Business Profits,' *Quarterly Journal of Economics*, 1(3): 265-288.

Yang, Mu-Jeung, Lorenz Kueng, and Bryan Hong (2015), 'Business Strategy and the Management of Firms,' NBER Working Paper 20846.