Employee Share Ownership, Management Practices, and Labor Productivity: An Analysis Using Establishment Level Micro-Data from the U.S. Census

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ABSTRACT

This project introduces the U.S. Census's Management and Organizational Practices Survey (MOPS) data into the employee share ownership research landscape, with the goal of investigating the role of workplace management and organizational practices in shaping the impact of broad-based employee share ownership on labor productivity at American manufacturing workplaces. We combine data from the 2010 and 2015 Census MOPS, the American Survey of Manufactures (ASM), the US Longitudinal Business Database (LBD), and the US Department of Labor Form 5500 Pension Database. MOPS is the largest management practices survey ever conducted of US manufacturing workplace establishments. We show, among other results, that adopting an Employee Stock Ownership Plan (ESOP) is associated with a 5.6 to 6.7 % increase in labor productivity over 2010 to 2015, controlling for workplace management and organizational practices.

JEL classification: J54, J33, M52, M54, D21, L2, L6
Keywords: Employee Share Ownership, ESOPs, Labor Productivity, Management and Organizational Practices

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INTRODUCTION

Does employee share ownership improve labor productivity, holding constant management and organizational practices? This question motivates our paper. To answer it, we built the first representative data set on employee share ownership, management practices, and labor productivity capturing both closely-held and publicly-traded companies in U.S. manufacturing. Our study combines workplace-level micro-data from the US Census's Longitudinal Business Database (LBD), the Management and Organizational Practices Survey (MOPS), the American Survey of Manufactures (ASM), and the US Department of Labor Form 5500 Pension Database, comprising the largest data compilation effort to date on employee ownership. Furthermore, our study comprises the first introduction into the employee ownership research landscape of the U.S. Census's Management and Organizational Practices Survey (MOPS), which is the largest management survey ever conducted of US manufacturing establishments.

The prevalence of broad-based share employee ownership, whereby workers at all levels of a firm's hierarchy have an ownership stake in the company where they work through holdings of stock, has been growing in the past several decades in the U.S. (Kurtulus and Kruse 2017, Kruse 2022). According to the 2022 wave of the General Social Survey, which is a nationally representative survey of employees conducted by the National Opinion Research Center, 24.5 million or 19.9% of employees in for-profit companies own some stock in the company where they work. Based on data from the U.S. Department of Labor's Form 5500 firm pension records, between 1999 and 2022, the number of workers in Employee Stock Ownership Plans (ESOPs) grew from 7.8 to 10.9 million, or from 7.2 percent to 8.3 percent of the private sector workforce. Given the increasing prevalence of employee ownership, understanding the relationships between employee ownership, management practices and labor productivity carries great policy significance.

In this paper, we focus on the most common form of broad-based employee equity ownership plan today in the US, namely Employee Stock Ownership Plans (ESOPs). An ESOP is a tax-advantaged retirement plan where employees are granted company stock without buying the stock with their own wages or savings. ESOPs were created in 1956 by Louis Kelso and institutionalized into U.S. law through the Employee Retirement Income Security Act of 1974 (ERISA). In an ESOP, ERISA allows companies to contribute company stock, or money to buy stock, or to use credit to buy stock, to an employee pension trust that holds the stock, so workers generally gain an ownership stake in the company without investing their own money (Blasi and Kruse 1991). The company then allocates the shares to employees over time as the workers have passed a vesting period (have been at the company for a certain period of time). Shares are often allocated to employee accounts based on compensation or years of service. When an employee leaves or retires, the company buys back their vested shares, paying the employee the value in

cash, which can be taken as a lump sum or in installments.[1] Per ERISA, all full-time employees at the firm must be included in the plan, making it a broad-based form of employee ownership. ESOPs have increased steadily over the last several decades and are now the most common form of broad-based employee ownership in the U.S.

Prior studies of employee ownership and employment outcomes are based on publicly-traded companies where the employee ownership percentages are low, or on small surveys and samples limited in their size and generalizability. The majority of prior research on the effects of employee ownership on firm performance outcomes like productivity, employment stability, and firm survival in the US are based on publicly-traded firms due to easily available performance data (e.g. Kurtulus and Kruse 2017, Kim and Ouimet 2014, O'Boyle, Patel and Gonzalez-Mule 2016, Doucouliagos 1995), but these firms typically have very small percentages of the company owned by employees (2-3% on average), and may have a different dynamic than closely-held firms that are often majority-owned by employees. There does not exist any prior study that has used high-quality representative data on closely-held firms, which are by far the majority of US ESOPs (in number of ESOPs, not employees covered). Furthermore, over 99% of US ESOP plans are within closely-held companies in 2010 and 2015, based on our calculations from Form 5500 and WRDS Compustat data. In manufacturing, over 98% of all ESOP plans were within closely-held companies in 2010 and 2015.

Another important advantage of our data is that it comprises the first introduction of the U.S. Census's Management and Organizational Practices Survey (MOPS) into the employee share ownership research landscape. The MOPS is the largest management survey ever conducted of US manufacturing establishments. When a U.S. company receives the Annual Survey of Manufactures (ASM) from the U.S. Census, its management is required to complete the survey. As a result, our data set is the most representative yet assembled for analyzing the relation of employee ownership with management practices. Importantly, the Annual Survey of Manufactures includes financial information about the closely-held companies that has not been available to researchers in previous studies comparing ESOP and non-ESOP firms, allowing for a fuller and more accurate analysis.

The manufacturing industry contains the greatest prevalence of ESOPs in the US, with over 20% of all US ESOPs in manufacturing. According to the US Department of Labor's Form 5500 records for 2022, among the 10.9 million employees in ESOPs, 2.5 million or 22.9% are in manufacturing firms. The high salience of ESOPs is due to a variety of factors including its ability to improve worker productivity, reduce turnover, and ensure long-term stability in a high-capital industry, as well as to provide tax-advantaged succession for retiring company owners under ERISA law. ESOPs often foster a "culture of ownership," where employees act like owners, improving quality control and reducing waste. Manufacturing is often viewed as the backbone of the US economy. For all of these reasons, it is worthwhile to focus on ESOPs in the

[1] When employees who are members of the ESOP leave the company or retire, they receive their stock. Privately-held companies are required to buy back the departing employee's shares at fair market value within 60 days of the employee's departure. The companies must have an annual stock valuation to determine the price of the shares. More information about ESOPs can be obtained from https://www.nceo.org/what-is-employee-ownership/esop-employee-stock-ownership-plan. ESOPs often exist alongside other retirement plans at the company, most frequently a 401(k), where workers get both.

manufacturing sector, as we do. According to the 2022 General Social Survey, 25.7% of all employees in durable manufacturing and 27.5% of all employees in non-durable manufacturing reported owning some stock in the company where they worked (author's calculations). This is in contrast to the 19.9% of employees across all for-profit companies owning some stock in the company where they worked. According to the Department of Labor's Form 5500 files for 2022, among the 10.9 million employee participants in 6,257 companies with an ESOP, 8.5 million employee participants are in ESOPs in 403 publicly-traded companies where the average value of the ESOP accounts are generally modest ($18,411), with non-employee ownership assets in 401k plans prevailing within those ESOPs. About 197,000 employee participants are in non-401(k) 99 public company ESOPs with average assets of $125,000 per participant. Notably, among closely-held corporations there are 5,854 ESOP companies with about 2.4 million employees with average assets per participant of $164,000. These closely-held ESOPs are concentrated in manufacturing and that is one reason why our analysis is particularly relevant (authors' calculations).

We address four research questions: (1) What is the impact of ESOP presence on workplace labor productivity? (2) Holding constant a set of management practices, does labor productivity change when a workplace switches from a non-ESOP workplace to an ESOP workplace? (3) What are the impacts specifically of broad-based group bonuses and broad-based information sharing on workplace labor productivity? (4) By how much, if at all, does employee ownership accentuate or attenuate the impact of broad-based group bonuses and broad-based information sharing on labor productivity?

THEORETICAL FRAMEWORK AND PRIOR LITERATURE

Employee ownership can increase worker and company performance by tying worker performance to pay. Since employee ownership shares the overall economic pie with employees of the firm, employee ownership can motivate workers to work to increase the size of the pie by putting forth more effort, improving innovation, sharing productive information with co-workers and management, and reducing worker-management conflict.

Consistent with the theory that employee ownership can raise worker effort, in the General Social Survey, which is a national representative survey of individuals conducted by the National Opinion Research Center at the University of Chicago, survey respondents who were employee owners reported that their co-workers had higher average effort than was reported by employee non-owners (Kurtulus and Kruse, 2017). Although this question did not ask specifically about the co-workers' employee ownership status, employee ownership programs tend to be implemented at the workplace level, so it was likely that most of an employee owner respondent's co-workers were also employee owners.

The above finding is consistent with firm-level studies that have found a positive association between employee ownership and firm performance. A 2016 meta-analysis of existing studies with 102 samples covering 56,984 firms found that employee ownership has a small but significant positive relationship on average with firm performance (O'Boyle et. al., 2016). These studies employed a variety of statistical methods, including pre/post-adoption comparisons and corrections for selection bias. A 2006 review of 129 studies found that two-thirds showed

evidence of positive employee ownership effects on performance and attitudes, and one-tenth found negative effects (Kaarsemaker, 2006). Jones and Kato (1995) examined the effect of broad-based employee stock ownership plans by estimating production functions using a panel of Japanese firms; they found that the introduction of an ESOP resulted in a 4–5 percent increase in productivity and that this productivity payoff took from three to four years to actualize. In the United States, a study by Blasi, Freeman, and Kruse (2014) examined 300 privately held firms that set up ESOPs between 1988 and 1994, comparing each ESOP firm to a similar company of the same size and in the same industry without an ESOP. They found that ESOP firms have significantly higher sales growth and higher sales per worker than matching firms without ESOPs.

Achieving incentive effects from sharing the overall economic pie with employees of the firm is complicated by the free-rider, or 1/N, problem. That is, as the number of people sharing the pie (N) grows, the incentive to contribute to the overall pie by individual workers (1/N) is diluted which can reduce productivity gains from share plans.

Game theory shows that the free rider problem (an example of the "prisoner's dilemma") can be overcome in a cooperative equilibrium where everyone can agree on and enforce high work norms (Axelrod 1984; Fudenberg and Maskin 1986). Firm policies that encourage higher effort, cooperation, and co-worker monitoring can counteract reduced incentives. The efficiency wage theory of "gift exchange" by Akerlof suggests that such a cooperative equilibrium can be reached when workers view employee ownership as coming on top of pay, rather than replacing pay--the idea is that workers respond to the "gift" of above market compensation with a reciprocal "gift" of high effort and cooperation to benefit the firm and fellow workers (Akerlof 1982). Consistent with this, Weltmann, Blasi and Kruse (2015) found that positive effects of employee ownership on attitudes and behaviors are more likely to occur when employee ownership comes on top of market-level wages and benefits. This result is from the NBER Shared Capitalism Dataset which is a survey of over 40,000 employees at 13 companies with employee ownership plans.

Empirical evidence has shown that workers with company stock are indeed more likely to engage in co-worker monitoring. Freeman, Blasi and Kruse (2010) showed that workers with company stock were much more likely to speak to a shirking co-worker or to a supervisor when they observe co-workers shirking in their analysis of the NBER Shared Capitalism Dataset. Furthermore, prior studies have shown that employee ownership generally comes on top of pay rather than replacing a portion of it. Kurtulus and Kruse (2017) showed using data from the General Social Survey that employee-owners were more likely than non–employee owners to report that their fixed pay levels were at or above market levels, and that the employee ownership came on top of market levels of fixed pay for most workers. Kim and Ouimet (2014) showed that ESOP adoption led to higher or constant employee wages. Consistent with this, cross-sectional comparisons of matched ESOP and non-ESOP firms found similar levels of pay and other benefits at such firms, so that ESOPs appear to come on top of other worker pay and benefits (Kardas, Scharf, and Keogh 1998; Scharf and Mackin 2000). A recent comparison of matched ESOP and non-ESOP firms found similar levels of pay and other benefits apart from the ESOP (Mazewski, 2024). Also, comparisons of young ESOP and non-ESOP workers in the

National Longitudinal Survey found that ESOP workers have 13% higher pay, after accounting for many demographic and jobs characteristics including individual fixed effects (Baek, 2019).

Past evidence on the higher average productivity at firms with employee share ownership, and the willingness of employee-owners to enforce higher workplace standards by countering shirking behavior, suggests that the free rider problem fails to hinder the potential of employee share ownership to improve firm performance. Combining employee share ownership with policies that build team spirit, loyalty, and high work standards may reduce and even overcome free riding. Because many of these studies found that employee-owned companies with a bundle of high performance human resource management practices were more likely to experience better firm performance and lower turnover, our current study is particularly relevant since it looks at both employee share ownership *and* the bundle of high performance human resource management practices.

A number of past studies have shown employee ownership increases worker incentives and team effort (Jones and Kato 1996, Blasi, Conte and Kruse 1996). Studies have also shown that employee ownership improves job satisfaction and overall pay, as well as employment stability and company survival in face of negative macroeconomic shocks (Kurtulus and Kruse, 2017, Kruse 2022, O'Boyle, Patel and Gonzalez-Mule 2016). Some of these studies have relied on case studies of a small number of companies or data limited in their representativeness or generalizability. Most of the larger-scale employee ownership performance studies were based on publicly-traded firms due to available data (e.g. Kurtulus and Kruse 2017), but these firms typically have very small percentages of the company owned by employees, on the order of 2-3% on average. Until now, we did not have good representative data on closely-held firms, which are often 100% employee-owned and are by far the majority of US ESOPs.

Two previous studies are closest to our new analysis of the impact of employee ownership on productivity in the U.S. Kurtulus and Kruse (2017) show that labor productivity increases with any employee ownership in company pension plans using panel data on the universe of publicly-traded firms from the Compustat database linked to U.S. Department of Labor Form 5500 pension records. However, their data did not capture closely-held companies, where most ESOPs are, so a major advantage of our analysis is our coverage of both closely-held and publicly-traded companies. Furthermore, their analysis was at the firm level, whereas ours is at a finer gradient of labor productivity at the workplace level. The second study closest to ours is Kim and Ouimet (2014). They showed that total factor productivity measured as outputs net of inputs increases with ESOP adoption, using panel data on publicly-traded manufacturing workplaces from the Compustat database linked to the Annual Survey of Manufactures/Census of Manufactures. Again, this analysis excluded closely-held companies. Our study uses representative US Census micro-data containing both closely-held and publicly-traded companies.

A criticism of employee share ownership is the financial risk entailed for employees. Having a large share of wealth in any one asset—including the stock of one's employer—means that one may face financial risk from failing to diversify one's savings. Financial risk may increase under employee share ownership, since if a firm fails employees lose both their income and their savings from company stock (Walter and Corley, 2015). However, financial theory

shows that reasonable amounts of a single asset—including stock in one's company—can be part of an efficient portfolio as long as the overall portfolio is properly diversified (Markowitz, Blasi, and Kruse, 2010). Furthermore, the research findings noted above are that employee share ownership (a) generally comes on top of standard pay and benefits, and (b) lowers the risk of job loss, the biggest threat to financial stability faced by most workers. Additionally, a majority of even the most risk-averse employees report that they would like at least some ownership, profit sharing, or stock options in their pay package (Kruse et al., 2010). When based on the ESOP, where typically employees receive the stock as a grant rather than paying for it with their wages or savings, employees encounter less financial risk .

Past scholarship also focuses upon the relationship of employee share ownership to corporate governance, labor-management conflict, and the quality of work life. Employee share ownership can give workers a greater role in corporate governance through increasing access to information and participation in decision-making, improving the quality of work life through increased agency on the job. Agency theory posits that residual returns should be accompanied by residual control to provide proper incentives to workers (Prendergast 2004, DeVaro and Kurtulus 2010). That is, workers should be provided with the means to improve performance—through increased skills, knowledge, and involvement in decision-making---so they can effectively take action in response to the financial incentives. Past research evidence is consistent with the idea that participatory workplace practices are complementary with shared rewards in improving performance-related attitudes and behaviors (Kruse, Freeman, and Blasi 2010).

Furthermore, ESOPs may reduce labor-management conflict by aligning incentives between workers and employers. Research shows that employee share ownership is linked to greater corporate transparency among stock market companies when employees have bargaining power, which may account for the lower likelihood of strikes in unionized companies that adopt ESOPs (Bova, 2014). Employees in ESOP firms report a higher likelihood of participation in company-sponsored training and workplace decisions and tend to give companies higher ratings on management-employee relations including the handling of promotions and workplace safety (Kruse, Freeman, and Blasi, 2010). Employee share owners are less likely than other employees to say they will look for a new job but report higher satisfaction only when employee ownership is combined with other supportive workplace policies. Without such policies, employee ownership may appear as an attempt to shift financial risk onto workers, rather than to empower them.

In our empirical analyses, we leverage information collected in the Management and Organizational Practices Survey to explore whether there is complementarity between employee share ownership and participatory workplace practices, and also control for union presence at the workplace.

DATA

Our project links the U.S. Census's Management and Organizational Practices Survey 2010 and 2015 (MOPS), the U.S. Census's American Survey of Manufactures (ASM), the U.S.

Census's Longitudinal Business Database (LBD), and the U.S. Department of Labor's Form 5500 Pension Database.

The Management and Organizational Practices Survey (MOPS), the largest management survey ever conducted of U.S. manufacturing establishments, was developed by the U.S. Census Bureau in partnership with external researchers including Nick Bloom (Stanford), Erik Brynjolfsson (MIT), and John Van Reenen (LSE). The MOPS is a longitudinal survey of approximately 50,000 workplace establishments piloted in 2010 as a supplement to the Annual Survey of Manufactures (ASM). The 2010 MOPS queried establishments about their management and organizational practices, their use of data in decision-making, and establishment characteristics. 37,000 establishments responded to the 2010 MOPS, accounting for 78% of those surveyed, making it by far the largest source of panel data on workplace management practices. For MOPS 2010, 58.4% of respondents answered the survey electronically and the remaining 41.6% returned a paper form (Buffington, Foster, Jarmin, and Olmacher, 2017). As a supplement to the 2015 ASM, the 2015 MOPS was again sent to approximately 50,000 manufacturing establishments, including the topics in the 2010 MOPS with expanded coverage on the use of data in decision making and establishment characteristics (Buffington, Hennessy, and Olmacher, 2018). The 2015 wave of the MOPS had a response rate of approximately 74%. We access the MOPS restricted-use microdata through Census Special Sworn Status at the Federal Statistical Research Data Centers (FSRDC) under Project Number 3061. The Appendix gives the full set of questions in the 2010 and 2015 MOPS.

In addition, we utilize the 2010 and 2015 Annual Survey of Manufactures restricted-use microdata (ASM). The ASM, a yearly[2] survey of approximately 50,000 manufacturing industry establishments, contains information on production, outputs, inputs, employment, hours, operating expenses and inventories. The ASM data underlies our labor productivity variable, measured as the natural logarithm of total value of shipments divided by total average production hours worked.

We also utilize the U.S. Census's 2010 and 2015 Longitudinal Business Database (LBD). The LBD is a database of *all* workplace establishments in the U.S. and provides information on firm and establishment activity longitudinally over time across all states and industries. The LBD provides detailed information about business formation and employment growth, survival and exit, and overall labor market dynamics. Indicators for firm and establishment identifiers allow us to track business units of the same firm across states and over time. Access to the LBD database also requires Census Special Sworn Status via the Federal Statistical Research Data Centers.

Finally, we utilize the U.S. Department of Labor's Form 5500 pension data. The U.S. Department of Labor, Internal Revenue Service, and the Pension Benefit Guaranty Corporation jointly developed the Form 5500 Series so employee benefit plans could satisfy annual reporting requirements under Title I and Title IV of the Employee Retirement Income Security Act and under the Internal Revenue Code. We use the Form 5500 Annual Reports of Employee Benefit

[2] The Annual Survey of Manufactures is conducted in each year except those ending in 2 and 7 (i.e. quinquennial years) when it is subsumed by the manufacturing sector portion of the Economic Census, known as Census of Manufactures.

Plans for 2010 and 2015 accessed from the U.S. DOL website, to construct firm-level variables on employee ownership. We focus on the most prevalent form of employee ownership in the United States, namely Employee Stock Ownership Plans (ESOPs).

In 2010 we match the MOPS to the ASM using the establishment level identifier in both datasets, keep only matched observations, and then match the resulting file to the LBD using the most recent 2021 LBD establishment level identifier included within the ASM and LBD, and again keep only matched observations. We then collapse the 2010 raw DOL Form 5500 plan level data to tax identifier EIN level of observation. Using the Form 5500 to Census bridge file, containing a one-to-one match of Census firm identification variables to tax identifier (i.e. one "firmid" for each "ein"), we then match the firm-level employee-ownership variables from the Form 5500 to the combined MOPS-ASM-LBD establishment-level file, and again keep only matched observations. We repeat these same exact steps for 2015 and then append the 2010 MOPS-ASM-LBD-Form 5500 data file to the 2015 MOPS-ASM-LBD-Form 5500 data file to create our entire establishment-year panel data set.

In the end, our final matched dataset, which we refer to as the 2010 and 2015 combined MOPS-ASM-LBD-Form 5500 dataset, consists of 44,000 unique establishments and over 22,500 firms in the U.S. manufacturing sector.[3,4] The vast majority of establishments in our MOPS-ASM-LBD-Form 5500 dataset appear both in 2010 and 2015, resulting in a formidable establishment-level panel. Our database comprises the largest to date on the correlates of employee ownership in the U.S. manufacturing industry.

Table 1 shows the basic summary statistics of our longitudinal 2010 and 2015 combined MOPS-ASM-LBD-Form 5500 manufacturing establishment data set. The total number of unique manufacturing establishments is 44,000 and the total number of unique manufacturing firms is 22,500. The total number of ESOP manufacturing establishments in the 2010 and 2015 combined sample is 6,200 and the total number of ESOP companies in the 2010 and 2015 combined sample is 1,000. We see that the mean dollar value of establishment labor productivity over these years, measured as total shipments per thousand production worker hours, is $473,700. The average total establishment employment is 179.9. The average level of expenditures (in $1,000s) in manufacturing establishments on materials and equipment is $64,210. The average proportion of establishments in which at least one union member is present is 19.7%. Average manufacturing establishment capital stock (in $1,000s) for buildings and structures is $21,180, and for tools and equipment is $11,430. 33.7% of establishments have broad-based group performance pay and 64.8% of establishments have broad-based information sharing. Finally, ESOP adoption from 2010 to 2015 occurs at 600

[3] Note that sample counts are rounded for Census disclosure reasons throughout the paper.

[4] To get an idea about coverage, we can compare to estimates of the total number of workplace establishments in U.S. manufacturing from the Quarterly Census of Employment and Wages (QCEW) produced by the U.S. Department of Labor Bureau of Labor Statistics. Our 44,000 establishments in the combined 2010 and 2015 MOPS-ASM-LBD-Form 5500 represents 12.9% of all establishments in the manufacturing sector in the United States, using the estimate of 341,631 total manufacturing establishments from the QCEW (average of the 2010 and the 2015 estimates).

establishments across 60 firms, while ESOP elimination occurs at 450 establishments across 45 firms, and ESOPs are present in both 2010 and 2015 at 4,800 establishments across 450 firms.

METHODOLOGY

Labor Productivity Model with only Main Effects for ESOP Presence and MOPS index

To examine the relationship between labor productivity (from the ASM at the establishment level), employee share ownership (from the USDOL Form 5500 at the firm level), and management and organizational practices (from the MOPS at the establishment level), we estimate the following establishment fixed effects regression equation on the 2010 and 2015 establishment panel:

$$Y_{kt} = \beta_0 + \beta_1 EO_{ft} + \beta_2 MOP_{kt} + \beta_3 X_{kt} + \theta_k + \varepsilon_{kt} \quad (1)$$

where the variables are:

Y_{kt} = labor productivity in establishment k at time t, measured in two alternative ways, either as 1) the natural logarithm of total value of shipments (in thousands of U.S. dollars) in year t over total average production worker hours (in thousands) in year t from the ASM (i.e. "LP calc" in the tables), or as 2) an estimated measure of the natural logarithm of labor productivity from the estimation developed by US Census researchers (Blackwood, Grim, Nesbit, Tuttle and Wolf, 2023)[5] (i.e. "LP est" in the tables), defined as establishment-level deflated total value of shipments, finished goods inventory, and work-in-process inventory, all divided by total hours worked, in 1997 base year U.S. dollars. The main difference between the two alternative measures of labor productivity is that "LP est" is more comprehensive and controls for the impact of inflation, while "LP calc" is in terms of 2010 and 2015 nominal U.S. dollars. Both versions of the labor productivity variable are winsorized at the 1st and 99th percentiles to reduce influence of extreme values.

EO_{ft} = employee share ownership variable at firm f in year t, measured as a 1/0 dummy variable indicating presence of an ESOP from the USDOL Form 5500 database.

MOP_{kt}= the management and organizational practices index from MOPS survey at establishment k in year t. We use Bloom et. al.'s (2019) "structured management index" as our initial broad management and organizational practices measure, which is based on the first 16 questions in the MOPS survey, and monotonized on a zero to one scale from least to most structured or active management practice. The index sums across all 16 monotonized survey questions and divides by the total to create an unweighted score across the 16 survey questions. The 16 MOPS questions regard: the extent of proactive remedial action when a problem arises in the production process; how many key

[5] This estimated labor productivity variable is described in detail in the Census working paper "Collaborative Micro-productivity Project: Establishment-Level Productivity Dataset, 1972-2020) by Blackwood et. al. (2023).

performance measures are monitored; how frequently key performance measures are monitored by managers (and separately by non-managers); how pervasively performance measures are displayed within the workplace; the usual time horizon (i.e. short vs. long-term) of production targets; the ease or difficulty of reaching production targets; the breadth of awareness of production targets within the workplace (i.e. senior managers vs. managers vs. production workers); the target on which manager (and separately non-manager) production bonuses are based (i.e. for reaching individual, team/shift, establishment, or firm production targets); the percentage of managers and non-managers receiving production bonuses when targets are met; the extent to which promotion of non-managers and managers is based upon performance and ability; and the rapidity with which an underperforming manager and non-manager is reassigned or dismissed. The average value of the MOPS structured management index in our 2010 and 2015 data set is 0.620 as shown in Table 1. See the Appendix for the full questionnaires for the 2010 and 2015 MOPS.

X_{kt} = vector of establishment controls for establishment k in year t, including: the natural logarithm of capital stock in structures and the natural log of capital stock in equipment, the natural log of expenditures on materials and equipment, the natural log of total employment from the ASM, union status (measured by presence of at least one union member within an establishment from the MOPS data), industry-specific year dummies to control for industry time trends, an interaction term between an indicator for the observations occurring during the year 2015 and an indicator for the U.S. state where an establishment resides, and interactions between union status and a year 2015 dummy variable to test for dynamics of labor productivity within establishments that maintain union status over the panel.

θ_k = establishment fixed effects.

With inclusion of the establishment fixed effects, changes in the EO and MOP variables within establishments drive the identification of the variables of interest. Thus β_1, the coefficient on EO_{ft}, estimates the impact of switching ESOP status from 2010 to 2015 on establishment labor productivity controlling for the diverse array of structured managerial practices captured by the MOPS structured management index, establishment characteristics, and unobserved time invariant establishment fixed effects.

It is worth noting that since EO_{ft} is measured at the firm level, our approach relies on inferring the establishment's ESOP status from the firm level data, which is a safe inference since ESOPs are required by federal pension law (ERISA) to be broad-based and never confined to only a particular location or group of workers. For our regression estimates, we compute robust standard errors clustered at the firm level, as well as non-clustered robust standard errors for comparison. Panel regression estimates can be attenuated towards zero if there is measurement error in the ESOP measures from year to year, for example due to misreporting or miscoding (Card 1996, Freeman 1984). However, since the ESOP variable comes from administrative data it is reasonable to expect that it carries only minimal measurement error.

Labor Productivity Model with Main Effects for ESOP, Broad Based Group Performance Pay, and Broad Based Information Sharing

Given the broad and varied components of the MOPS structured management index (from the first 16 questions of the MOPS survey), in our second approach we estimate a version of equation 1 with two specific variables indicating the presence of broad based group performance pay (i.e. from MOPS Questions 9 and 10) and presence of broad based information sharing (i.e. from MOPS Questions 4 and 8) within an establishment, using the following fixed effects model:

$$Y_{kt} = \beta_0 + \beta_1 EO_{ft} + \beta_2 BGS_{kt} + \beta_3 BIS_{kt} + \beta_4 X_{kt} + \theta_k + \varepsilon_{kt} \quad (2)$$

All variables are as defined above, with subscripts k for establishment, f for firm, and t for time aside from BGS_{kt} and BIS_{kt} which substitute for the MOPS structured management index as the main human resources variable. These two variables are defined as follows :

BGS_{kt} = 1/0 indicator variable for presence of broad-based group performance pay at establishment k in year t. BGS_{kt} turns on from zero to one if non-managers are paid bonuses upon the reaching of team/shift, establishment, or firm performance objectives (based on Question 9 of the MOPS survey) and over two-thirds of non-managers usually receive performance bonuses in an establishment (based on Question 10 of the MOPS survey). The average proportion of establishments in the sample with broad-based group performance pay is 33.7%, as shown in Table 1.

BIS_{kt} ==1/0 indicator variable that turns from 0 to 1 if non-managers within an establishment review key establishment performance indicators at least once per year at establishment k in year t (based on Question 4 of the MOPS survey) and most production workers are aware of key performance objectives of the establishment (based on Question 8 of the MOPS survey).[6] The average proportion of establishments in the sample with broad-based information sharing is 64.8%.

Because ESOPs encourage employee engagement (Guzek and Whillans, 2024), it is especially important to control for broad-based group performance pay and broad-based information sharing to isolate the impact of employee ownership on labor productivity.

Given the presence of establishment fixed effects in model 2, β_1 , the coefficient of interest associated with the variable EO_{ft}, estimates the impact of switching from non-ESOP to ESOP between 2010 and 2015 on establishment labor productivity controlling for the high-engagement managerial practices of broad-based group performance pay and broad-based information sharing.

Instrumental Variables Robustness Check for Baseline Labor Productivity Model

[6] Key establishment performance indicators include metrics on production, cost, waste, quality, inventory, energy, absenteeism, and on-time deliveries.

As a robustness check we employ an instrumental variables approach wherein we instrument for the continuous ESOP assets per active employee variable. The value of ESOP assets rises on account of growth in stock values. If stock values rise because of recent productivity gains, then productivity may drive growth in ESOP assets, rather than ESOP assets impacting productivity as an outcome variable. To account for the potential endogeneity of ESOP assets, we estimate a two-stage least-squares fixed effects instrumental regression identical to regressions 1 and 2 with the distinction that ESOP assets per active employee replaces the ESOP presence indicator variable, and that we instrument this with state and industry indicator variables plus the pre-analysis 2008 and 2009 values of ESOP assets per active employee at firm f. State and industry indicators, and pre-analysis 2008 and 2009 ESOP assets per active employee, are good instruments for ESOP assets per active employee at the time of analysis (i.e. 2010 and 2015) because they are correlated with the potential endogenous variable ESOP assets per active employee.

Our model with instrumental variables takes two forms, with the first utilizing the overall MOPS structured management index and the second using the more focused high-engagement management practice control variables of broad-based group performance pay and broad-based information sharing:

$$Y_{kt} = \beta_1 EO'_{ft} + \beta_2 MOP_{kt} + \beta_3 X_{kt} + \theta_k + u_{kt} \qquad (3)$$

$$\text{where } EO_{ft}' = \beta_4 State_t + \beta_5 Industry_{kt} + \beta_6 EO_{f\,t=2008} + \beta_7 EO_{f\,t=2009} + \beta_8 X_{kt} + \theta_k + v_{kt}$$

and

$$Y_{kt} = \beta_1 EO'_{ft} + \beta_2 BGS_{kt} + \beta_3 BIS_{kt} + \beta_4 X_{kt} + \theta_k + u_{kt} \qquad (4)$$

$$\text{where } EO_{ft}' = \beta_5 State_t + \beta_6 Industry_{kt} + \beta_7 EO_{f\,t=2008} + \beta_8 EO_{f\,t=2009} + \beta_9 X_{kt} + \theta_k + v_{kt}$$

Nearly all variables are as defined above in equations 1 and 2, except Y_{kt} and EO'_{ft} which are defined as follows:

> Y_{kt} is as above though it takes on the first standard measure of labor productivity in our analysis of the natural logarithm of total value of shipments (in thousands of U.S. dollars) in year t from the ASM divided by the total average production worker hours (in thousands of production worker hours) in year t from the ASM. Labor productivity is again winsorized at the 1st and 99th percentiles to reduce influence of extreme values.
>
> EO_{ft}' is the continuous measure of employee ownership intensity captured by the variable ESOP assets per active employee in 2010 and 2015. We employ two-stage least-squares estimation to instrument for the endogenous variable of ESOP assets per active employee. We employ two versions of the instrumental variables fixed effects regression which we call IV1 and IV2. IV1 uses ESOP assets per active employee in 2009 and state and industry indicator variables to instrument for ESOP assets per active employee in

2010 and 2015. IV2 uses ESOP assets per active employee in 2008, ESOP assets per active employee in 2009, and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. The version of equation 3 and 4 above depicts IV2.

Note that we also estimate the non-IV versions of the above models (with standard fixed effects), for comparison in the empirical results section.

Labor Productivity Models with Main Effects and Interactions:

In our third approach, we estimate an interactive model which augments equations 1 through 4 with an interaction of employee ownership and our human resources practices variables (i.e. the MOPs structured management practices index and broad-based group performance pay and broad-based information sharing indicator variables). We use the following fixed effects interactive model which builds upon equation 1 above:

$$Y_{kt} = \beta_0 + \beta_1 EO_{ft} + \beta_2 MOP_{kt} + \beta_3 MOP_{kt}*EO_{ft} + \beta_4 X_{kt} + \theta_k + \varepsilon_{kt} \quad (5)$$

All variables are as defined above for equation 1, with subscripts k for establishment, f for firm, and t for time. Here the coefficient β_3 on the interaction term measures the marginal impact of management practices, conditional on the presence of employee share ownership. In other words, the coefficient on β_3 will show us the specific implications of combining both the MOPS structured management practices and the presence of an ESOP.

We also use the following fixed effects interactive model which builds upon equation 2 above:

$$Y_{kt} = \beta_0 + \beta_1 EO_{ft} + \beta_2 BGS_{kt} + \beta_3 BIS_{kt} + \beta_4 BGS_{kt} *EO_{ft} + \beta_5 BIS_{kt} *EO_{ft} + \beta_6 X_{kt} + \theta_k + \varepsilon_{kt} \quad (6)$$

All variables are as defined above for equation 2, with subscripts k for establishment, f for firm, and t for time. Here the coefficient on the interaction terms β_4 and β_5 measure the marginal impact of the presence of the high-engagement management practices broad-based group performance pay and broad-based information sharing, conditional on the presence of employee share ownership. In other words, the coefficients β_4 and β_5 on the interaction terms will show us the specific implications of combining, respectively, broad-based group performance pay practices with an ESOP, and broad-based information sharing with an ESOP.

We use the following fixed effects interactive models which build upon the IV models of equations 3 and 4 above:

$$Y_{kt} = \beta_1 EO'_{ft} + \beta_2 MOP_{kt} + \beta_3 MOP_{kt}*EO'_{ft} + \beta_4 X_{kt} + \theta_k + u_{kt} \quad (7)$$

where

$$EO_{ft}' = \beta_5 State_t + \beta_6 Industry_{kt} + \beta_7 EO_{f\,t=2008} + \beta_8 EO_{f\,t=2009} + \beta_9 X_{kt} + \theta_k + v_{kt}$$

$$MOP_{kt}*EO'_{ft} = \beta_{10}\,State_t + \beta_{11}\,Industry_{kt} + \beta_{12}\,MOP_{kt}*EO_{f\,t=2008} + \beta_{13}\,MOP_{kt}*EO_{f\,t=2009} + \beta_{14}X_{kt} + \theta_k + e_{kt}$$

and

$$Y_{kt} = \beta_1 EO'_{ft} + \beta_2\,BGS_{kt} + \beta_3\,BIS_{kt} + \beta_4\,BGS_{kt}*EO'_{ft} + \beta_5\,BIS_{kt}*EO'_{ft} + \beta_6 X_{kt} + \theta_k + u_{kt} \quad (8)$$

where

$$EO_{ft}' = \beta_7\,State_t + \beta_8\,Industry_{kt} + \beta_9\,EO_{f\,t=2008} + \beta_{10}\,EO_{f\,t=2009} + \beta_{11}X_{kt} + \theta_k + v_{kt}$$

$$BGS_{kt}*EO'_{ft} = \beta_{12}\,State_t + \beta_{13}\,Industry_{kt} + \beta_{14}\,BGS_{kt}*EO_{f\,t=2008} + \beta_{15}\,BGS_{kt}*EO_{f\,t=2009} + \beta_{16}X_{kt} + \theta_k + e_{kt}$$

$$BIS_{kt}*EO'_{ft} = \beta_{17}State_t + \beta_{18}\,Industry_{kt} + \beta_{19}\,BIS_{kt}*EO_{f\,t=2008} + \beta_{20}\,BIS_{kt}*EO_{f\,t=2009} + \beta_{21}X_{kt} + \theta_k + o_{kt}$$

Productivity Growth Model Using the First Difference of the MOPS structured management index

In our fourth approach, we turn to productivity change as the outcome variables, using OLS estimation on the following two first differenced equations with ESOP and human resources baseline and interactive effects. The first equation utilizes as the human resources variable the first difference of the MOPS structured management index:

$$\Delta Y_{kt} = \beta_0 + \beta_1\,\Delta MOP_{k,\,t} + \beta_2\,Adopt\;EO_{ft} + \beta_3\,Drop\;EO_{ft} + \beta_4\,Maintain\;EO_{ft}$$

$$+ \beta_5\,ESOP\;Adopt_{ft} * \Delta\,MOP_{kt} + \beta_6\,ESOP\;Drop_{ft} * \Delta\,MOP_{kt} + \beta_7\,ESOP\;Maintain_{ft} * \Delta\,MOP_{kt}$$

$$+ \beta_8\,Adopt\;Union_{kt} + \beta_9\,Drop\;Union_{kt} + \beta_{10}\,Maintain\;Union_{kt} + \beta_{11}X_{kt} + \varepsilon_{kt} \quad (9)$$

where

ΔY_{kt} = the first difference of the natural logarithm of the level of establishment labor productivity (using both the calculated and estimated versions described above) in establishment k in year 2015 minus in year 2010 from the ASM. Establishment labor productivity is also winsorized at 1st and 99th percentiles to reduce influence of extreme values.

Adopt EO_{ft} = adoption of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 0 in 2010 and dummy for ESOP = 1 in 2015.

Drop EO_{ft} = repeal of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 1 in 2010 and dummy for ESOP = 0 in 2015.

Maintain EO_{ft} = maintenance of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 1 in 2010 and dummy for ESOP = 1 in 2015. Omitted variable in this group is Never EO_{ft}.[7]

Adopt $Union_{kt}$ = adoption of any union membership at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 0 in 2010 and "any union mem" = 1 in 2015.

Drop $Union_{kt}$ = switching from any union membership to no union membership at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 1 in 2010 and "any union mem" = 0 in 2015.

Maintain $Union_{kt}$ = maintenance of at least one union member at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 1 in 2010 and "any union mem" = 1 in 2015. Omitted variable in this group is Never $Union_{kt}$.

$\Delta MOP_{k,\,t}$= = the first difference of the management organizational practice from MOPS survey index at establishment k in the year 2015 minus in year 2010. This is the first difference of Bloom et. al. (2019)'s MOPS "structured management index". The MOPS index is based on the first 16 questions in the 2010 and 2015 MOPS survey, monotonized on a zero to one scale from least to most structured or active management practices. The index sums across all these 16 monotonized survey questions and divides by the total to create an unweighted score across the 16 survey questions. We also interact each of Adopt EO_{ft}, Drop EO_{ft}, and Maintain EO_{ft} variables with $\Delta MOP_{k,\,t.}$

X_{kt} = vector of establishment controls for establishment k in year t, including the first difference of the natural logarithm of the level of capital stock, the first difference of the natural logarithm of the total establishment cost of materials, as well as industry-specific dummies to control for changes in industry level employment trends, an indicator for the state in which an establishment resides, and the natural logarithm of the 2010 level of total establishment employment.

Our second first differenced equation with productivity change as outcome variable utilizes as the human resources variables the first difference of the broad based group performance pay and first difference of the broad based information sharing indicators. The model is as follows:

$$\Delta Y_{kt} = \beta_0 + \beta_1 \text{ Adopt } EO_{ft} + \beta_2 \text{ Drop } EO_{ft} + \beta_{43} \text{Maintain } EO_{ft} + \beta_4 \text{ Adopt } BGS_{k,\,t}$$

$$+ \beta_5 \text{ Drop } BGS_{k,\,t} + \beta_6 \text{ Maintain } BGS_{k,\,t} + \beta_7 \text{Adopt } BIS_{k,\,t} + \beta_8 \text{ Drop } BIS_{k,\,t} + \beta_9 \text{ Maintain } BIS_{k,\,t}$$

$$+ \beta_{10} \text{ ESOP Adopt}_{ft} * \Delta BGS_{k,\,t} + \beta_{11} \text{ ESOP Drop}_{ft} * \Delta BGS_{k,\,t} + \beta_{12} \text{ ESOP Maintain}_{ft} * \Delta BGS_{k,\,t}$$

[7] We do not use the framework of ESOP adopt, ESOP drop, and ESOP maintain in equations 1 through 8 as those have as the outcome variable the level of the natural logarithm of labor productivity in 2010 and 2015 rather than the first differenced variables as outcomes in equations 9 and 10: the first difference of the natural logarithm of the levels of calculated and estimated labor productivity in 2015 minus in 2010.

$$+ \beta_{13}\,\text{ESOP Adopt}_{ft} * \Delta\text{BIS}_{k,t} + \beta_{14}\,\text{ESOP Drop}_{ft} * \Delta\text{BIS}_{k,t} + \beta_{15}\,\text{ESOP Maintain}_{ft} * \Delta\text{BIS}_{k,t}$$

$$+ \beta_{16}\,\text{ESOP Adopt}_{ft} * \text{Maintain BGS}_{k,t} + \beta_{17}\,\text{ESOP Drop}_{ft} * \text{Maintain BGS}_{k,t}$$

$$+ \beta_{18}\,\text{ESOP Maintain}_{ft} * \text{Maintain BGS}_{k,t} + \beta_{19}\,\text{ESOP Adopt}_{ft} * \text{Maintain BIS}_{k,t}$$

$$+ \beta_{20}\,\text{ESOP Drop}_{ft} * \text{Maintain BIS}_{k,t} + \beta_{21}\,\text{ESOP Maintain}_{ft} * \text{Maintain BIS}_{k,t}$$

$$+ \beta_{22}\,\text{Adopt Union}_{kt} + \beta_{23}\,\text{Drop Union}_{kt} + \beta_{24}\,\text{Maintain Union}_{kt} + \beta_{25}X_{kt} + \varepsilon_{kt} \qquad (10)$$

where

ΔY_{kt} = the first difference of the natural logarithm of the level of establishment labor productivity (using both the calculated and estimated versions described above) in establishment k in year 2015 minus in year 2010 from the ASM. Establishment labor productivity is also winsorized at 1st and 99th percentiles to reduce influence of extreme values.

Adopt EO_{ft} = adoption of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 0 in 2010 and dummy for ESOP = 1 in 2015.

Drop EO_{ft} = repeal of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 1 in 2010 and dummy for ESOP = 0 in 2015.

Maintain EO_{ft} = maintenance of employee share ownership at firm f from 2010 to 2015 measured as i) dummy for ESOP = 1 in 2010 and dummy for ESOP = 1 in 2015. Omitted variable in this group is Never $EO_{ft.}$

Adopt BGS_{kt} = adoption of broad based group performance pay at establishment k from 2010 to 2015 measured as i) dummy for BGS_{kt} = 0 in 2010 and dummy for BGS_{kt} = 1 in 2015.

Drop BGS_{kt} = repeal of broad based group performance pay at establishment k from 2010 to 2015 measured as i) dummy for BGS_{kt} = 1 in 2010 and dummy for BGS_{kt} = 0 in 2015.

Maintain BGS_{kt} = maintenance of broad based group performance pay at establishment k from 2010 to 2015 measured as i) dummy for BGS_{kt} = 1 in 2010 and dummy for BGS_{kt} = 1 in 2015. Omitted variable in this group is Never $BGS_{kt.}$ We also interact each of Adopt EO_{ft}, Drop EO_{ft}, and Maintain EO_{ft} variables with Maintain BGS_{kt}. These interaction terms allow for the estimation of different effects on establishment labor productivity growth of ESOP adoption, ESOP repeal, and ESOP maintenance in workplaces that maintained broad-based group performance pay over 2010 to 2015.

Adopt BIS_{kt} = adoption of broad based information sharing at establishment k from 2010 to 2015 measured as i) dummy for BIS_{kt} = 0 in 2010 and dummy for BIS_{kt} = 1 in 2015.

Drop BIS_{kt} = repeal of broad based information sharing at establishment k from 2010 to 2015 measured as i) dummy for BIS_{kt} = 1 in 2010 and dummy for BIS_{kt} = 0 in 2015.

Maintain BIS_{kt} = maintenance of broad based information sharing at establishment k from 2010 to 2015 measured as i) dummy for BIS_{kt} = 1 in 2010 and dummy for

BIS_{kt} = 1 in 2015. Omitted variable in this group is Never $BIS_{kt.}$ We also interact each of Adopt EO_{ft}, Drop EO_{ft}, and Maintain EO_{ft} variables with Maintain BIS_{kt}. These interaction terms allow for the estimation of different effects on establishment labor productivity growth of ESOP adoption, ESOP repeal, and ESOP maintenance in workplaces that maintained broad-based information sharing over 2010 to 2015.

Adopt $Union_{kt}$ = adoption of any union membership at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 0 in 2010 and "any union mem" = 1 in 2015.

Drop $Union_{kt}$ = switching from any union membership to no union membership at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 1 in 2010 and "any union mem" = 0 in 2015.

Maintain $Union_{kt}$ = maintenance of at least one union member at establishment k from 2010 to 2015 measured as i) dummy for at least one union member at an establishment "any union mem"= 1 in 2010 and "any union mem" = 1 in 2015. Omitted variable in this group is Never $Union_{kt}$.

$\Delta BGS_{k,\,t}$ = the first difference of broad based group performance pay indicator in establishment k in year 2015 minus in year 2010. We also interact each of Adopt EO_{ft}, Drop EO_{ft}, and Maintain EO_{ft} variables with $\Delta BGS_{k,\,t}$. These interaction terms entail the assumption that the effects of the interactions are symmetric (i.e. that the effect of Drop EO_{ft} * Drop BGS_{kt} is opposite but of like magnitude to the effect of Drop EO_{ft} * Adopt BGS_{kt}). Including all permutations of adopt, drop, and maintain indicators of both ESOP and broad-based group performance pay leads to a total number of indicator variables that is large given the size of our data sample, so the above simplifying assumption is adopted to economize on total variables within the model needed to estimate all the baseline and interactive effects.

$\Delta BIS_{k,\,t}$ = the first difference of broad-based information sharing indicator in establishment k in year 2015 minus in year 2010. We also interact each of Adopt EO_{ft}, Drop EO_{ft}, and Maintain EO_{ft} variables with $\Delta BIS_{k,\,t}$. These interaction terms entail the assumption that the effects of the interactions are symmetric (i.e. that the effect of Drop EO_{ft} * Drop BIS_{kt} is opposite but of like magnitude to the effect of Drop EO_{ft} * Adopt BIS_{kt}). Including all permutations of adopt, drop, and maintain indicators of both ESOP and broad-based information sharing leads to a total number of indicator variables that is large given the size of our data sample, so the above reasonable simplifying assumption is adopted to economize on total variables within the model needed to estimate all the baseline and interactive effects.

X_{kt} = vector of establishment controls for establishment k in year t, including the first difference of the natural logarithm of the level of capital stock, the first difference of the natural logarithm of total establishment cost of materials, as well as industry-specific dummies to control for changes in industry level employment trends, an indicator for the state in which an establishment resides and the natural logarithm of the 2010 level of total establishment employment.

EMPIRICAL RESULTS

Baseline Labor Productivity Model

Table 2 reports the fixed effect regressions of establishment labor productivity on the ESOP presence indicator and the MOPS structured management index with the full set of controls (columns 1-2), i.e., equation 1, and the fixed effects regressions of labor productivity on the ESOP presence indicator and the broad-based group performance pay indicator and broad-based information sharing indicator with the full set of controls (columns 3-4), i.e. equation 2. The inclusion of establishment fixed effects means that the estimated coefficients represent the change in labor productivity over 2010 to 2015 associated with changes in ESOP status, the MOPS structured management index, and broad-based group performance pay or broad-based information sharing. For each model, we present the findings for the two alternative labor productivity measures, namely, LP Calc (the measure of labor productivity calculated as the natural logarithm of total value of shipments divided by the average total production worker hours by establishment, and LP Est (the measure of labor productivity estimated by Census researchers using state-of-the-art accounting for depreciation available to researchers at the FSRDC).

Table 2, row 1 column 1 shows that adopting an ESOP is associated with a 0.065 log point increase, translating[8] to a 6.72% increase, in labor productivity (LP calc), when controlling for the broad spectrum of managerial practices contained within the MOPS structured management index. In row 1 column 2 we see that similar increases in the estimated labor productivity measure (LP est) occur, with adopting an employee stock ownership plan associated with a 0.055 log point increase, translating to a 5.65% increase. In row 2 column 2, we see that an increase from 0 to 1 in the MOPS structured management index is associated with a 0.077 log point increase, translating to an 8.00% increase in estimated labor productivity.

Table 2, row 1, column 3 shows that adopting an ESOP is associated with a 0.066 log point increase, translating to a 6.82% increase in labor productivity (LP calc) when controlling for the presence of the high engagement managerial practices of broad-based group performance pay and broad-based information sharing within an establishment. In row 1 column 4, we find again that adopting an ESOP is associated with a 0.055 log point increase in estimated labor productivity, controlling for broad-based group performance pay and broad-based information sharing rather than the MOPS structured management index.

In row 3 of column 3 and 4, we find that adopting broad-based group performance pay increases labor productivity (i.e. LP calc and LP est, respectively) by 0.025 and 0.020 logpoints, an increase of 2.52% and 2.02%, controlling for the presence of an ESOP and broad-based information sharing. In row 4 of column 4, we see that adopting broad-based information sharing within an establishment is associated with an increase in estimated labor productivity of 0.024 logpoints, translating to an increase of 2.43%, controlling for the adoption of an ESOP and broad-based group performance pay.

[8] We employ the following formula to translate the 0.065 log point increase to a percentage increase: $e^{0.065} - 1 = 6.72\ \%$

Instrumental Variables Robustness Results for Baseline Labor Productivity Model

As a robustness check we estimate a two-stage least squares fixed effect instrumental variables regression of estimated labor productivity (LP Calc) on the continuous variable ESOP assets per active employee (in $100,000), instrumenting for the potentially endogenous variable ESOP assets per active employee in the current year (2010 and 2015) with state and industry indicators and the pre-analysis 2009 ESOP assets per active employee (IV1 model) and additionally the pre-analysis 2008 ESOP assets per active employee (IV2 model).

Table 3 depicts the estimates from this regression with the MOPS structured management index control (i.e. specification 3), and alternately with the Broad-based Group Performance Pay and Broad-based Information Sharing controls (i.e. specification 4). IV1 results are presented in columns 1 and 3 of Table 3, and IV2 results are presented in columns 2 and 4 of Table 3.

In Table 3, we see in column 1 of row 1 that a $100,000 increase in ESOP assets per active employee is associated with a 0.229 log point (i.e. 25.73%) increase in labor productivity when using IV1 and controlling for the MOPS structured management index. We see that in column 2 or row 1, using IV2, a $100,000 increase in ESOP assets per active employee is associated with a 0.235 log point (i.e. 26.49%) increase in labor productivity, controlling for the MOPS structured management index. In columns 3 and 4 of row 1, using IV1 and IV2 respectively and controlling for the presence of broad-based group performance pay and broad-based information sharing within an establishment, we find that a $100,000 increase in ESOP assets per active employee is associated with 0.235 log point (i.e. 26.49%) and 0.242 log point (i.e. 27.38%) increase in labor productivity. In all specifications of columns 1-4, the estimated coefficients on the MOPS index, the Broad-based Group Performance Pay indicator, and the Broad-Based Information Sharing Indicator are not statistically significant.

Interactive Results

Table 4 shows our estimates of the impact on calculated (i.e. column 1) and estimated (i.e. column 2) labor productivity of ESOP presence, the MOPS structured management index, and their interaction using specification 5. We find in rows 1 and 2 of column 2 of Table 4 that the base coefficient on ESOP presence is 0.16 logpoints (i.e. 17.35%) and statistically significant, and the coefficient on the MOPS index is 0.079 (i.e. 8.22%) and statistically significant, though their interaction is statistically insignificant.

In our post-estimation analysis, we investigate the total effect of ESOP adoption across the distribution of the MOPS index, as seen in rows 6 through 9 of column 2. We find positive and statistically significant total effects of ESOP presence at the 25th, median, 75th, and 90th percentiles of the MOPS structured management index. The magnitude of the effect ranges from 0.09 logpoints (i.e. 9.42%) at the 25th percentile of the MOPS index to 0.058 logpoints (i.e. 5.97%) at the 90th percentile of the MOPS index. In rows 10 through 12 of column 2 of Table 4, we find no statistically significant gaps between the total effect of ESOP presence from the median to the 25th percentile of the MOPS index, from the 75th to the 25th percentile of the

MOPS index, or from the 90th to the 25th percentile of the MOPS index, indicating no statistically significant change in the total effect as the MOPS index grows in value. In other words, though the magnitude of the total effect diminishes, while remaining statistically significant over the distribution of the MOPS index, the drop is too small to create a statistically significant gap across the distribution of the MOPS index.

While in rows 1 through 3 of column 1 of Table 4 we find no statistically significant impact of ESOP presence, the MOPS structured management index, or their interaction, we find a statistically significant positive total effect in our post-estimation analysis, in row 5 of column 1, of ESOP presence on calculated labor productivity of 0.064 logpoints, translating to an increase of 6.61%. We also find, in our post-estimation analysis in rows 6 through 9 of column 1, positive and statistically significant total effects of ESOP presence at the 25th, median, 75th, and 90th percentiles of the MOPS structured management index. The magnitude of the effect ranges from 0.079 logpoints (i.e. 8.22%) at the 25th percentile of the MOPS index to 0.07 lopoints (i.e. 7.25%) at the 90th percentile of the MOPS index. As in column 2, in rows 10 through 12 of column 1, we find no statistically significant gaps between the total effect of ESOP presence from the median to the 25th percentile of the MOPS index, from the 75th to the 25th percentile of the MOPS index, or from the 90th to the 25th percentile of the MOPS index, indicating no statistically significant change in the total effect of ESOP presence as the MOPS index grows in value.

Table 5 contains our estimates of the impact on calculated (i.e. column 1) and estimated (i.e. column 2) labor productivity of ESOP presence, broad-based group performance pay and broad-based information sharing presence, and the interaction of the former with each of the latter using specification 6. Specification 6, our full interactive model, includes: an indicator variable for ESOP presence, an indicator variable for presence of broad-based group performance pay, an indicator variable for broad-based information sharing presence, an indicator variable for the interaction of ESOP presence and broad-based group performance pay presence, and an indicator variable for the interaction of ESOP presence and broad-based information sharing presence.

We find in row 1 of column 1 of Table 5 that ESOP presence is associated with a 0.082 logpoint (i.e. 8.55%) increase in calculated labor productivity, and in row 2 of column 1 that broad-based group performance pay presence is associated with a 0.031 logpoint (i.e. 3.15%) increase in calculated labor productivity. However, we find some evidence of a negative 0.037 logpoint interactive effect of ESOP presence and broad-based group performance pay presence at the 5% level of statistical significance in row 4 of column 1. We find no statistically significant impact on calculated labor productivity of the presence of broad-based information sharing as a baseline effect in row 3, or as an interactive effect with ESOP presence in row 5, of column 1.

We find somewhat different results for estimated labor productivity in column 2 of Table 5. We find that ESOP presence, in row 1 of column 2, is associated with a statistically significant 0.061 logpoint (i.e. 6.29%) increase in estimated labor productivity and broad-based group performance pay presence, while in row 2 of column 2 ESOP presence is associated with a 0.026 logpoint (i.e. 2.63%) statistically significant increase in estimated labor productivity. We also find, in row 3 of column 2, that broad-based information sharing presence is associated with a 0.023 logpoint (i.e. 2.33%) increase in estimated labor productivity. We find no statistically

significant interactive effects on estimated labor productivity of ESOP presence with broad-based group performance pay or broad-based information sharing presence in rows 4 and 5 of column 2, contrary to the negative statistically significant interactive effect between ESOP presence and broad-based group performance pay for calculated labor productivity in row 4 of column 1.

As mentioned in the methodology section above, our measure of calculated labor productivity is only available in nominal dollars while our measure of estimated labor productivity is in real base 1997 U.S. dollars. Since only the latter measure accounts for inflation, the finding of a negative statistically significant interactive effect for calculated labor productivity in column 1 of Table 5 is less compelling than the finding of no statistically significant interactive effects when using estimated labor productivity in column 2 of Table 5. We find no evidence of statistically significant total effects in our post-estimation linear combination results when combining the coefficient on ESOP presence with the interaction effects of ESOP presence and broad-based group performance pay and broad-based information sharing in row 7 of columns 1 and 2 of Table 5. We similarly find no statistically significant total effects of post-estimation lincom results combining the coefficient on broad-based group performance pay with the interaction of ESOP presence and broad-based group performance pay in row 8, or combining the coefficient on broad-based information sharing with the interaction of ESOP presence and broad-based information sharing in row 9, of columns 1 and 2 of Table 5.

Table 6 provides our estimates of the impact of an increase of $100,000 in ESOP assets per active employee, an increase from 0 to 1 in the MOPS structured management index, and their interaction, on labor productivity using specification 7 using IV1 (i.e. column 1) and IV2 (i.e. column 2) to instrument for ESOP assets per active employee.

We find in row 1 of column 1 of Table 6 that an increase of $100,000 in ESOP assets per active employee is associated with a statistically significant 0.252 logpoint (i.e. 28.66%) increase in labor productivity, controlling for the MOPS structured management index and its interaction with ESOP assets per active employee and instrumenting for ESOP assets per active employee using IV1. We find in row 1 of column 2 of Table 6 that an increase of $100,000 in ESOP assets per active employee is associated with a 0.263 logpoint (i.e. 30.08%) increase in labor productivity, controlling for the MOPS structured management index and its interaction with ESOP assets per active employee and instrumenting for ESOP assets using IV2.

In our post-estimation analysis, we investigate the total effect of an increase of $100,000 in ESOP assets per active employee both overall (i.e. row 5) and across the distribution of the MOPS index (i.e. rows 6 through 9). We find positive and statistically significant overall total effects of a $100,000 increase in ESOP assets per active employee using the method of IV1 in row 5 of column 1 of 0.205 logpoints (i.e. 22.75%) and using the method of IV2 in row 5 of column 2 of 0.232 logpoints (i.e. 26.11%). We also find positive and statistically significant impacts of an increase of $100,000 in ESOP assets per active employee at the 25th, median, 75th, and 90th percentiles of the MOPS structured management index. The magnitude of the effect ranges from 0.226 logpoints (i.e. 25.36%) at the 25th percentile of the MOPS index to 0.214 logpoints (i.e. 23.86%) at the 90th percentile of the MOPS index when using the method of IV1 in column 1 rows 6 through 9, and the magnitude of the effect ranges from 0.246 logpoints (i.e.

27.89%) at the 25th percentile of the MOPS index to 0.238 logpoints (i.e. 26.87%) at the median of the MOPS index in column 2 rows 6 through 9 of Table 6.

In rows 10 through 12 of columns 1 and 2 of Table 6, we find no statistically significant gaps between the total effect of a $100,000 increase in ESOP assets per active employee from the median to the 25th percentile of the MOPS index, from the 75th to the 25th percentile of the MOPS index, or from the 90th to the 25th percentile of the MOPS index, indicating no statistically significant change in the total effect as the MOPS index grows in value. In the regressions using specification 7 in columns 1 (i.e. IV1) and 2 (i.e. IV2) in Table 6, we find no statistically significant impact of increasing the MOPS structured management index on labor productivity, controlling for an increase of $100,000 in ESOP assets per active employee and for the interaction of ESOP assets per active employee and the MOPS structured management index. We also find no statistically significant interactive effects when using specification 7 with the method of IV1 and IV2 in row 3 of columns 1 and 2 of Table 6.

Table 7 shows our estimates of the impact of an increase of $100,000 in ESOP assets per active employee, the presence of broad-based group performance pay and broad-based information sharing, and the interaction of an increase of $100,000 in ESOP assets per active employee and broad-based group performance pay and broad-based information sharing, on labor productivity using specification 8 and the methods of IV1 (i.e. column 1) and IV2 (i.e. column 2) to instrument for ESOP assets per active employee.

We find in row 1 of column 1 of Table 7 that, using the method of IV1 to instrument for ESOP assets per active employee, an increase of $100,000 in ESOP assets per active employee is associated with statistically significant a 0.160 logpoint (i.e. 17.35%) increase in labor productivity, controlling for the presence of broad-based group performance pay and broad-based information sharing and the interaction of these variables with ESOP assets per active employee. We find in row 1 of column 2 of Table 7 that, using the method of IV2 to instrument for ESOP assets per active employee, an increase of $100,000 in ESOP assets per active employee is associated with statistically significant a 0.167 logpoint (i.e. 18.18%) increase in labor productivity, controlling for the presence of broad-based group performance pay and broad-based information sharing and the interaction of these variables with ESOP assets per active employee.

Consistent with the baseline effects of the ESOP assets per active employee variable, we find evidence of statistically significant positive total effects on labor productivity in our post-estimation lincom results when combining the coefficient on ESOP assets per active employee with the interaction effects of ESOP assets per active employee and indicators for presence of broad-based group performance pay and broad-based information sharing in row 7 of columns 1 (i.e. using IV1) and 2 (i.e. using IV2) of Table 7. Specifically, we find a positive statistically significant total effect of a $100,000 increase in ESOP assets per active employee of 0.142 logpoints using IV1 (i.e. column 1 row 7), translating to an increase of 15.26%, and of 0.139 logpoints using IV2 (i.e. column 2 row 7), translating to an increase of 14.91% in labor productivity.

We similarly find no statistically significant effects of the presence of broad-based group performance pay or broad-based information sharing, or the interaction of these variables with an increase of $100,000 in ESOP assets per active employee, whether using IV1 or IV2 (i.e. rows 2 through 5 of columns 1 and 2 of Table 7). Similarly, we find no statistically significant total effects of post-estimation lincom results combining the coefficient on broad-based group performance pay with the interaction of ESOP assets per active employee and broad-based group performance pay in row 8, or combining the coefficient on broad-based information sharing with the interaction of ESOP assets per active employee and broad-based information sharing in row 9, of columns 1 and 2 of Table 7.

For comparison, we provide the non-instrumental variables fixed effects regression results for our model with the continuous ESOP assets per active employee variable, the MOPS index, and the interaction of the MOPS index with ESOP assets per active employee in Table 10, which are analogous to the IV results for the MOPS index model in Tables 3 and 6. We also provide the non-instrumental variables fixed effects regression results for our model with the continuous ESOP assets per active employee variable, the broad based group performance pay and broad based information sharing indicator variables, and the interaction of these with the ESOP assets per active employee variable in Table 11, which are analogous to the IV results for the broad-based group performance pay and broad based information sharing model in Tables 3 and 7. In all cases, our non-instrumental variables regressions do not show any statistically significant impacts of the ESOP assets per active employee main effect. Nevertheless, given the strong potential for endogeneity of labor productivity with increases in ESOP assets per active employee (i.e. a rise in stock value caused by increases in productivity could bring about growth in ESOP assets per active employee, rather than the converse scenario), we prefer the instrumental variables model which we have highlighted in the results above.

Productivity Change Results

Table 8 summarizes our main findings from the OLS regression of establishment labor productivity growth on the first difference of the MOPS structured management index and whether the establishment adopted, dropped, or maintained ESOP status (i.e. specification 9). We find that using either underlying measure of labor productivity in row 2 of columns 1 and 2 of Table 8, ESOP adoption is associated with a positive and statistically significant increase of 0.091 logpoints (i.e. 9.53%) for calculated labor productivity growth and 0.094 logpoints (i.e. 9.86%) for estimated labor productivity growth, controlling for the first difference of the MOPS structured management index and its interaction with ESOP adoption, repeal, and maintenance.

We do not find statistically significant total effects, in our post-estimation analysis, of combining the regression coefficients of ESOP adoption and ESOP adoption interacted with the first difference of the MOPS index, ESOP repeal and its interaction with the first difference of the MOPS index, or ESOP maintenance and its interaction with the first difference of the MOPS index in rows 9 through 11 of columns 1 and 2 of Table 8.

Table 9 presents our findings from the OLS regression of establishment labor productivity growth (columns 1 and 2) on whether the establishment adopted, dropped, or

maintained broad-based group performance pay and/or broad-based information sharing, as well as whether an establishment adopted, dropped, or maintained ESOP status (i.e. specification 10).

We find in row 1 of column 1 of Table 9 that adopting broad-based group performance pay within an establishment over 2010 to 2015 has a statistically significant positive impact on the first difference of the natural logarithm of calculated establishment labor productivity of 0.047 log points (i.e. 4.81%). Furthermore, we find, in row 2 of column 1, that dropping broad-based group performance pay over these same years is associated with a parallel statistically significant 0.033 log points (i.e. 3.36%) decline in the first difference of the natural log of calculated labor productivity. We find no statistically significant main effects on the first difference of calculated labor productivity associated with maintaining broad-based group performance pay (row 3, column 1), with adopting, repealing, or maintaining broad-based information sharing (rows 4 through 6, column 1), or with adopting, repealing, or maintaining ESOP status (rows 7 through 9, column 1).

However, we do find in row 13 of column 1 a large statistically significant 0.118 log point (i.e. 12.52%) increase in the first difference of the natural log of calculated establishment labor productivity associated with the interaction of adopting an ESOP and changing broad-based information sharing status within an establishment over 2010 to 2015. We also find, in row 17 of column 1, a 0.117 log point (i.e. 12.41%) increase in the first difference of log calculated labor productivity associated with the interaction of maintaining broad-based group performance pay while dropping an ESOP. This result is analogous to our finding of a negative interaction between ESOP presence and broad-based group performance pay using specification 6 (i.e. in row 4 of column 1 of Table 5, only with "LP calc" as the outcome variable). It suggests that, at least in the case of the outcome of "LP calc" and broad-based group performance pay, workplaces with less high engagement managerial practices benefit the most from ESOPs in labor productivity, and vice versa (i.e. workplaces already maintaining broad-based group performance pay benefit less from ESOPs in labor productivity).

Nonetheless, we find, in the post-estimation analysis in row 22 of column 1 of Table 9, a large statistically significant positive total effect of ESOP adoption on the first difference of the natural log of calculated establishment labor productivity of 0.264 log points (i.e. 30.21%) over 2010 to 2015. In other words, ESOP adoption is associated with statistically significant growth in calculated labor productivity, when accounting for the total effect across the regression coefficient on the ESOP adoption indicator main effect and the regression coefficient on the interaction of the ESOP adoption indicator and the indicators for changing and maintaining high engagement managerial practices over 2010 to 2015.

Furthermore, we find, in row 4 of column 2 of Table 9, that maintaining broad-based group performance pay is associated with a statistically significant 0.05 log point (i.e. 5.13%) increase in the first difference of the natural log of estimated establishment labor productivity in 2015 minus in 2010. We find no other statistically significant main effects of changing or maintaining high engagement managerial practices or ESOP status on estimated labor productivity growth in column 3 of Table 9.

We find a large statistically significant positive interactive effect, in row 16 of column 2, of adopting an ESOP while also maintaining broad-based group performance pay within an establishment over 2010 to 2015. Specifically, we find that adopting an ESOP while simultaneously maintaining broad-based group performance pay over 2010 to 2015 is associated with statistically significant growth of 0.122 log points (i.e. 12.93%) in estimated establishment labor productivity, an average increase of 2.6% per year. This result suggests that, at least in the case of the outcome of the first difference of estimated labor productivity, workplaces with the high engagement managerial practice of broad-based group performance pay experience an accentuation of the positive effect of maintaining this workplace practice on labor productivity growth when they simultaneously adopt an ESOP.

We find no other statistically significant regression coefficients on main or interactive effects or post-estimation total effects in the analysis of estimated labor productivity growth in column 2 of Table 9.

CONCLUSION

We have introduced a new data source to the Employee Ownership research landscape which links workplace-level micro-data on labor productivity, management and organizational practices, and ESOPs, consisting of the first representative data on ESOP labor productivity covering both closely-held and publicly-traded companies.

We show, among other results, that there is a positive association between ESOP status and labor productivity in the U.S. manufacturing industry, controlling for management and organizational practices. Adopting an ESOP is associated with a 5.6 to 6.7 % increase in labor productivity over 2010 to 2015, controlling for management and organizational practices. A $100,000 increase in ESOP assets per active employee is associated with a 25.7 to 26.5 % increase over 2010 to 2015, which represents an increase of between 5.1-5.3% per year. The greatest ESOP labor productivity effects are at workplaces with less structured management practices (lower percentiles of the MOPS management index); the ESOP labor productivity effect stays positive but gets smaller in magnitude as we move along the management index distribution. By contrast, when we instead investigate the interaction of ESOP adoption and broad-based group performance pay, in our regression of estimated labor productivity growth (i.e. specification 10), we find a large statistically significant positive synergistic effect. Specifically, we find that adopting an ESOP while simultaneously maintaining broad-based group performance pay over 2010 to 2015 is associated with statistically significant growth in estimated labor productivity of 12.93%, an average increase of 2.6% per year.

Our findings add to the literature showing that, contrary to the prediction of the economic theory of compensating differentials which argues that employees will sacrifice pay or benefits in exchange for employee share ownership, workers instead appear to respond in a way consistent with ideas of reciprocity and the economic model of “gift exchange” developed by Akerlof (1982). Workers may respond to a “gift” of employee share ownership on top of market compensation with a reciprocal “gift” of high effort, cooperation, and work standards. The collective incentive nature of employee ownership can produce an effective “gift” for creating and reinforcing a sense of common purpose and encouraging higher commitment and

productivity. The consistent finding that employee ownership supplements other pay and wealth suggests it as a compelling means for increasing worker incomes and wealth in general, which may help to reduce inequality.

Our findings illustrate that structured and high-engagement management practices, such as broad-based group performance pay and broad-based information sharing, can improve firm performance through fostering worker engagement and boosting establishment productivity.

At a broader level, our results point to positive externalities of employee ownership on workers and companies, suggesting that there is justification for widespread government support to broaden the prevalence of employee ownership in our society.

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APPENDIX 1:

Summary Statistics and Regression Results Tables

Table 1 --- Summary Statistics for the Full Sample, Manufacturing Establishments, in MOPS-ASM-BLS Form 5500 matched data set for 2010 and 2015

Variables	Definition	Categories	Sum	Mean	S.D.	N
Labor productivity	Total value of shipments ($1,000s) in an establishment over the average total production worker hours (1,000s) in an establishment	Continuous		473.7	3,573	59,000
Establishment employment	Total manufacturing establishment employment (1,000s)	Continuous		179.9	387	59,000
MOPS index	Index of establishment structured management practices based on first 16 questions of MOPS 2010 and 2015, in order of more active management	Continuous scale of 0 to 1		0.620	0.204	59,000
Broad-based group performance pay indicator	Indicator variable for whether or not an establishment: 1) provides any bonuses to non-managerial workers for obtaining team/shift, establishment, or firm-level performance goals AND 2) regularly provides over two-thirds of nonmanagerial workers with performance bonuses	0=No, 1=Yes		0.337	0.473	59,000
Broad-based information sharing indicator	Dummy variable for whether or not: 1) non-managerial workers review key performance measures at least once per year AND 2) most production workers are aware of key performance objectives within an establishment	0=No, 1=Yes		0.648	0.478	59,000
Union presence indicator	Dummy variable for whether or not an establishment has at least one union member	0=No, 1=Yes		0.197	0.398	59,000
Expenditures on materials and equipment	Total level of establishment expenditures on materials and equipment ($1,000s)	Continuous		64,210	368,100	59,000
Capital stock in structures	Total estimated level of establishment capital stock on structures and buildings ($1,000s)	Continuous		21,180	101,200	58,500
Capital stock in equipment	Total estimated level of capital stock on equipment ($1,000s)	Continuous		11,430	65,150	58,500
Total manufacturing firms	Total manufacturing firms	Continuous	22,500			
Total ESOP manufacturing firms	Total ESOP manufacturing firms	Continuous	1,000			
Total manufacturing establishments	Total manufacturing establishments	Continuous	44,000			
Total ESOP manufacturing estabs.	Total ESOP manufacturing establishments	Continuous	6,200			
ESOP adopt firms	Total ESOP adopting manufacturing firms	Continuous	60			
ESOP adopt establishments	Total ESOP adopting manufacturing establishments	Continuous	600			
ESOP drop firms	Total ESOP dropping manufacturing firms	Continuous	70			
ESOP drop establishments	Total ESOP dropping manufacturing establishments	Continuous	450			
ESOP maintain firms	Total ESOP maintaining manufacturing firms	Continuous	450			
ESOP maintain establishments	Total ESOP maintaining manufacturing establishments	Continuous	4,800			
Broad-based group perform. pay firms	Total manufacturing firms w/broad-based group perform. pay	Continuous	7,700			
Broad-based group perform. pay estabs	Total manufacturing estabs. w/broad-based group perform. pay	Continuous	16,000			
Broad-based information sharing firms	Total manufacturing firms w/broad-based inform.-sharing	Continuous	13,000			
Broad-based information sharing estabs	Total manufacturing estabs w/broad-based inform-sharing	Continuous	29,500			

Note: ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; S.D., standard deviation. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-0318) (CBDRB-FY25-P3061-R12676)

Table 2 --- Fixed Effects Regression Estimates of the Impact of ESOP presencethe MOPS Structured Management Index, Broad-based Group Performance Pay, and Broad-based Information Sharing on Labor Productivity

	(1) LP calc	(2) LP est	(3) LP calc	(4) LP est
ESOP Presence Indicator	0.065**	0.055*	0.066**	0.055*
	(0.020)	(0.022)	(0.020)	(0.022)
MOPS index	0.034	0.077***		
	(0.022)	(0.021)		
Broad-based group performance pay indicator			0.025**	0.020*
			(0.008)	(0.008)
Broad-based information sharing indicator			0.013	0.024**
			(0.007)	(0.008)
N	54,500	54,500	54,500	54,500

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 1, which is an establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc and LP est, respectively) with two main effects: (1) an indicator for presence of an employee stock ownership plan (ESOP) and (2) the MOPS structured management index. Each entry in columns 3 and 4 shows output from analysis using the full specification 2, which is an establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc and LP est, respectively) with three main effects: (1) an indicator for presence of an employee stock ownership plan (ESOP), (2) an indicator for presence of broad-based group performance pay, and an indicator for presence of broad-based information sharing. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, and interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for the observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for the observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM); LP est, estimated measure of labor productivity, calculated as part of Census researchers' estimation of total factor productivity and labor productivity using Annual Survey of Manufacturing data. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-0318) (CBDRB-FY25-P3061-R12676)

Table 3 --- Fixed Effects Instrumental Variables Regression Estimates of the Impact of ESOP Assets per Active Employee, the MOPS Structured Management Index, Broad-based Group Performance Pay, and Broad-based Information Sharing on Labor Productivity

	(1) IV1	(2) IV2	(3) IV1	(4) IV2
ESOP assets (in $100,000s) per active employee	0.229* (0.101)	0.235* (0.104)	0.235* (0.100)	0.242* (0.103)
MOPS index	0.012 (0.055)	0.018 (0.059)		
Broad-based group performance pay indicator			-0.036 (0.019)	-0.032 (0.020)
Broad-based information sharing indicator			-0.016 (0.024)	-0.014 (0.025)
N	7,200	6,900	7,200	6,900

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 3, which is an establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity calculated as Total Value of Shipments over Total Production Worker Hours from the ASM (i.e LP calc) with two main effects: (1) an endogenous continuous employee ownership variable of ESOP assets per active employee (in $100,000) in 2010 and 2015, and (2) the MOPS structured management index. Each entry in columns 3 and 4 shows output from analysis using the full specification 4, which is an establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity calculated as Total Value of Shipments over Total Production Worker Hours from the ASM (i.e LP calc) with three main effects: (1) an endogenous continuous employee ownership variable of ESOP assets per active employee (in $100,000) in 2010 and 2015, (2) an indicator variable for the presence of broad-based group performance pay, and (3) an indicator variable for the presence of broad-based information sharing. We employ two stage least squares estimation to instrument for the endogenous variable of ESOP assets per active employee. As a robustness check, we employ two versions of the instrumental variables fixed effects regression which we call IV1 and IV2. IV1 uses ESOP assets per active employee in 2009 and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV1 results are in columns 1 and 3. IV2 uses ESOP assets per active employee in 2008, ESOP assets per active employee in 2009, and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV2 results are in columns 2 and 4. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, and interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for the observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for the observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM). This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676)

Table 4 --- Fixed Effects Regression Estimates of the Impact of ESOP presence, the MOPS Structured Management Index, and their Interaction, on Labor Productivity

	(1) LP calc	(2) LP est
ESOP Presence Indicator	0.098 (0.056)	0.16* (0.064)
MOPS index	0.052 (0.034)	0.079* (0.034)
ESOP Presence x MOPS index	-0.033 (0.072)	-0.12 (0.085)
N	51,500	51,500
Marginal Effects of Interaction Term		
lincom ESOP presence indicator + ESOP presence indicator X Management AER index	0.064* (0.029)	0.035 (0.034)
lincom ESOP presence indicator + ESOP presence indicator X Management AER index at 0.25 of its distribution	0.079** (0.025)	0.090** (0.027)
lincom ESOP presence indicator + ESOP presence indicator X Management AER index at 0.5 of its distribution	0.075*** (0.022)	0.075** (0.023)
lincom ESOP presence indicator + ESOP presence indicator X Management AER index at 0.75 of its distribution	0.072** (0.021)	0.065** (0.023)
lincom ESOP presence indicator + ESOP presence indicator X Management AER index at 0.9 of its distribution	0.070** (0.022)	0.058* (0.025)
lincom(ESOP presence indicator + ESOP presence indicator X Management AER index at 0.5 of its distribution) – (ESOP presence indicator + ESOP presence indicator X Management AER index at 0.25 of its distribution)	-0.004 (0.009)	-0.015 (0.010)
lincom(ESOP presence indicator + ESOP presence indicator X Management AER index at 0.75 of its distribution) – (ESOP presence indicator + ESOP presence indicator X Management AER index at 0.25 of its distribution)	-0.007 (0.015)	-0.025 (0.018)
lincom(ESOP presence indicator + ESOP presence indicator X Management AER index at 0.9 of its distribution) – (ESOP presence indicator + ESOP presence indicator X Management AER index at 0.25 of its distribution)	-0.009 (0.019)	-0.033 (0.023)

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 5, which is a establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc and LP est, respectively) with two main effects and an interaction term: (1) an indicator for presence of an employee stock ownership plan (ESOP), (2) the MOPS structured management index, and (3) the interaction of the ESOP presence indicator and the MOPS structured management index. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, an interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for the observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for the observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM); LP est, estimated measure of labor productivity, calculated as part of Census researchers' estimation of total factor productivity and labor productivity using Annual Survey of Manufacturing data. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676)

Table 5 --- Fixed Effects Regression Estimates of the Impact of ESOP presence, Broad-based Group Performance Pay, and Broad-based Information Sharing, and their Interactions on Labor Productivity

	(1) LP calc	(2) LP est
ESOP Presence Indicator	0.082** (0.027)	0.061* (0.030)
Broad based group performance pay indic.	0.031*** (0.009)	0.026** (0.009)
Broad based information sharing indic.	0.012 (0.008)	0.023** (0.008)
ESOP Presence x Broad based group performance pay	-0.037* (0.019)	-0.033 (0.019)
ESOP Presence X Broad based information sharing	0.001 (0.021)	0.011 (0.025)
N	54,500	54,500
Marginal Effects		
lincom ESOP presence indicator + ESOP presence indicator X Broad based group performance pay presence indicator + ESOP presence indicator X Broad based information sharing presence indicator	0.045 (0.023)	0.038 (0.025)
lincom Broad based group performance pay presence indicator + ESOP presence indicator X Broad based group performance pay presence indicator	-0.006 (0.017)	-0.008 (0.017)
lincom Broad based information sharing presence indicator + ESOP presence indicator X Broad based information sharing presence indicator	0.013 (0.020)	0.034 (0.024)

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 6, which is a establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc and LP est, respectively) with three main effects and two interaction terms: (1) an indicator for presence of an employee stock ownership plan (ESOP), (2) an indicator for presence of broad-based group performance pay, (3) an indicator for presence of broad-based information sharing, (4) an interaction of the ESOP presence indicator and the indicator for presence of broad-based group performance pay, and (5) an interaction of the ESOP presence indicator and the indicator for presence of broad-based information sharing. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, an interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM); LP est, estimated measure of labor productivity, calculated as part of Census researchers' estimation of total factor productivity and labor productivity using Annual Survey of Manufacturing data. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676

Table 6 --- Fixed Effects Instrumental Variables Regression Estimates of the Impact of ESOP Assets per Active Employee, the MOPS Structured Management Index, and their Interaction, on Labor Productivity

	(1) IV1	(2) IV2
ESOP assets (in $100,000s) per active employee	0.252*	0.263*
	(0.113)	(0.116)
MOPS index	0.035	0.024
	(0.144)	(0.16)
ESOP assets per active employee x MOPS index	-0.047	-0.032
	(0.115)	(0.12)
N	7,000	6,700
Marginal Effects of Interaction Term		
lincom ESOP assets per active employee + ESOP assets per active employee X Management AER index	0.205*	0.232*
	(0.089)	(0.092)
lincom ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.25 of its distribution	0.226**	0.246**
	(0.082)	(0.085)
lincom ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.5 of its distribution	0.22**	0.242**
	(0.081)	(0.083)
lincom ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.75 of its distribution	0.216**	0.239**
	(0.081)	(0.084)
lincom ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.9 of its distribution	0.214**	0.238**
	(0.082)	(0.085)
lincom(ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.5 of its distribution) – (ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.25 of its distribution)	-0.006	-0.004
	(0.014)	(0.015)
lincom(ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.75 of its distribution) – (ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.25 of its distribution)	-0.010	-0.007
	(0.024)	(0.025)
lincom(ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.9 of its distribution) – (ESOP assets per active employee + ESOP assets per active employee X Management AER index at 0.25 of its distribution)	-0.013	-0.009
	(0.031)	(0.032)

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 7, which is an instrumental variables establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc) with two main effects and an interaction term: (1) an endogenous continuous employee ownership variable of ESOP assets per active employee (in $100,000) in 2010 and 2015, (2) the MOPS structured management index, and (3) the interaction of these two main effects. We employ two stage least squares estimation to instrument for the endogenous variable of ESOP assets per active employee. As a robustness check, we employ two versions of the instrumental variables fixed effects regression which we call IV1 and IV2. IV1 uses ESOP assets per active employee in 2009 and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV1 results are in column 1. IV2 uses ESOP assets per active employee in 2008, ESOP assets per active employee in 2009, and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV2 results are in column 2. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, and interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for the observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM). This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676)

Table 7 --- Fixed Effects Instrumental Variables Regression Estimates of the Impact of ESOP Assets per Active Employee, Broad-based Group Performance Pay, Broad-based Information Sharing and their Interactions on Labor Productivity

	(1) IV1	(2) IV2
ESOP assets (in $100,000s) per active employee	0.160*	0.167**
	(0.064)	(0.116)
Broad-based group performance pay indic.	-0.021	-0.005
	(0.037)	(0.039)
Broad-based information sharing indic.	-0.002	0.002
	(0.038)	(0.042)
ESOP assets per active employee x Broad based group performance pay indic.	-0.009	-0.018
	(0.028)	(0.029)
ESOP assets per active employee x Broad based information sharing indic.	-0.010	-0.010
	(0.026)	(0.027)
N	7,200	6,900
Marginal Effects		
lincom ESOP assets per active employee + ESOP assets per active employee X Broad based group performance pay presence indicator + ESOP assets per active employee X Broad based information sharing presence indicator	0.142*	0.139*
	(0.059)	(0.058)
lincom Broad based group performance pay presence indicator + ESOP assets per active employee X Broad based group performance pay presence indicator	-0.0207	-0.005
	(0.037)	(0.039)
lincom Broad based information sharing presence indicator + ESOP assets per active employee X Broad based information sharing presence indicator	-0.002	0.002
	(0.038)	(0.042)

Note: Each entry in all columns shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in columns 1 and 2 shows output from analysis using the full specification 8, which is an instrumental variables establishment fixed effects regression in which the dependent variable is the natural logarithm of establishment labor productivity from the ASM (i.e. LP calc) with three main effects and an interaction term: (1) an endogenous continuous employee ownership variable of ESOP assets per active employee (in $100,000) in 2010 and 2015, (2) an indicator for presence of broad-based group performance pay, (3) an indicator for presence of broad-based information sharing, (4) an interaction term of ESOP assets per active employee and the indicator for broad-based group performance pay, and (5) an interaction term of ESOP assets per active employee and the indicator for broad-based information sharing. We employ two stage least squares estimation to instrument for the endogenous variable of ESOP assets per active employee. As a robustness check, we employ two versions of the instrumental variables fixed effects regression which we call IV1 and IV2. IV1 uses ESOP assets per active employee in 2009 and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV1 results are in column 1. IV2 uses ESOP assets per active employee in 2008, ESOP assets per active employee in 2009, and state and industry indicator variables to instrument for ESOP assets per active employee in 2010 and 2015. IV2 results are in column 2. All regressions include controls for the natural logarithm of the winsorized total value of establishment capital stock in structures, the natural logarithm of the winsorized total value of establishment capital stock in equipment, the natural logarithm of the winsorized total value of establishment expenditure on materials, the natural logarithm of the winsorized level of total establishment employment, an indicator variable for the presence of at least one union member within an establishment, an interaction term between an indicator for the presence of at least one union member within an establishment and an indicator variable for observations occurring during the year 2015, an interaction term between an indicator for observations occurring during the year 2015 and three-digit NAICS industry indicator variables, and an interaction term between an indicator for the observations occurring during the year 2015 and an indicator for the U.S. state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports; LP calc, natural logarithm of establishment total value of shipments ($1,000s) over the establishment average total production worker hours (1,000s) from the Annual Survey of Manufacturers (ASM). This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676)

Table 8 --- OLS Regression Estimates of the Impact of ESOP Adoption, ESOP Maintenance, ESOP Removal and the First Difference of the MOPS Structured Management Index, and Interactions on Productivity Change

	(1) First Diff LP calc	(2) First Diff LP est
First Diff of MOPS index	0.042	0.079
	(0.041)	(0.041)
ESOP adopt	0.091*	0.094**
	(0.037)	(0.030)
ESOP drop	-0.076	-0.058
	(0.044)	(0.052)
ESOP maintain	0.004	0.022
	(0.018)	(0.018)
ESOP adopt x First Diff of MOPS index	0.237	0.015
	(0.263)	(0.308)
ESOP drop x First Diff of MOPS index	-0.454	-0.255
	(0.308)	(0.332)
ESOP maintain x First Diff of MOPS index	-0.036	-0.133
	(0.087)	(0.108)
N	24,500	24,500
Marginal Effects		
lincom ESOP adopt indicator + ESOP adopt indicator X First Difference of Management AER index	0.329	0.109
	(0.266)	(0.305)
lincom ESOP drop indicator + ESOP drop indicator X First Difference of Management AER index	-0.530	-0.313
	(0.310)	(0.341)
lincom ESOP maintain indicator + ESOP maintain indicator X First Difference of Management AER index	-0.033	-0.111
	(0.089)	(0.108)

Note: Each entry in the two main columns of the table shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in the three main column of the table shows output from analysis using the full specification 9, which is an OLS regression in which the dependent variable is the first difference of the natural logarithm of establishment labor productivity in 2015 minus in 2010 from the ASM, with the output in column 1 reflecting labor productivity calculated as Total Value of Shipments over Total Production Worker Hours (i.e. LP calc.) and the output in column 2 reflecting the dependent variable of labor productivity as estimated within Annual Survey of Manufacturers (i.e. LP est.). Specification 9 has four main effects: (1) the first difference of the MOPS structured management index in 2015 minus in 2010, (2) an indicator for a switch from none to any employee stock ownership plan (ESOP) at a firm from 2010 to 2015, (3) an indicator for a switch from any employee stock ownership to none at a firm from 2010 to 2015, and (4) an indicator for maintenance of at least one employee stock ownership at firm from 2010 to 2015. Specification 9 has three interaction terms between the first difference of the MOPS structured management index and, respectively, the ESOP adopt, ESOP drop, and ESOP maintain indicator variables. All regressions include controls for the first difference of the natural logarithm of total value of establishment capital stock in structures in 2015 minus in 2010, the first difference of the natural logarithm of the total value of establishment capital stock in equipment in 2015 minus in 2010, the first difference of the natural logarithm of the total value of establishment expenditure on materials in 2015 minus in 2010, an indicator variable for switching from none to any union membership at an establishment from 2010 to 2015, an indicator variable for switching from any to no union membership at an establishment from 2010 to 2015, an indicator variable for maintenance of any union membership at an establishment from 2010 to 2015, the natural logarithm of the level of total establishment employment in 2010, three-digit NAICS industry indicator variables, and an indicator for the state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY25-P3061-R12676)

Table 9 --- OLS Regression Estimates of the Impact of Adoption, Maintenance, and Removal of ESOPs, Broad-based Group Performance Pay, and Broad-based Information Sharing Indicator Variables on Productivity Change

	First Diff LP calc	First Diff LP est
ESOP adopt	0.009	0.060
	(0.064)	(0.055)
ESOP drop	-0.092	0.014
	(0.082)	(0.081)
ESOP maintain	-0.003	0.020
	(0.027)	(0.031)
B.b. group perf pay adopt	0.047**	0.050**
	(0.015)	(0.015)
B.b. group perf pay drop	-0.033*	-0.025
	(0.015)	(0.016)
B.b. group perf pay maintain	-0.005	-0.001
	(0.013)	(0.014)
B.b. info share adopt	0.004	0.017
	(0.017)	(0.017)
B.b. info share drop	-0.015	-0.027
	(0.017)	(0.017)
B.b. info share maintain	-0.012	-0.006
	(0.015)	(0.015)
ESOP adopt x First Diff of B.b. group perf pay	0.003	-0.011
	(0.059)	(0.055)
ESOP drop x First Diff of B.b. group perf pay	0.102	0.134
	(0.096)	(0.126)
ESOP maintain x First Diff of B.b. group perf pay	-0.033	-0.044
	(0.022)	(0.025)
ESOP adopt x First Diff of B.b. info share	0.118**	0.032
	(0.045)	(0.065)
ESOP drop x First Diff of B.b. info share	0.030	0.069
	(0.080)	(0.093)
ESOP maintain x First Diff of B.b. info share	-0.028	-0.013
	(0.026)	(0.031)
ESOP adopt x B.b. group perf pay maintain	0.069	0.122*
	(0.065)	(0.060)
ESOP drop x B.b. group perf pay maintain	0.117*	0.049
	(0.058)	(0.053)
ESOP maintain x B.b. group perf pay maintain	0.036	0.006
	(0.029)	(0.029)
ESOP adopt x B.b. info share maintain	0.065	-0.017
	(0.061)	(0.067)
ESOP drop x B.b. info share maintain	-0.050	-0.108
	(0.097)	(0.106)
ESOP maintain x B.b. info share maintain	-0.011	-0.002
	(0.029)	(0.035)
N	26,000	26,000

Note: Each entry in the two main columns of the table shows output for private-sector manufacturing workers from the MOPS-ASM-BLS Form 5500 data set for the years 2010 and 2015. Each entry in the two main columns of the table shows output from analysis using the full specification 10, which is an OLS regression in which the dependent variable is the first difference of the natural logarithm of establishment labor productivity in 2015 minus in 2010 from the ASM, with the output in column 1 reflecting labor productivity calculated as Total Value of Shipments over Total Production Worker Hours (i.e. LP calc.) and the output in column 2 reflecting the dependent variable of labor productivity as estimated within Annual Survey of Manufacturers (i.e. LP est.) calculated as part of Census researchers' estimation of total factor productivity and labor productivity using information from existing surveys collected by BLS and Census and defined as the ratio of deflated output over total hours worked.. Specification 10 has eight main effects: (1) an indicator for a switch from none to any broad-based group performance pay at an establishment from 2010 to 2015, (2) an indicator for a switch from any to no broad-based group performance pay in an establishment over 2010 to 2015, (3) an indicator for maintenance of any broad based group performance pay in an establishment of 2010 to 2015, (4) an indicator for a switch from none to any broad based information sharing in an establishment over 2010 to 2015, (5) an indicator for a switch from any to no broad based information sharing in a establishment over 2010 to 2015, (6) an indicator for maintenance of broad based information sharing in an establishment over 2010 to 2015, (6) an indicator for a switch from none to any employee stock ownership plan (ESOP) at a firm from 2010 to 2015, (7) an indicator for a switch from any employee stock ownership to none at a firm from 2010 to 2015, and (8) an indicator for maintenance of at least one employee stock ownership at firm from 2010 to 2015. Specification 10 has twelve interaction terms: the first three between the first difference of the broad based group performance pay indicator and, respectively, the ESOP adopt, ESOP drop, and ESOP maintain indicator variables, the next three between the first difference of the broad based information sharing indicator variable and, respectively, the ESOP adopt, ESOP drop, and ESOP maintain indicator variables, the next three between the broad-based group performance pay maintenance indicator variable and, respectively, the ESOP adopt, ESOP drop, and ESOP maintain indicator variables, and the final three between the broad-based information sharing maintenance indicator variable and, respectively, the ESOP adopt, ESOP drop, and ESOP maintain indicator variables . All regressions include controls for the natural logarithm of the first difference of the total value of establishment capital stock in structures in 2015 minus in 2010, the natural logarithm of the first difference of the total value of establishment capital stock in equipment in 2015 minus in 2010, the natural logarithm of the first difference of the total value of establishment expenditure on materials in 2015 minus in 2010, an indicator variable for switching from none to any union membership at an establishment from 2010 to 2015, an indicator variable for switching from any to no union membership at an establishment from 2010 to 2015, an indicator variable for maintenance of any union membership at an establishment from 2010 to 2015, the natural logarithm of the level of total establishment employment in 2010, three-digit NAICS industry indicator variables, and an indicator for the state in which an establishment resides. ASM, Annual Survey of Manufacturers; MOPS, Management and Organizational Practices Survey; Form 5500, Bureau of Labor Statistics Form 5500 Employer Pension reports. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061 (CBDRB-FY26-P3061-R12815)

Table 10 --- Non-Instrumental Variables Fixed Effects Regression Estimates of the Impact of ESOP Assets per Active Employee, the MOPS structured management index, and their Interaction on Employment Change

	(1) LP calc	(2) LP est	(3) LP calc	(4) LP est
ESOP assets (in $100,000s) per active employee	0.022	0.026	-0.025	0.038
	(0.040)	(0.036)	(0.076)	(0.086)
MOPS index	0.011	0.051	-0.077	-0.039
	(0.053)	(0.056)	(0.126)	(0.149)
ESOP assets per active employee X MOPS index			0.060	-0.021
			(0.095)	(0.112)
N	7,600	7,600	7,400	7,400
Marginal Effects				
lincom ESOP assets per active employee + ESOP assets per active employee X MOPS index			0.035	0.017
			(0.050)	(0.051)

Note: This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY26-067)"

Table 11 --- Non-Instrumental Variables Fixed Effects Regression Estimates of the Impact of ESOP Assets per Active Employee, Broad-based Group Performance Pay, Broad-based Information Sharing, and their Interactions on Labor Productivity

	(1) LP calc	(2) LP est	(3) LP calc	(4) LP est
ESOP assets (in $100,000s) per active employee	0.023	0.028	0.031	0.024
	(0.040)	(0.037)	(0.043)	(0.043)
Broad-based group performance pay indic.	-0.015	-0.025	-0.020	-0.009
	(0.017)	(0.017)	(0.029)	(0.028)
Broad-based information sharing indic.	-0.021	0.012	-0.005	-0.005
	(0.021)	(0.027)	(0.031)	(0.042)
ESOP assets per active employee x Broad based group performance pay indic.			0.004	-0.014
			(0.020)	(0.021)
ESOP assets per active employee x Broad based information sharing indic.			-0.014	0.015
			(0.023)	(0.026)
N	7,600	7,600	7,600	7,600
Marginal Effects				
lincom ESOP assets per active employee + ESOP assets per active employee X Broad based group performance pay presence indicator + ESOP assets per active employee X Broad based information sharing presence indicator			0.021	0.025
			(0.042)	(0.038)

Note: This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 3061. (CBDRB-FY26-067)"

APPENDIX 2:

Full Set of Questions from the 2010 and 2015 Management and Organizational Practices Survey (MOPS)

I. 2010 Management and Organizational Practices Survey Questions

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
   a) We fixed it but did not take further action.
   b) We fixed it and took action to make sure that it did not happen again.
   c) 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.
   d) 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
   a) 1-2 key performance indicators
   b) 3-9 key performance indicators
   c) 10 or more key performance indicators
   d) 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.

   a) Yearly
   b) Quarterly
   c) Monthly
   d) Weekly
   e) Daily
   f) Hourly or more frequently
   g) Never

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.

a) Yearly
b) Quarterly
c) Monthly
d) Weekly
e) Daily
f) Hourly or more frequently
g) 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*

a) All display boards were located in one place (e.g. at the end of the production line)
b) Display boards were located in multiple places (e.g. at multiple stages of the production line)
c) 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

7)

a) Main focus was on short-term (less than one year) production targets
b) Main focus was on long-term (more than one year) production targets
c) Combination of short-term and long-term production targets
d) No production targets (If no production targets in both years, SKIP to 13).

8) In 2005 and 2010, how easy or difficult was it for this establishment to achieve its production targets? *Check one box for each year*

a) Possible to achieve without much effort
b) Possible to achieve with some effort
c) Possible to achieve with normal amount of effort
d) Possible to achieve with more than normal effort
e) Only possible to achieve with extraordinary effort

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

a) Only senior managers
b) Most managers and some production workers
c) Most managers and most production workers
d) All managers and most production workers

10) In 2005 and 2010, what were **non-managers'** performance bonuses usually based on? ***Mark all that apply***
    a) Their own performance as measured by production targets
    b) Their team or shift performance as measured by production targets
    c) Their establishment's performance as measured by production targets
    d) Their company's performance as measured by production targets
    e) No performance bonuses (If no performance bonuses in both years, SKIP to 11)

11) 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*
    a) 0%
    b) 1-33%
    c) 34-66%
    d) 67-99%
    e) 100%
    f) Production targets not met

12) In 2005 and 2010, what were **managers'** performance bonuses usually based on? ***Mark all that apply***
    a) Their own performance as measured by production targets
    b) Their team or shift performance as measured by production targets
    c) Their establishment's performance as measured by production targets
    d) Their company's performance as measured by production targets
    e) No performance bonuses (If no performance bonuses in both years, SKIP to 13)

13) 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*
    a) 0%
    b) 1-33%
    c) 34-66%
    d) 67-99%
    e) 100%
    f) Production targets not met

14) In 2005 and 2010, what was the primary way **non-managers** were promoted at this establishment? *Check one box for each year*
    a) Promotions were based solely on performance and ability
    b) Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)
    c) Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)
    d) Non-managers are normally not promoted

15) In 2005 and 2010, what was the primary way **managers** were promoted at this establishment? *Check one box for each year*
   a) Promotions were based solely on performance and ability
   b) Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)
   c) Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)
   d) Managers are normally not promoted

16) In 2005 and 2010, when was an under-performing **non-manager** reassigned or dismissed? *Check one box for each year*
   a) Within 6 months of identifying non-manager under-performance
   b) After 6 months of identifying non-manager under-performance
   c) Rarely or never

17) In 2005 and 2010, when was an under-performing **manager** reassigned or dismissed? *Check one box for each year*
   a) Within 6 months of identifying non-manager under-performance
   b) After 6 months of identifying non-manager under-performance
   c) Rarely or never

Section B- Organization

18) In 2005 and 2010, was the headquarters for this company at the same location as this establishment?
   Check one box for each year
   a) Yes (if yes in both years, SKIP to 24)
   b) No

19) In 2005 and 2010, where were decisions on **hiring permanent full-time employees** made? *Check one box for each year*
   a) Only at this establishment
   b) Only at headquarters
   c) Both at this establishment and at headquarters
   d) Other (*please specify*)

20) 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*
   a) Only at this establishment
   b) Only at headquarters
   c) Both at this establishment and at headquarters
   d) Other (*please specify*)

21) In 2005 and 2010, where were decisions on **new product introductions** made? *Check one box for each year*
   a) Only at this establishment
   b) Only at headquarters
   c) Both at this establishment and at headquarters
   d) Other (*please specify*)

22) In 2005 and 2010, where were **product pricing** decisions made? *Check one box for each year*
   a) Only at this establishment
   b) Only at headquarters
   c) Both at this establishment and at headquarters
   d) Other (*please specify*)

23) In 2005 and 2010, where were **advertising** decisions for products made? *Check one box for each year*
   a) Only at this establishment
   b) Only at headquarters
   c) Both at this establishment and at headquarters
   d) Other (*please specify*)

24) 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*
   a) Under $1,000
   b) $1,000 to $9,999
   c) $10,000 to $99,999
   d) $100,000 to $999,999
   e) $1 million or more

25) 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.
a) Number of direct reports (Estimates are acceptable)

26) 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.
a) Number of layers (Estimates are acceptable)

27) In 2005 and 2010, who prioritized or allocated tasks to production workers at this establishment? *Check one box for each year*
   a) Only managers
   b) Mostly managers
   c) Managers and production workers jointly
   d) Mostly production workers
   e) Only production workers
   f) Other (*please specify*)

28) In 2005 and 2010, what best describes the **availability** of data to support decision making at this establishment? *Check one box for each year*
   a) Data to support decision making are not available
   b) A small amount of data to support decision making is available
   c) A moderate amount of data to support decision making is available
   d) A great deal of data to support decision making is available
   e) All the data we need to support decision making is available

29) In 2005 and 2010, what best describes the **use** of data to support decision making at this establishment? *Check one box for each year*
   a) Decision making does not use data
   b) Decision making relies slightly on data
   c) Decision making relies moderately on data
   d) Decision making relies heavily on data
   e) Decision making relies entirely on data

30) In 2005 and 2010, did the **managers** at this establishment learn about management practices from any of the following? ***Mark all that apply***
   a) Consultants
   b) Competitors
   c) Suppliers
   d) Customers
   e) Trade associations or conferences
   f) New employees
   g) Headquarters
   h) Other (*please specify*)
   i) None of the above

31) What was your level of seniority in 2010?
   a) CEO or Executive Officer, e.g., CFO
   b) Manager of multiple establishments, e.g., Division Manager
   c) Manager of one establishment, e.g., Plant Manager or Controller
   d) Non-manager
   e) Other (*please specify*)

32) What year did you start working at this establishment?

33) 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.
   a) Number of managers at this establishment (Estimates are acceptable)

34) 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?
   a) Number of employees at this establishment (Estimates are acceptable)

35) In 2005 and 2010, what was the percent of **managers** at this establishment with a bachelors degree? *Check one box for each year*
   a) 20% or less
   b) 21%-40%
   c) 41%-60%
   d) 61%-80%
   e) More than 80%

36) In 2005 and 2010, what was the percent of **non-managers** at this establishment with a bachelors degree? *Check one box for each year*
   a) 0%
   b) 1-10%
   c) 11-20%
   d) More than 20%

37) In 2005 and 2010, what percent of all **employees** at this establishment were members of a labor union? *Check one box for each year*
   a) 0%
   b) 1-20%
   c) 21-40%
   d) 41-60%
   e) 61-80%
   f) More than 80%

II. 2015 Management and Organizational Practices Survey Questions

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

a) We fixed it but did not take further action.
b) We fixed it and took action to make sure that it did not happen again.
c) 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.
d) 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

a) 1-2 key performance indicators
b) 3-9 key performance indicators
c) 10 or more key performance indicators
d) 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.
a) Yearly
b) Quarterly
c) Monthly
d) Weekly
e) Daily
f) Hourly or more frequently
g) Never

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
   a) Yearly
   b) Quarterly
   c) Monthly
   d) Weekly
   e) Daily
   f) Hourly or more frequently
   g) 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***
   a) All display boards were located in one place (e.g. at the end of the production line)
   b) Display boards were located in multiple places (e.g. at multiple stages of the production line)
   c) 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
   a) Main focus was on short-term (less than one year) production targets
   b) Main focus was on long-term (more than one year) production targets
   c) Combination of short-term and long-term production targets
   d) 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***
   a) Possible to achieve without much effort
   b) Possible to achieve with some effort
   c) Possible to achieve with normal amount of effort
   d) Possible to achieve with more than normal effort
   e) Only possible to achieve with extraordinary effort

8) In 2010 and 2015, who was aware of the production targets at this establishment? ***Mark one box for each year***
   a) Only senior managers
   b) Most managers and some production workers
   c) Most managers and most production workers
   d) All managers and most production workers

9) In 2010 and 2015, what were **non-managers'** performance bonuses usually based on? ***Mark all that apply***
   a) Their own performance as measured by production targets
   b) Their team or shift performance as measured by production targets
   c) Their establishment's performance as measured by production targets
   d) Their company's performance as measured by production targets
   e) 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***
   a) 0%
   b) 1-33%
   c) 34-66%
   d) 67-99%
   e) 100%
   f) Production targets not met

11) In 2010 and 2015, what were **managers'** performance bonuses usually based on***?*** ***Mark all that apply***
   a) Their own performance as measured by production targets
   b) Their team or shift performance as measured by production targets
   c) Their establishment's performance as measured by production targets
   d) Their company's performance as measured by production targets
   e) No performance bonuses (If no performance bonuses in both years, SKIP to 13)

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***
   a) 0%
   b) 1-33%
   c) 34-66%
   d) 67-99%
   e) 100%
   f) 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***
   a) Promotions were based solely on performance and ability
   b) Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)
   c) Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)
   d) 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***
    a) Promotions were based solely on performance and ability
    b) Promotions were based partly on performance and ability, and partly on other factors (for example, tenure or family connections)
    c) Promotions were based mainly on factors other than performance and ability (for example, tenure or family connections)
    d) Managers are normally not promoted

15) In 2010 and 2015, when was an under-performing **non-manager** reassigned or dismissed? ***Mark one box for each year***
    a) Within 6 months of identifying non-manager under-performance
    b) After 6 months of identifying non-manager under-performance
    c) Rarely or never

16) In 2010 and 2015, when was an under-performing **manager** reassigned or dismissed? ***Mark one box for each year***
    a) Within 6 months of identifying non-manager under-performance
    b) After 6 months of identifying non-manager under-performance
    c) Rarely or never

Section B- Organization

17) In 2010 and 2015, was the headquarters for this company at the same location as this establishment?

Mark one box for each year
    a) Yes (if yes in both years, SKIP to 24)
    b) No
    c) 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? ***Mark one box for each year***
    a) Only at this establishment
    b) Only at headquarters
    c) Both at this establishment and at headquarters
    d) Other (please specify)

19) In 2010 and 2015, where were decisions to **give an employee a pay increase of at least 10%** made? ***Mark one box for each year***
    a) Only at this establishment
    b) Only at headquarters
    c) Both at this establishment and at headquarters
    d) Other (please specify)

20) In 2010 and 2015, where were decisions on **new product introductions** made? ***Mark one box for each year***
    a) Only at this establishment
    b) Only at headquarters
    c) Both at this establishment and at headquarters
    d) Other (please specify)

21) In 2010 and 2015, where were **product pricing** decisions made? ***Mark one box for each year***
    a) Only at this establishment
    b) Only at headquarters
    c) Both at this establishment and at headquarters
    d) Other (please specify)

22) In 2010 and 2015, where were **advertising** decisions for products made? ***Mark one box for each year***
    a) Only at this establishment
    b) Only at headquarters
    c) Both at this establishment and at headquarters
    d) Other (please specify)

23) In 2010 and 2015, what was the dollar amount that could be used to purchase a fixed/capital asset at this establishment without prior authorization from headquarters? ***Mark one box for each year***
    a) Under $1,000
    b) $1,000 to $9,999
    c) $10,000 to $99,999
    d) $100,000 to $999,999
    e) $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
    a) Data to support decision making are not available.
    b) A small amount of data to support decision making is available
    c) A moderate amount of data to support decision making is available
    d) A great deal of data to support decision making is available
    e) 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

a) Decision making does not use data
b) Decision making relies slightly on data
c) Decision making relies moderately on data
d) Decision making relies heavily on data
e) Decision making relies entirely on data

26) In 2010 and 2015, who chose what type of data to collect at this establishment?

Mark all that apply

a) Managers at this establishment
b) Managers at headquarters and/or other establishments
c) Production workers
d) Engineers
e) Customers
f) 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 (i.e. across daily, weekly, monthly, yearly, and never)

i. Performance indicators from production technology or instruments
ii. Formal or informal feedback from managers
iii. Formal or informal feedback from production workers
iv. 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 (i.e. across daily, weekly, monthly, yearly, and never)

i. Performance indicators from production technology or instruments
ii. Formal or informal feedback from managers
iii. Formal or informal feedback from production workers
iv. 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 (i.e. across daily, weekly, monthly, yearly, and never)

i. Design of new products or services
ii. Demand forecasting
iii. 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 2**010**?

Mark all that apply (i.e. across daily, weekly, monthly, yearly, and never)

i. Design of new products or services
ii. Demand forecasting
iii. Supply chain management

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

a) Daily
b) Weekly
c) Monthly
d) Yearly
e) Never

Section D- Uncertainty

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.
   a) For 2015 calendar year
   b) 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?

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.
   a) For 2015 calendar year
   b) Estimate for 2016 calendar year

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?

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.
   a) On March 12, 2015
   b) 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?

36) For calendar years 2015 and 2016, what are the approximate dollar expenditures for this establishment on materials, parts, containers, and packaging?
   a) For 2015 calendar year
   b) 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?

Section E- Characteristics

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.
   a) Number of managers at this establishment (Estimates are acceptable)

40) In 2010 and 2015, what was the percent of managers at this establishment with a bachelors degree? ***Mark one box for each year***
   a) 20% or less
   b) 21%-40%
   c) 41%-60%
   d) 61%-80%
   e) 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***
   a) 0%
   b) 1-10%
   c) 11-20%
   d) 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***
   a) 0%
   b) 1-20%
   c) 21-40%
   d) 41-60%
   e) 61-80%
   f) 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.
   a) Employees who were part-time
   b) Employees who were working flexible hours
   c) Employees who worked from home one day or more per week
   d) Employees who were cross-trained

44) In 2010 and 2015, which of the following best described the production of this establishment?

Mark one box for each year
   a) Job shop
   b) Batch production
   c) Cellular manufacturing
   d) Continuous flow (other than cellular manufacturing)
   e) 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
   a) Yes, founder(s) owns it
   b) Yes, member(s) of a founder's family owns it (e.g., daughter, son, sister, brother)
   c) No
   d) If yes to either of the above, is the CEO of the firm also a founder or a member of a founder's family?

      i)Yes ii) No

46) Is this establishment part of a firm which has production establishments in other countries?
   a) Yes
   b) No