

Employee stock ownership during the Great Depression: the varying impacts of ESOPs on output growth and worker utilization

LILLIAN GAETO TROTTER

Wofford College

The Great Depression era provides a natural experiment to study the effects of employee stock ownership on productivity due to the unexpected nature of the stock market crash in 1929 and the predetermined expiration of employee stock offerings staggered throughout the 1930s. I collect information on employee stock ownership from reports by the National Industrial Conference Board, annual company reports and other primary sources, and then merge them with the US Census of Manufactures to form the main establishment-level dataset. The results indicate that companies with active programs had significantly lower establishment-level output growth and fewer hours worked per employee than firms with inactive ESOPs post-crash. These negative effects, however, can be mitigated in smaller firms where employees feel their effort level has non-negligible effects. To my knowledge, this is the first study to empirically investigate these early ESOPs as well as address how continuing an employee stock ownership program during a financial crisis affects productivity.

Keywords: stock market, employee stock ownership, great depression, productivity

JEL classification: N120, N220, G230

I

Employee stock ownership programs (ESOPs) have expanded to become a conventional component of employee compensation in the modern context, and subsequently research on their effects in terms of worker behavior and firm motivations has similarly burgeoned.¹ Today, there are estimated to be over 6,500 employee stock ownership programs with almost 15 million total participants in the US (National Center for Employee Ownership 2024). Over 10 percent of individuals who directly own stocks do so through an ESOP (Saad and Jones 2021). Yet,

Lillian Gaeto Trotter, Wofford College, 429 N. Church St., Spartanburg SC 29303, United States, email: trotterlr@wofford.edu

¹ Throughout the article, ESOP is used in the general sense for an employee stock ownership program instead of a formal succession plan which is believed to have originated with Louis O. Kelso in 1956 (Menke and Buxton 2010).

even as these programs are increasingly adopted, the key questions in the employee stock ownership literature such as how these programs relate to worker productivity remain largely unanswered.

These programs are often adopted under the assumption that they align incentives between employees and shareholders, which is known as the incentive-compatibility mechanism (Brickley and Hevert 1991; Hochberg and Lindsey 2010). However, the usefulness of these programs from a firm productivity perspective, their direct effects under various conditions and the mechanisms behind these effects are not generally agreed upon. The literature tends to rely on case studies and narrative evidence to draw conclusions since robust, empirical results about the causal effects of these programs are difficult to obtain due to a lack of exogenous variation in the timing of adoption. Throughout history, the adoption of ESOPs has been shown to be pro-cyclical and highly correlated to rising stock prices and firm profits (Ott 2011). Thus, little is known about their direct effects in an expansionary economy, let alone under less favorable economic conditions.

This article seeks to fill a gap in the research on ESOPs by answering the question of how continuing an employee stock ownership program during a financial crisis affects productivity. I look to the past for insight and study employee stock ownership in a setting where companies were ending their programs but only when contractually allowed to do so. Specifically, I analyze the effects of ESOPs during the Great Depression as stock prices fall, but firms remain locked into their programs. In doing so, I find that establishments with active ESOPs have lower worker productivity after the stock market crash. The main results align with price appreciation being an important mechanism for understanding how stocks incentivize worker effort.

Employee stock ownership has been present in the United States for over 100 years, which makes the extent of the uncertainty about their real effects more striking.² Large companies adopted ESOPs starting in the early 1900s, and adoption increased in the 1920s following the success of the Liberty Loan Program and its effect on financial education for the general public (Ott 2011; Hilt, Rahn and Jaremski 2022). For management, giving employees the opportunity to have ownership in the company was seen as a way to appease workers, discourage unionization and increase loyalty. The number of programs reached a peak in the mid 1920s, and on the eve of the Great Depression hundreds of thousands of employees owned stock in their employers (National Industrial Conference Board, Inc. 1928).

Instead of following the modern literature and using the choice of adoption by company executives to determine the timing of treatment, which is likely related to firm characteristics such as hiring decisions and profits, I leverage the predetermined expiration of the programs. I present data that suggest the timing of expiration,

² Proctor and Gamble is believed to be one of the first companies to adopt a program for employees to purchase stock, dating back to 1886 (National Industrial Conference Board, Inc. 1928).

according to the format of company contracts, was plausibly exogenous to the company's underlying characteristics. The long-term nature of these programs which began in the mid-to-late 1920s means that both companies and employees were more or less locked into their contracts after the largely unanticipated stock market crash of 1929. Following the strategy developed by Almeida *et al.* (2012) and Benmelech, Frydman and Papanikolaou (2019) more recently, the predetermined length of the contract between firm management and rank-and-file employees is used to identify the effects of employee stock ownership in the turmoil of the poor stock performance during the Depression.

Given the lack of research on employee stock ownership in this period, this project required an extensive data collection process. The basis for the employee stock ownership data comes from a comprehensive study by the National Industrial Conference Board, Inc. (NICB; 1928) conducted prior to the Depression in 1928. I then hand-collected information from various primary sources to establish the details of these programs, especially the origination and expiration of the stock contracts. The establishment-level data utilized in this article are from the United States Census of Manufactures, 1929–35, digitized by Vickers and Ziebarth (2018) and are manually matched to the novel, employee stock ownership data. Establishments are defined as all the individual plants of manufacturing companies in the sample. Only establishments whose parent firm ever had a stock ownership program remain in the dataset. The advantage of using establishment-level schedules over aggregated firm-level data is that the former gives a more precise understanding of how employee monitoring and the free-rider problem affect productivity.³ A limitation of the Census of Manufactures data for this particular project is that I am unable to test for pre-trends throughout the 1920s. Instead, there is only one pre-period of data prior to the crash. However, I successfully leverage firm-level stock market data to rule out systematic differences in the stock performance of public firms based on timing of ESOP activity. Section III delves into this issue and how it is overcome.

Treatment and control groups are then assigned based on the quasi-random timing of plan expiration after the 1929 stock market crash. Establishments are treated as long as their program, which originated prior to the crash and was set for a predetermined duration, remains active.⁴ Once the parent firm's program becomes inactive, these establishments move to the control group.

The baseline results show that these first employee stock ownership programs had an unanticipated negative effect on productivity after the stock market crash. Having an active program during the Great Depression caused lower establishment-level

³ The free-rider problem exists when it is believed that one worker's individual productivity decisions will not affect overall output, and they choose to 'free ride' off the hard work of co-workers. This incentive to shirk grows with the size of the firm.

⁴ In this article, an ESOP is considered active if employees are still able to purchase new stock at the employee rate. A program is inactive once new employees do not have the option to buy stock since the formal plan has ended, even if some workers already have stock in their portfolio.

output growth and decreased the hours worked by employees. These results suggest employee stock ownership programs can have negative incentive effects for employees during times of extreme economic turmoil. I present a table that suggests workers were further discouraged by poor stock performance and conclude that the real monetary benefit to employees does matter when it comes to aligning incentives. Employee stock ownership requires more than simply bonding individual workers to each other and to the firm as has been suggested (Lazear 1981; Kim and Ouimet 2014).

I also further break down the productivity results based on firm size to better understand the competing roles of incentive-compatibility and free-riding. The results suggest that the free-rider problem can be mitigated when individual employees feel they can affect the stock price which accords with the existing ESOP literature (Blasi, Conte and Kruse 1996). Smaller firms, those in the first tercile based on number of employees, with active programs saw establishment-level output decrease by less than larger firms. Finally, I show that there is a direct tradeoff between wages and stock purchases as anticipated since employees pay for company stocks through wage deductions in active programs. Employees, in effect, saw their real benefit of working fall through this substitution. Additionally, employees paying into these programs were likely disincentivized by their falling return to working. Thus, the firm's marginal costs of implementing the program outweighed the marginal benefit of increased worker effort in this setting.

My empirical strategy contributes to the literature by providing convincing causal estimates on the effect of employee ownership on productivity in a historical setting. To my knowledge, this study is the first to empirically investigate this early period of employee stock ownership.⁵ The majority of previous empirical studies on the topic of employee stock ownership and the functioning of a firm are confined to analyzing the past few decades and highlight the expansion of employee stock ownership programs in times of economic prosperity (Jones and Kato 1995; Blasi, Conte and Kruse 1996; Kim and Ouimet 2014). In doing so, these studies often perform cross-sectional analyses or event studies to document how ESOPs are related to firm-level characteristics. While these relationships are important, the previous literature cannot provide causal conclusions due to the lack of any plausibly exogenous variation in the timing of employee stock programs in the modern setting. In the end, the empirical results are generally mixed in terms of the strength of an ESOP's effect on productivity and firm profitability in an expansionary economy (Livingston and Henry 1980; Jones and Kato 1995; Blasi, Conte and Kruse 1996; Kim and Ouimet 2014).

⁵ Two previous studies of the beginnings of employee stock ownership which were extremely helpful during the data collection process are National Industrial Conference Board, Inc. (1928, 1930). These primary sources outline specific dates when programs were adopted, but they provide no empirical tests or analyses.

My results also contribute to the broad literature on the impact of the Great Depression in terms of the stock market, output and employment. The crash of the stock market in October 1929 precipitated the severe economic contraction and led to a persistent change in stock market volatility (White 1990; Rappoport and White 1994; Cortes and Weidenmier 2019). Overall real output fell by 26 percent between 1929 and 1933, and the Great Depression remains the worst economic downturn in US history to date (Margo 1993). At its peak, unemployment reached 25 percent. Several explanations have been suggested for the economic fallout, such as widespread bank failures, financial frictions and inappropriate policies by the Federal Reserve (Bernanke 1983; Richardson and Troost 2009; Lee and Mezzanotti 2015; Benmelech, Frydman and Papanikolaou 2019). Various effects from this economic contraction have been documented in terms of reduced manufacturing output but also a foundation for significant technological progress in the following decades (Field 2003; Lee and Mezzanotti 2015). My results support an additional mechanism through which the stock market affected workers and firms during the Great Depression. ESOPs reduced productivity at the companies hardest hit by the stock crash and made workers worse off in this period.

By studying ESOPs when stock prices are falling across industries, this article also addresses a key point of disagreement in the theoretical literature about how and when these programs increase worker effort. Social identity theory posits that these programs bond employees together and reduce turnover regardless of the individual's influence on the stock price (Kim and Ouimet 2014). The overall decrease in productivity from employee stock ownership rules out the social cohesion theory and instead points to the real return of ownership as being an important driver of worker effort.

The empirical results in this study remain consistent with aspects of both theories on efficiency wages and incentive-compatibility. Efficiency wage theory predicts firms pay above market wages to attract high-quality workers and this should increase productivity over time (Shapiro and Stiglitz 1984). While eager workers may have been attracted to firms because of these programs initially, the fall in prices reversed the predicted effect of efficiency wages and instead decreased productivity. The real output results for the smaller firms show that when the free-rider problem is reduced, the fall in productivity may be attenuated by more directly aligning the workers' effort levels with firm profits even in a struggling economy (Jensen and Meckling 1976; Blasi, Conte and Kruse 1996). The relevance of these theories suggests that with an active ESOP, labor effort is dependent on both the asset's return and the individual's perception of how they can affect the return over time.

The remainder of the article is organized as follows. The next section describes the historical background of employee stock ownership and the Great Depression. Section III discusses the data collection process and empirical strategy. Section IV presents the main results along with robustness tests and then discusses how they relate to prevailing theories on employee stock ownership. Section V concludes.

II

The first employee stock ownership programs emerged in the United States at the turn of the twentieth century (Ott 2011). Companies increasingly adopted these novel programs in the aftermath of World War I following the emergence of a new class of modest-income investors during the Liberty Loan Campaigns (Hilt, Rahn and Jaremski 2022). In 1924, the economist H. T. Warshow used income tax returns to estimate the number of stock holders in the US (Warshow 1924). While acknowledging the lack of data on employee stock ownership, he posits that the expansion of stockholders was due, at least in part, to the growth of ownership programs throughout the country.

At the time, company surveys highlighted various motivations behind the introduction of these programs. Continuing the rhetoric introduced by the war bond drives, many employers stated these programs were a way to encourage thrift (National Industrial Conference Board, Inc. 1928). Additional reasons acknowledged in surveys include rewarding employee contributions to the company's success and garnering public interest in the company. Historian Julia Ott emphasizes that ESOPs also effectively discouraged discussions of unionization among lower-level employees (Ott 2011).

The initial stock programs and their contracts introduced in the 1920s can be roughly categorized into two main types based on who was eligible to participate. Programs that were open to all employees, specifically lower-level employees, are referred to as 'rank-and-file' plans. These plans may have had additional requirements for eligibility, such as length of time with the company and a lack of any previous work offenses. Alternatively, programs that only allowed employees to participate once they had achieved a certain rank in the company are termed selective programs. In this period, the broad-based, rank-and-file plans were more prevalent and are the primary focus of this article.

By 1928, the programs had gained enough attention to warrant an extensive study by the National Industrial Conference Board. They documented the trends and timing of plan adoption by sending surveys to companies across the US. Figure 1 shows the number of companies that adopted their first program in each year until 1928. The graph shows the peak of adoption occurred in the early 1920s. Table A1 in Appendix B shows these data in table form. The five-year-period which corresponds to the most companies establishing their first program was 1921–5.

It should be noted that the US economy and, particularly, the stock market boomed during the 1920s and participating employees were positioned to benefit from ownership. Even so, the growing adoption of these programs was not without controversy. Even the National Industrial Conference Board report acknowledged the impact of these programs likely depended on the state of the economy. It states:

It should always be remembered, however, that more than half of the companies whose experience with selling stock to their employees is considered here offered their securities for

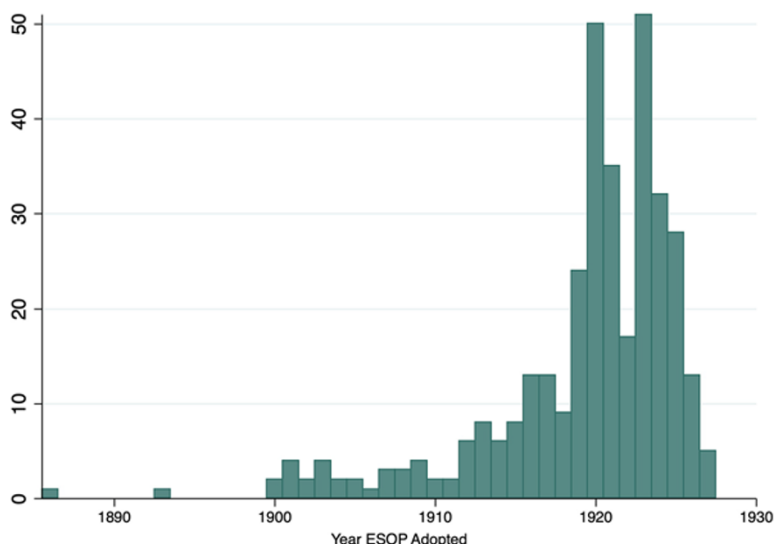


Figure 1. *Years companies adopted programs until 1928*

Source: National Industrial Conference Board, Inc. 1930.

the first time in 1921 or later. Steady employment, high wages and rising prices of securities have marked this entire period. How conclusive evidence is, therefore, regarding experience with stock purchase plans for employees during periods of depression as well as prosperity is not quite certain. (National Industrial Conference Board, Inc. 1928, p. 17)

New York University economist Willard Fischer emphasized the need for employees to diversify and not ‘put all of [their] eggs in one basket’. He went as far as condemning the practice of employee stock ownership.⁶

Stock ownership programs were also viewed with deep suspicion by organized labor. The American Federation of Labor feared stock ownership would lead to workers losing their identity, and it would never effectively redistribute power to the working class (Ott 2011). Despite the various concerns raised publicly the programs continued to expand, and on the eve of the Great Depression, over 800,000 employees at over 300 companies owned stock in their employers (National Industrial Conference Board, Inc. 1928).

The specific details of the programs and offerings varied significantly across companies in terms of eligibility, payment options, resale and so on. Nevertheless, this section draws heavily on the National Industrial Conference Board reports and two Princeton University studies to summarize their main characteristics as well

⁶ ‘Fisher condemns workers investing in own companies’, *New York Herald Tribune*, 6 April 1927.

as outline their key differences (National Industrial Conference Board, Inc. 1928, 1930; Baker 1932; Davis 1933).⁷

Most companies had plans that lasted from two to five years, and their duration was set from the outset or until a certain number of shares had been subscribed for. For example, the Standard Oil Company of New Jersey had four ‘long-term’ plans from 1920 to 1935 that ranged from three to five years (National Industrial Conference Board, Inc. 1930). Each plan specified an amount of the employees’ contribution that the company would match, eligibility requirements for participation and a rule to determine the employee price (Davis 1933). The vast majority of companies, including the Standard Oil Company of New Jersey, allowed employees to purchase shares through installments. Often, employees would have a percentage of their wages taken out each month to be directly deposited into their stock accounts.

Table A2 in Appendix B summarizes the number of companies in the National Industrial Conference Board’s extensive sample that allow various lengths of employee payment plans and the price level at which employees can purchase stock. It shows that most companies allow deferred payments for some length of time and offer their stock to employees at either market or par value.

Taken together, this information implies that the greatest benefit to employees of ownership in most cases was the long-term installment plan. An example of a typical statement of stocks is provided as Figure A1 in Appendix A. As the statement shows, it will take several years for this employee to fully own the stock she has subscribed for, but the shares are waiting with her name on them when she does. This effectively broadened access to stock ownership because most workers earning modest hourly wages could not afford the face market value of stocks at a single time. While New York Stock Exchange brokerage offices also expanded across the country throughout the 1920s, these firms could not offer the working class this kind of subscription program (Ott 2011).

The first major test of the companies’ commitment to employee stock ownership came in 1929 with the stock market crash and the beginning of the Great Depression. As the Industrial Conference Board had noted, most employee stock owners had no experience with market volatility at this time. Some employees sought to sell their stock while others chose to no longer make their subscription payments and to instead receive their investment back in the form of cash. Still others held onto their assets and even subscribed to additional shares at low prices with the hope that their value would bounce back quickly (National Industrial Conference Board, Inc. 1930).

Unfortunately, detailed data on employee participation, the exact amount of cancelled subscriptions and stock resales are unavailable at the aggregate level, but studies

⁷ Table A4 in Appendix B provides an overview of the ESOPs for every company in the main dataset which is described more fully in Section III.

Table 1. *Standard Oil Co. of New Jersey timeline of plans*

Plan	Start date	End date	Duration
First stock acquisition plan	30 Dec. 1920	30 Dec. 1925	5 years
Second stock acquisition plan	1 Jan. 1926	30 Dec. 1928	3 years
Third stock acquisition plan	1 Jan. 1929	31 Dec. 1931	3 years
Fourth stock acquisition plan	1 Jan. 1932	31 Dec. 1935	4 years

Source: Baker (1932), p. 17.

of a sample of representative companies provide an overview of the situation. Similar to the way ownership plans varied across companies, there were a range of responses to the downturn and allowances for employees. Out of 99 companies surveyed, a majority of them would purchase the stock back from their employees at the cost the employee incurred (usually with a low interest rate). However, a large number of companies had no plan in place should employees want to sell their stock quickly. This highlights the unanticipated nature of the crash to the public (Davis 1933). In the midst of the overall enthusiasm for broad-based stock ownership, most employers could not fathom a scenario where workers would want to discard their securities.

The National Industrial Board also surveyed the sample of companies on how subscription cancellations and resales in 1930 compare to previous years. The majority of companies reported they either had no cancellations or resales or a normal level of them. The selective ESOPs exhibited more stability in terms of the long-term holding of stocks since most companies had no cancellations or resales. Some companies took this as evidence that the working class should not have had the opportunity to own stock in the first place (Davis 1933). This is represented by a trend of companies switching to offering only selective ESOPs when they are contractually able to do so following the crash.

Additionally, many companies decided to indefinitely postpone their regularly scheduled offerings during the aftermath of the crash. Because most of the companies had the length of the plan or installment period determined from the outset, there is substantial variation in the timing of discontinuance across companies.

Still, a few companies persevered through the market turmoil and continued to renew their programs. From a sample of 50 companies studied by Baker (1932), 19 continued their programs uninterrupted throughout the Great Depression. The Standard Oil Company of New Jersey was one such company that made a new offering to employees in 1932 instead of postponing it. A timeline of the four stock acquisition plans offered by the Standard Oil Company of New Jersey is provided as Table 1. With each plan, the length of the program was determined when it went into effect. For example, the company committed to continuing the third plan for three years on 1 January 1929 before the stock market crash.

When it was time to decide whether to implement the fourth plan, the company executives surveyed the current participants about their stance Baker (1932). The rank-and-file employees involved in the third plan responded positively with 88 percent in favor of renewing the plan. This shows how the choice to make an additional offering after the crash was endogenous since it arose from the workers' attitude toward the company and the stock market more broadly.

Ultimately, the ideal of employees owning stock in their employers would outlast the Great Depression and recovery. Even amidst the market volatility, a survey taken in 1930 suggests that a majority of employees would choose to subscribe to a plan again in the future (National Industrial Conference Board, Inc. 1930). While there was a trend away from rank-and-file programs in the initial aftermath of the crash, broad-based stock ownership would gain popularity again following World War II when organized labor also rebounded (Ott 2011).

More recently, the 1970s and 1980s were also periods of rapid growth in ESOPs, and represent a time when employee stock ownership became more of the rule rather than the exception. A survey by the National Center for Employee Ownership conducted in 1989 reported that 36 percent of large public firms had an ESOP and an additional 33 percent of companies without a program suggested they would likely start one (Blasi and Kruse 1991). A full analysis and summary of the modern state of employee stock ownership is beyond the scope of this article, but this section provides a background on the genesis of these enduring programs.

III

The data utilized in this project come from a variety of sources, including novel, hand-collected data on employee stock ownership programs throughout the late 1920s and early 1930s.

The establishment panel data come from the US Census of Manufactures (CoM), which contains detailed production and compensation information for individual manufacturing establishments producing a variety of goods every two years from 1929 to 1935 (Vickers and Ziebarth 2018). The data are coded at the establishment level, and in many cases, there are multiple establishments for each firm. To further diminish the possibility of confounding variables affecting the estimation of the ESOPs' direct effect, only the establishments which are separate from a company's headquarters will be analyzed (henceforth, referred to as branches). As mentioned above, all establishments are equally affected by the decision to offer a rank and file ESOP, and company executives cannot pick and choose which establishments are eligible. Recent research further suggests that multi-location and single-location firms may have behaved quite differently during the Great Depression (Loulaliche, Vickers and Ziebarth 2019). Thus, to mitigate systematic differences in companies, the main analysis seeks to compare multi-location firms with active ESOPs to other multi-location firms with inactive programs. Figure 2 presents the locations of all

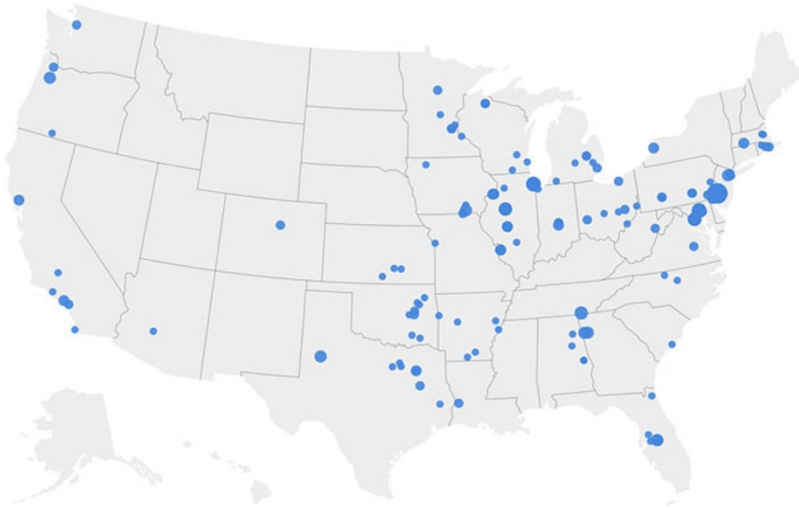


Figure 2. *Locations of all the branches with ESOPs in Census of Manufactures, 1929*

Source: ESOP data come from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment locations are from Vickers and Ziebarth (2018).

the branches which ever had ESOPs by 1929 in the CoM data where the size of the bubble reflects the number of branches at that location.

For the key information about the various stock programs, the extensive report from the National Industrial Conference Board (NICB) again proves useful for summarizing the state of employee stock ownership at the beginning of the period of interest. In 1928, the NICB published a detailed analysis using firm surveys to document the rapid growth in the number of ESOPs throughout the 1920s. This document contains appendices which categorize the companies by their level of activity and include the address of the company's headquarters, the year the plan was adopted and the approximate number of employees for all US-based firms ever having programs. To complete the ESOP data collection, this information is supplemented by two later studies published by the Industrial Relations Section at Princeton University in 1932 and 1933 (Baker 1932; Davis 1933).

These sources essentially cover the largest firms in the data until 1933. Additional information on smaller companies and changes in ESOPs through 1935 was collected by hand from various historical annual company reports and newspaper articles. The reports were obtained from ProQuest Historical Annual Reports database and various editions and volumes of *Moody's Manual of Investments* (Moody 1929–35). These sources contain statements to stockholders and typically include a detailed balance sheet of the companies' operating expenses and outstanding stock. Once these statements were collected, the level of activity of the employee stock ownership programs as well as the length of the contract and subscription period

could be determined. A sample of a balance sheet from the Firestone Tire & Rubber Company's annual report is provided as [Figure A2](#) in [Appendix A](#).

The final panel dataset of establishments was created by merging the establishment panel data with the novel employee stock ownership data. These were matched by hand according to the owner name, firm industry and location of firm headquarters. Of the full sample of companies which instituted an ESOP at some point in their history collected by the NICB study in 1928, about 23 percent appear in the full Census of Manufactures data. When focusing on just the manufacturing companies which appear in the NICB report, the proportion of these firms which are in the Census of Manufactures increases to 40 percent (Vickers and Ziebarth 2018). Because the CoM provides data on the population of establishments for only specific manufacturing industries that have been digitized, this match rate seems reasonable. [Appendix A](#) provides the precise details of the data cleaning and merging processes.

An important feature of the data is that not all companies that had employee stock programs were listed on a major stock exchange (and vice versa). In many cases, the companies offered private assets to their employees (National Industrial Conference Board, Inc. 1928). Data on which firms in the Census of Manufactures dataset were listed and when come from Jovanovic and Rousseau (2001). Approximately 20 percent of the companies with ESOPs were listed according to their data from the Center for Research in Securities Prices (CRSP). This information is crucial because whether a firm is public is an important control variable in order to isolate the effect of the ESOP in the analysis. With this variable included in the regression models, the stock market financing channel can be ruled out when examining the effects of employee stock ownership. CRSP data were also collected to study the stock price and return trends for listed firms in the main sample. [Figure A4](#) in [Appendix A](#) presents the monthly average prices for these firms.

The historical background section summarized the specifics of how these early employee stock ownership programs were often set for a pre-determined amount of time when they went into effect. For example, [Table 1](#) shows that the length of time for Standard Oil Co. of New Jersey's programs varied from three to five years throughout the 1920s and 1930s. The length of the contracts in this example are fairly standard for the manufacturing sector in this period.⁸

This means that in October 1929 when the Dow Jones Industrial Average fell 23 percent over two days, companies and their employees had varying lengths of commitment to their ESOP depending on when it was initially instituted and/or when the program was last renewed (Rappoport and White 1994). Since many firms adopted programs in the 1920s, some plans had already expired before the crash and were waiting to be renewed, but others were instituted shortly before the unanticipated fall in stock prices. The present study circumvents the endogenous

⁸ For the baseline manufacturing sample, the average length of a contract is 3.95 years and the median is 4 years.

choice to begin or discontinue an ESOP, which restricts much of the previous literature from establishing causal estimates, because of this variation in plan timing and commitment device.

In the following analysis, when the stock market crash occurs, I focus solely on the ESOP that is in place at that point in time. This is referred to as the ‘pre-Depression’ plan. The program is considered ‘active’ until this contract expires. Then, the firm’s establishments are denoted as having an inactive ESOP in the dataset going forward, regardless of whether it chooses to renew its program or not. The control group is composed of the establishments whose plans had already expired prior to 1929 and those whose pre-Depression plans have ended. The main identifying assumption is that, in the absence of treatment, establishments whose ESOPs were active throughout the 1930s would have evolved identically to establishments that had expired ESOPs when the stock market crashed.⁹

It is one of the most-agreed upon facts in twentieth-century economic history that the stock market crash and the severity of the Great Depression were largely unanticipated (Benmelech, Frydman and Papanikolaou 2019; Cortes and Weidenmier 2019). Even with hindsight, modern studies have failed to accurately forecast the magnitude of the economic downturn throughout the 1930s (Dominguez, Fair and Shapiro 1988; Cortes, Taylor and Weidenmier 2022). One study by Klug, Landon-Lane and White (2005), in particular, emphasizes that businesses did not anticipate the decline in economic activity using railroad shipment forecasts. Although railroad companies do not appear in the Census of Manufactures data, the demand for the railroad industry is directly related to nationwide demand for various manufacturing commodities that do appear in the data such as lumber, coal and automobile parts.¹⁰ Building on the mountain of previous research regarding the unforeseen nature of the Great Depression, there is no reason to believe that firms would have targeted 1929 as the year for their plan to expire.¹¹ For example, Procter and Gamble renewed their program in early 1929 for six years, meaning they were locked into the contract until the end of 1934 (National Industrial Conference Board, Inc. 1930). Therefore, the causal effects of employee stock ownership are identified by exploiting this preexisting variation in the timing of plan expiration.

The identification strategy outlined in this section can be related to Almeida *et al.* (2012) and Benmelech, Frydman and Papanikolaou (2019), who identify financial frictions using pre-existing levels of long-term corporate bonds. Almeida *et al.* (2012)

⁹ A propensity score matching (PSM) strategy was also considered, but it was ultimately decided against due to data limitations and concerns with bias. Further discussion of why the PSM approach was not used is available from the author on request.

¹⁰ Klug provide detailed data on estimated train carloadings broken down by commodity compared to the actual amounts transported. In total, only 84% of the estimated carloadings were actually transported in the first quarter of 1930.

¹¹ In fact, in the data I find that many companies actually decide to renew their programs early in 1929, which provides excellent variation in the timing of plan expiration.

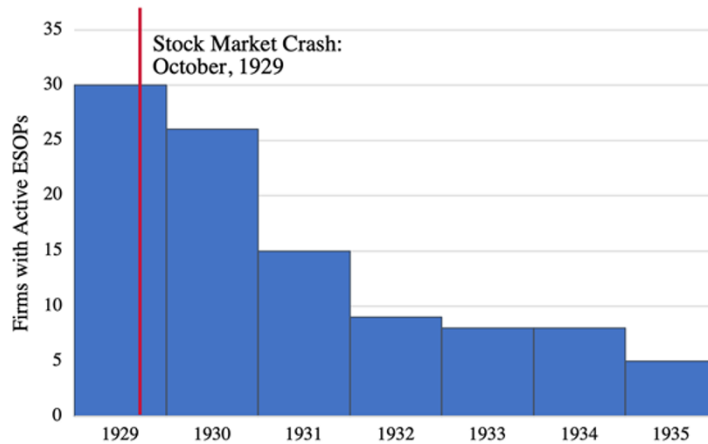


Figure 3. *Timing of ESOPs becoming inactive in main sample*

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928), and plan length data collected by author from various sources.

first used ex ante variation in the debt-maturity structure of long-term bonds to identify financial frictions during the 2007 crisis. Following this identification strategy, Benmelech, Frydman and Papanikolaou (2019) study the effect of financing frictions on firm changes in employment during the Great Depression. Instead of using the ex ante debt-maturity structure of long-term bonds, I use the pre-existing variation in employee stock ownership program expiration dates across firms to identify the productivity effects of the programs.

Figure 3 provides an overview of the baseline sample and shows the variation in timing of plan expiration. Since the study focuses on programs that expire after the stock market crash, 1929 is the year when the highest number of firms have active programs. The red line reflects the ‘event’ of the stock market crash in 1929 that rocked the securities markets (White 1990). In each year of the CoM data, the active group of firms or their establishments are compared to the analogous group whose plan had already expired (either before or after 1929). Table A4 in Appendix B provides a more detailed overview of the length and type of active, pre-Depression plans that make up the treated establishments in the main sample. This table shows that plans range from one and a half years to seven years in length. Balance tables are provided below to support the identifying assumption outlined here.

Table A3 in Appendix B breaks down the main dataset by industry and summarizes the number of firms (not establishments) which have ESOPs in each industry and their rate of survival through the Depression. Only firms that are multi-location companies appear in this aggregated sample. Ice and petroleum refining are the industries which have the most firms with employee stock programs. The various industries which have been collected to form the Census of Manufactures are

clearly not evenly distributed within the dataset (Vickers and Ziebarth 2018). This is expected because within each industry, the full population of establishments, and thus firms, were collected and not merely a random sample. Thus, it seems logical that the linoleum industry has many fewer firms than the beverages industry when we think in terms of the entire population of firms. The varying size of the industries and exposure to ESOPs provide strong reasoning for why controlling for industry-specific factors through fixed effects is important and will be discussed below.

Even though employee stock ownership programs were gaining popularity on the eve of the Great Depression, they were still more the exception than the rule at the time (National Industrial Conference Board, Inc. 1928). While there are over 1,000 firms in the dataset, only about 40 had ever had ESOPs by 1928. An additional advantage of studying the effects of the programs at the establishment level is the increase in the number of observations, especially for ‘treated’ establishments. ESOP firms have around seven branches on average with the median number being three in the main sample. Thus, there are some large outliers which will be discussed in the Section IV.

To further understand the validity of the identification strategy, the timing of plan expiration is broken down in Table 2. Each active, pre-Depression plan is grouped based on when it expires and their 1929 firm statistics are shown. The groups correspond to the timing of the Census of Manufactures data as they are grouped into two-year bins. While the categories are not even in terms of the number of firms whose programs expire in each window, the data do not suggest there is any clear trend. In terms of the mean, no one group dominates a majority of the variables.

With this background and summary of the main sample, the results of more rigorous tests for balance are presented with particular focus on establishment-level variables. Unfortunately, due to data limitations with the sample of CoM data, testing pre-trends for all observables is not possible. I am able to test for differences in stock prices and returns in the 1920s, however, using the data extracted from Center for Research in Securities Prices (CRSP). Panels A and B of Figure 4 present the difference-in-difference results before and after the stock market crash. The treated group is firms with active programs in 1929, and the coefficients of the treated indicator interacted with the year fixed effects are shown on the graphs. There appear to be no differences in prices or annual stock returns leading up to the crash between the treated and control groups.¹²

¹² Figure A5 and Table A5 in the Appendix provide further analysis of the firm-level stock market data including difference-in-differences coefficients for stock volatility and t-test statistics for stock prices, returns and volatility. The stock volatility parallel trends are not ideal as they suggest that ESOP firms have lower volatility in the pre-period. However, this is not a cause for concern as the magnitude of the difference is small leading up to the stock market crash and does not reflect economic significance in terms of realized volatility.

Table 2. *Company summary statistics by timing of rank-and-file ESOP expiration, 1929*

	Mean (1)	Median (2)	Obs. (3)
Inactive before 1929			
Average no. salaried employees	17	0	8
Average no. wage earners	2,302	1,020	8
Average value of production	10,400,000	6,673,458	8
Average hours plant operation (per week)	109.05	123.44	8
Average total wages	1,303,766	1,144,396	8
Inactive between 1929 and 1931			
Average no. salaried employees	24.067	0	15
Average no. wage earners	3,360	51	15
Average value of production	13,700,000	550,969	15
Average hours plant operation (per week)	124.44	168	15
Average total wages	599,456	23,778	15
Inactive between 1931 and 1933			
Average no. salaried employees	69.25	51	4
Average no. wage earners	10,812.65	1,300.42	4
Average value of production	52,100,000	61,800,000	4
Average hours plant operation (per week)	130.68	151.69	4
Average total wages	3,277,753	1,887,352	4
Inactive between 1933 and 1935			
Average no. salaried employees	216.75	12	4
Average no. wage earners	30,910	4,349	4
Average value of production	23,600,000	29,300,000	4
Average hours plant operation (per week)	126.74	140.08	4
Average total wages	2,297,674	2,285,306	4
Plans still active by 1935			
Average no. salaried employees	199.29	0	7
Average no. wage earners	5,830	3,784	7
Average value of production	54,600,000	28,100,000	7
Average hours plant operation (per week)	92.71	50	7
Average total wages	2,340,620	2,050,284	7
Total			38

Note: Firm-level data aggregated up from establishment-level data digitized by CoM. ESOP data collected from NICB, and plan length data collected by author from various sources.

For the variables where pre-trend data are unavailable, there is still one period before the crash that is analyzed.¹³ Table 3 summarizes the establishment-level 1929

¹³ It should be noted that there is also the potential of important omitted variables. That is, variables (possibly unobserved) that differentially affect treated versus untreated establishments that are not in the dataset. In this historical context, it is impossible to collect all the establishment-level data

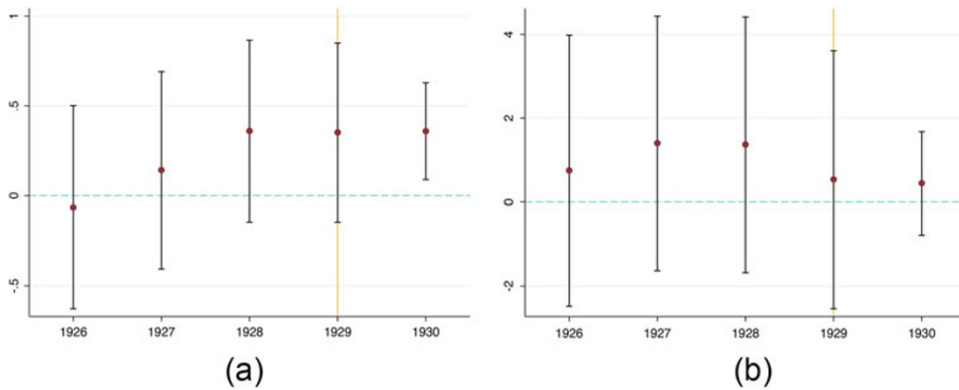


Figure 4. Stock market difference-in-differences coefficient plots (a) Parallel trends in stock prices between active and inactive firms (b) Parallel trends in stock returns between active and inactive firms

Notes: Monthly data extracted from Center for Research in Securities Prices (CRSP) and averaged to get annual data. Prices deflated to 1929 USD. Coefficients are from a difference-in-difference regression, and Inactive1929 firms in 1926 is omitted category. Black error bars represent 95 percent confidence intervals.

data and compares establishments of firms with active versus inactive programs before the stock market crash. Once industry and Federal Reserve district fixed effects are included in the regression, the conditional t-statistics show that the active and inactive establishments are similar before the stock market crash.

With the inactive bins at the establishment level, Table 4 shows the establishments are generally balanced on 1929 observables. Once the average number of wage earners is included as a control variable, only one t-statistic is significant and then only at the 10 percent level with an incredibly small coefficient estimate. It is expected that at least one test returns a significant result in a random sample of 24 t-statistics. Even so, the average hours a plant operates is included as a control variable in the main estimations where possible.¹⁴ With these tables suggesting the sample is balanced before the crash and consistent with the identification assumption, the next section presents the precise empirical model used to estimate the effects of employee stock ownership on establishment-level outcomes.

Based on the identification strategy defined above, the causal effect of employee stock ownership can be estimated using a straightforward difference-in-differences regression. In the main specifications, the dependent variable is the growth rate of various establishment-level outcomes of interest, where $g_{i,t} = \ln(y_{i,t}) - \ln(y_{i,t-1})$.

that I would prefer in the ideal scenario. However, this section seeks to rule out the possibility of omitted variables bias to the extent possible through the various treatment bins and balance tests.

¹⁴ Average hours a plant operates is missing in some years and causes the sample size to be reduced significantly in a few estimations.

Table 3. *Establishment summary statistics, 1929*

	Mean	SD	$\overline{\text{Active}} - \overline{\text{Inactive}}$	Uncond. T	Cond. T	N
Value of production	32.6	3.86	23.3	1.82*	0.56	277
Avg. hours plant operation (per week)	125	2.94	27.9	2.89***	-0.87	277
Avg. ind. days worked (per week)	6.22	0.13	0.28	0.66	-0.02	275
Avg. ind. hours worked (per week)	54.4	0.60	1.64	0.82	1.37	277
Total wages	2.74	0.32	1.41	1.34	0.97	276
Total salaries	0.93	0.23	0.44	0.57	0.00	277
Avg. no. wage earners	998	109	379	1.05	1.35	277

Note: Establishment-level data from Vickers and Ziebarth (2018). ESOP and plan activity data from National Industrial Conference Board, Inc. (1928) and various sources collected by author. All establishments of firms ever having ESOPs in CoM data included. Value of production, total wages and total salaries shown in millions of 1929 USD. T-statistics for equality of means based on whether ESOP active in 1929. Conditional t refers to outcome on active 1929 dummy with industry and Federal Reserve fixed effects as controls. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

The baseline regression specification is provided as equation (1) below.

$$g_{i,t} = \alpha_0 + \beta 1_{\text{Active}_{i,t}} + \alpha_2 1_{\text{Listed}_i} + \alpha_3 \ln(y_{i,t-1}) + \Gamma X_{i,t} + \omega_I \times \gamma_t + \nu_i + \varepsilon_{i,t} \quad (1)$$

The coefficient of interest which captures the growth effects of having an active rank and file ESOP during the Great Depression is represented by β . To accurately summarize this effect, the omitted category in the estimation is the group of rank-and-file ESOPs that are not active at time t . That is, the regression compares the establishments with ESOPs still active based on the predetermined length of the firm's contract and timing of renewal before the crash to establishments with programs that are already inactive.

The preferred regression also includes a dummy variable equal to one if the firm is listed on a major stock exchange. Listed firms may have differing access to financial capital and have more sophisticated financial reporting than private firms, and employees may more easily resell their shares if their employer is listed.

Other control variables include the initial level of the growth outcome variable, $y_{i,t-1}$, and a vector of establishment-level controls suggested by the balance tables above. This includes the number of wage earning employees and the average hours

Table 4. *Establishment conditional t-statistics, 1929*

	Inactive b/t 1929 and 1931	Inactive b/t 1931 and 1933	Inactive b/t 1933 and 1935	Still active post-1935	N
Value of production	1.25	0.57	1.04	2.59 [★]	272
Avg. hours plant operates (per week)	-0.97	0.65	-0.72	-0.52	272
Avg. ind. days worked (per week)	-0.23	0.03	0.68	0.21	270
Avg. ind. hours worked (per week)	1.38	1.54	1.50	0.34	272
Total wages	0.73	1.57	1.45	1.42	271
Total salaries	-0.08	0.26	0.09	0.35	272
Avg. no. wage earners	1.07	1.82 [★]	1.62	1.53	277
With additional controls					
Value of production	0.91	-0.86	-0.74	1.54	272
Avg. hours plant operates (per week)	-1.29	-0.17	-1.79 [★]	-1.31	272
Avg. ind. days worked (per week)	-0.24	0.02	0.65	0.20	270
Avg. ind. hours worked (per week)	1.37	1.51	1.45	0.33	272
Total wages	0.16	-0.28	-1.04	-0.27	271
Total salaries	-0.39	-0.63	-1.04	-0.46	272

Note: Establishment-level data from Vickers and Ziebarth (2018). ESOP and plan activity data from National Industrial Conference Board, Inc. (1928) and various sources collected by author. All establishments of firms ever having ESOPs in CoM data included. Conditional t refers to outcome on inactive dummy for specific window with industry and Federal Reserve fixed effects as controls. Bottom panel also includes average no. wage earners as control. ★, ★★ and ★★★ denote significance at the 10, 5 and 1 percent levels, respectively.

of operation for the establishment at time t .¹⁵ Finally, the preferred regression structure includes three sets of fixed effects: year by industry, year by Federal Reserve district and establishment denoted by $\gamma_t \times \omega_I$, $\gamma_t \times \delta_{FED}$ and ν_i , respectively. These fixed effects control for growth factors that may affect specific sectors and regions of the country in certain years.¹⁶

One important policy enacted during this period of study is the National Industrial Recovery Act (NIRA) which differentially affected economic sectors starting in 1933 (Roos 1937). It was a short-lived program that sought to stabilize employment in the economy during the Great Depression. President Roosevelt had a particular interest in the the automobile industry, which was prone to dramatic shifts in employment and production because of the demand for new car models (Cooper and Haltiwanger 1993). The year-by-industry fixed effects in the preferred regression will control for these shocks for companies in the automobile industry in my sample and should alleviate concerns about the NIRA affecting the coefficient estimates.

For a concrete example of how the identification of employee stock ownership works in practice, consider two similar tire manufacturers in the Census of Manufactures data, Kelly-Springfield and Firestone. Kelly-Springfield was founded in Springfield, Ohio, in 1894 and listed on the New York Stock Exchange in 1916 (Kelly Tires: Commercial Truck Tires; Jovanovic and Rousseau 2001). In December 1917, a rank-and-file employee stock ownership program was adopted, and by that point, the company had moved its headquarters to New York City (National Industrial Conference Board, Inc. 1928). Responding to the query by the National Industrial Conference Board, Inc. (1928), they state that they were no longer actively selling stock to employees by 1928.

Founded in 1900, Firestone Tire & Rubber was headquartered in Akron, Ohio (Sull 1999). In 1902, it adopted its first rank-and-file employee stock ownership program and was still actively selling stock to employees in 1928 (National Industrial Conference Board, Inc. 1928). This plan was renewed early in 1929 and was set to run for the following five years. Also in 1929, it was listed on the New York Stock Exchange (Jovanovic and Rousseau 2001).

In terms of the regression, all of the Kelly-Springfield establishments would always be in the inactive control group and the active indicator in equation (1) is always equal to zero. The establishments of Firestone Tire & Rubber, however, are all treated until their pre-Depression plan expires in 1934, when they move to the

¹⁵ In the preferred regression, these control variables are not interacted with the year fixed effects. However, these additional interactions are something I consider in Section IV.

¹⁶ The Federal Reserve district fixed effects in theory control for the different policies and approaches enacted by the districts in response to the Great Depression (Richardson and Troost 2009). In practice, the district fixed effects turn out to explain little variation. Table A6 in Appendix B shows the main table of results without these additional controls, and the coefficient estimates and significance levels are largely unchanged.

control group. Both companies are listed throughout the sample period, meaning the listed indicator variable is turned on, and the differences in their establishment-level outcome variables captured by the active indicator represent the causal effect of being locked into a program in 1929 through 1934. It should be noted that the identification strategy outlined above only applies to the structure of rank and file ESOPs, and selective programs are not studied here. Firms that only have selective ESOPs are excluded from the main dataset and thus are not included in the control group.¹⁷

I use an additional regression model to estimate the intensity of the effect of the ESOP becoming inactive. The bins in equation (2) are identical to the categories in the balance table. Instead of forcing the effects to be the same for each level of treatment, this specification allows the coefficient estimates to vary based on the duration of activity after 1929. The control variables and fixed effects are the same as in the baseline model.

$$g_{i,t} = \alpha_0 + \beta_1 1_{Inactive_{f,1929-31}} + \beta_2 1_{Inactive_{f,1931-33}} + \beta_3 1_{Inactive_{f,1933-35}} + \beta_4 1_{Active_{f,1935}} \\ + \alpha_2 1_{Listed_f} + \alpha_3 \ln(\gamma_{i,t-1}) + \Gamma X_{i,t} + \omega_I \times \gamma_t + \delta_{FED} + \nu_i + \varepsilon_{i,t} \quad (2)$$

The advantage of estimating the effects of these different treatment levels is that it allows me to see how the duration of the program matters and, specifically, whether there is a linear relationship between duration and growth. With the four β_j estimates above, the omitted category is the group of establishments or firms that never had an active program. Therefore, each coefficient should be interpreted as the effect of becoming inactive in the specified window as opposed to being inactive for the entire post-1929 sample.

IV

The most often cited motivation for a firm to offer an ESOP is to increase worker productivity, which holds for this early period of employee stock ownership as mentioned in Section II.¹⁸ The employee stock scheme increases firm profits if the increase in productivity outweighs the cost of the program, which consists of administrative fees and stock discounts. To test this main motivator, results of ESOPs' effects on a proxy for productivity, value of product, and for worker utilization,

¹⁷ There were only a few selective ESOPs identified in the CoM sample to begin with. For robustness, specifications with selective ESOPs included in the main sample were estimated with an indicator for having a selective program, but in most cases the coefficients were not significant and did not alter the remaining estimates.

¹⁸ A representative of New York Trust Company provides narrative evidence: 'The chief purpose of a company's efforts to enroll its employees as stockholders is to engage the interest of the rank and file of the workers. For the company itself there is no immediate financial gain. On the contrary, the stock is usually sold at less than its market price. The indirect profit to be realized by the company will depend upon the effect of stock ownership upon the workers.' *The Los Angeles Times*, 1 Sept. 1926.

hours worked for individual worker per week, are presented first. Beyond the productivity effects, we might expect management at companies with ESOPs to push their employees harder since the programs should encourage the workers' interest in the company's welfare. Estimating the effect of having an active program on a measure of worker utilization is a way to capture this.

Table 5 presents the results with the real value of output growth and average days worked per worker as the dependent variables. The size of the firm in terms of the number of wage earners and the hours of operation are included as control variables and versions of equation (1) are estimated as discussed in Section III. With these controls, the active indicator variable captures worker output and hours worked driven by having an active, employee stock-ownership program that employees are paying into at time t .

Table 5 shows that active programs have a negative effect on the real value of the output produced at the establishment level. This estimate is quite large, but recall that this is the average effect over a two-year period based on the establishment-level data structure.¹⁹ Columns (4) through (7) show ESOPs also have a statistically significant negative effect on average days worked per worker. Given the setting in the midst of the Great Depression, it seems unlikely that employees are the ones choosing to work less. Instead, it seems reasonable that the managers at the establishment are cutting back their hours for various reasons. Nevertheless, these results suggest establishments with active ESOPs could have better utilized their workforce, especially if these programs were intended to attract high-quality, loyal employees.

Instead of forcing the effect of having an active program be the same in each period, Table 6 estimates equation (2), which allows the effect to vary depending on how long the program is in place after the crash. The control variables are unchanged from the previous table. Column (3) is the preferred regression which controls for establishment size, and Figure 5 is a visual representation of the coefficients which capture these differing effects.

Column (3) of Table 6 shows that there is an increasingly negative effect the longer the program is active following the 1929 stock market crash. Further, Figure 5 suggests the effect is linear. This provides additional evidence that I am capturing the causal effects of these programs as it suggests the longer employees are paying into these programs, the lower their effort and in turn their real output.

With these baseline results of reduced productivity and worker utilization established, this section presents possible mechanisms driving worker behavior. In doing so, it explains what factors and employee characteristics a firm should account for when deciding whether to implement such a program.

¹⁹ Placebo tests using randomized treatment dates for when establishments have an active ESOP were also conducted to validate the significance of the active coefficient in column (3). Using the placebo distribution, the coefficient was significant with a p-value of 0.011. The histogram from these placebo tests is available upon request.

Table 5. *Effects of ESOP activity on establishment productivity*

Dependent Variable:	$g_{\text{RealValueProduct}_{i,t}}$			$g_{\text{AveDaysWorkedPerWorker}_{i,t}}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Active	−1.038 (0.650)	−1.038 [★] (0.650)	−1.112 [★] (0.593)	−0.188 ^{***} (0.038)	−0.197 ^{***} (0.051)	−0.193 ^{***} (0.050)	−0.190 ^{***} (0.048)
Initial value	−1.009 ^{***} (0.152)	−1.009 ^{***} (0.152)	−1.015 ^{***} (0.155)	−0.267 (0.241)	−0.234 (0.189)	−0.227 (0.191)	−0.173 (0.189)
Listed		1.379 ^{***} (0.342)	−0.076 (0.791)		−0.012 (0.038)	−0.009 (0.036)	−0.004 (0.033)
No. wage earners			0.664 [★] (0.354)			−0.005 (0.009)	−0.004 (0.008)
Hours of operation							−0.037 (0.031)
Establishment FE?	Yes	Yes	Yes	No	No	No	No
Year×industry FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year×Fed District FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	336	336	335	102	102	102	102
R-squared	0.925	0.925	0.927	0.615	0.616	0.617	0.630

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment-level data from Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. Columns (5) through (7) only present a cross-section due to missing data and do not include establishment or year fixed effects. Robust standard errors are given in parentheses. ★, ★★ and *** denote significance at the 10, 5 and 1 percent levels, respectively.

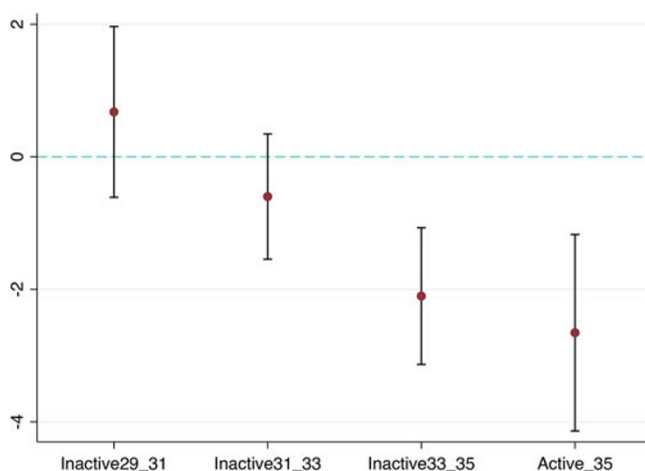


Figure 5. *Intensity of treatment on output over time*

Note: Graphical representation of coefficients from column (3) of Table 6. The omitted category is establishments which had an inactive ESOP in 1929. Black error bars represent 95 percent confidence intervals.

To more directly understand the role of the stock market in discouraging workers and leading to decreased establishment-level output growth, Table 7 adds in stock price and return data from the Center for Research in Securities Prices (CRSP) for listed firms ever having ESOPs in the CoM data. Due to many ESOP firms not being listed, the sample size falls substantially for these results. Nevertheless, they provide suggestive evidence that stock prices and returns are significantly related to productivity. Column (3) includes an interaction between having a negative return and an active program. Since having a non-negative return and an active program is the omitted category, the interaction coefficient shows that the overall negative productivity effect from having an active program becomes stronger for companies with worse returns.

To get a better understanding of the varying effects of the free-rider problem, I next study real output while directly controlling for the size of the firm. A small firm is defined as a company having fewer than 2,770 total employees, which is the first tercile, or the 33rd percentile, for firms ever having ESOPs in 1929. The free-rider problem is believed to be mitigated in smaller companies where one employee's effort level can more directly affect firm profit (Blasi, Conte and Kruse, 1996). If employees believe their individual choice to work harder can have non-negligible effects on the stock price, the firm is more likely to see increased productivity.

In Table 8, the coefficient for the small firm, active interaction in column (2) is positive and statistically significant consistent with the narrative that incentive effects of ESOPs are more powerful in smaller firms. For comparison, columns (3) and (4) of Table 8 include an indicator for being a small establishment, which is defined as

Table 6. *Effects of intensity of ESOP activity on establishment output growth*

Dependent variable:	$\Delta \ln \text{RealValueProduct}_{i,t}$		
	(1)	(2)	(3)
Inactive _{1929–1931}	0.890★ (0.476)	−0.251 (0.467)	0.677 (0.650)
Inactive _{1931–1933}	0.325 (0.326)	−0.817 (0.517)	−0.601 (0.477)
Inactive _{1933–1935}	−1.403*** (0.342)	−2.545*** (0.547)	−2.102*** (0.521)
Active 1935	−0.540** (0.249)	−1.681*** (0.526)	−2.655*** (0.748)
Initial value	−1.020*** (0.152)	−1.020*** (0.152)	−1.026*** (0.156)
Listed		−1.141** (0.549)	−2.067*** (0.719)
Total wage earners			0.625★ (0.355)
Establishment FE?	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes
R-squared	0.922	0.922	0.923
Obs.	336	336	335

Note: ESOP data collected from NICB and various sources collected by author. Firm-level data aggregated up from establishment-level CoM data digitized by CoM. Due to data availability, data on wage earners is the average of monthly data on wage earners. All firms ever having ESOPs in CoM data are included. The omitted category is establishments which had an inactive ESOP in 1929. Robust standard errors are given in parentheses. ★, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

the first tercile of the average number of wage earners in the establishment sample. In contrast to firm size, the size of the establishment has no statistically significant relationship with output growth. While the results thus far suggest that there is a significant negative effect of having an active ESOP during the Great Depression, this response dissipates when the free-rider problem is at least partially mitigated. The fact that the size of the establishment does not seem to matter suggests that employees may have accounted for how their individual effort affects the stock price, which depends on the size of the firm and not the size of the establishment.

Next, I turn to compensation to understand how employees may have been discouraged by a falling return to labor. The Census of Manufactures dataset has detailed information on total wages at the establishment level. Wage growth might be expected to fall when a company has an active ESOP for two reasons. Mechanically, most companies allowed employees to extract a certain percentage of

Table 7. *Effect of ESOPs and stock performance on establishment output growth*

Dependent variable:	$\mathcal{G}^{\text{RealValueProduct}}_{i,t}$		
	(1)	(2)	(3)
Active	-1.00*** (0.247)	-0.300 (0.192)	-0.513 (0.295)
Stock price	1.725*** (0.374)		
Total return		0.248*** (0.054)	
LowReturn $\times$ Active			-4.217** (1.492)
Initial value	-0.860*** (0.285)	-0.860** (0.285)	-0.860** (0.285)
Establishment FE?	Yes	Yes	Yes
Year $\times$ industry FE?	Yes	Yes	Yes
Year $\times$ fed district FE?	Yes	Yes	Yes
Observations	67	67	67
R-squared	0.952	0.952	0.952

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by author. Establishment-level data from CoM data digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Stock price and return data extracted from CRSP. All establishments ever having ESOPs in CoM data are included. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

their wages each month to go directly to purchasing company stock. Unfortunately, I am unable to discern if total wages in the United States Census of Manufactures data consists of net wages, after this deduction has been taken, or gross real wages. If it is net, then a strong, causal relationship is expected. Otherwise, a negative effect would reflect a substitution between real wages and stock benefits by the firm. This second mechanism allows firms to defer payments to employees until a future period when it may pay dividends and likely represents a key advantage of these programs for firms struggling to pay employees during the depths of the Great Depression.

The first two columns of Table 9 suggest that there is not a strong effect overall before the timing of becoming inactive is taken into account. The final two columns of Table 9, however, suggest there is indeed a strong, negative causal effect of having an active pre-Depression plan on wage growth, specifically for establishments with plans expiring after 1931. The omitted category remains establishments whose programs were inactive prior to 1929. The coefficient estimate for the group of establishments with active programs in 1935 is still negative, but it breaks the linear pattern seen before and is only significant at the 10 percent level, as shown by

Table 8. *Effects of ESOP activity on output growth in small establishments*

Dependent variable:	$\Delta \text{RealValueProduct}_{i,t}$			
	(1)	(2)	(3)	(4)
Active	-0.421** (0.197)	-0.477** (0.206)	-0.530*** (0.189)	-0.601*** (0.054)
Small firm	0.164 (0.245)			
Small firm $\times$ active		0.422* (0.237)		
Small estab.			-0.303 (0.290)	
Small estab. $\times$ active				-0.312 (0.321)
Initial value product	-0.605*** (0.053)	-0.604*** (0.053)	-0.601*** (0.054)	-0.601*** (0.054)
No. wage earners	0.731*** (0.090)	0.730*** (0.090)	0.684*** (0.103)	0.684*** (0.103)
Listed	-0.300 (0.207)	-0.323 (0.212)	-0.368* (0.199)	-0.366* (0.198)
Year $\times$ industry FE?	Yes	Yes	Yes	Yes
Year $\times$ fed district FE?	Yes	Yes	Yes	Yes
Observations	335	335	335	335
R-squared	0.776	0.777	0.777	0.777

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. Small is defined as being below the first tercile for either establishments or firms based on the distribution of the average number of wage earners. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Figure 6. It is not obvious why this would be the case, but it suggests that those firms whose plans are active the longest do not see their wages fall quite as much as other firms with programs.

One potential explanation is that these plans do not require employees to deposit as high a percentage of their wage income into their employee stock account for these longer plans. Or rather, it may reflect employees finishing their subscription payments earlier in the sample before the expiration of the plan and starting to see their wages rebound. Even without statistically significant lower wages, Figure 5 still shows that output is significantly decreased for establishments with active plans in 1935. This might suggest that current lower real wages are not the only mechanism

Table 9. *Effect of ESOPs on real wage growth*

Dependent variable:	$g\text{RealWagesPerWorker}_{i,t}$			
	(1)	(2)	(3)	(4)
Active	0.043 (0.087)	0.043 (0.087)		
Inactive _{1929–1931}			0.510** (0.201)	0.027 (0.104)
Inactive _{1931–1933}			0.026 (0.150)	−0.457* (0.232)
Inactive _{1933–1935}			−0.673*** (0.030)	−1.157*** (0.220)
Active 1935			0.108*** (0.011)	−0.375* (0.203)
Initial wages (per worker)	−1.321*** (0.112)	−1.321*** (0.112)	−1.323*** (0.111)	−1.323*** (0.111)
Listed		0.673*** (0.030)		−0.483** (0.207)
Establishment FE?	Yes	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes	Yes
Observations	385	385	385	385
R-squared	0.863	0.863	0.863	0.863

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928). Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. Robust standard errors clustered at the firm level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

leading to reduced output, or periods of lower wages may have a more permanent productivity effect.

Various robustness tests which further validate the results presented are discussed next.

To ensure the main, establishment-level results are not contingent on the specific regression or driven by any individual firm, the above results are rerun with various alterations. First, given the wide range in the number of branches across firms, the largest company in terms of number of establishments in the dataset is excluded and the results re-estimated. The largest company overall is United States Steel, having 92 establishments. US Steel had an active pre-Depression plan that expired in 1934 putting it in the treated category until the 1935 panel. With this firm excluded, the sample size becomes smaller, of course, but the qualitative results remain consistent.

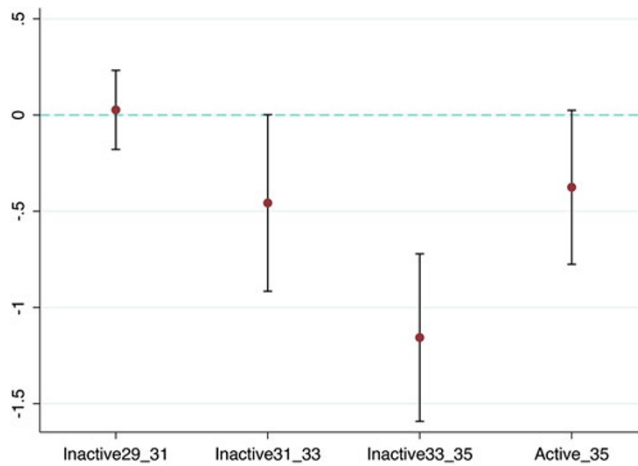


Figure 6. *Intensity of treatment on wage growth over time*

Note: Graphical representation of coefficients from column (4) of Table 9. The omitted category is establishments which had an inactive ESOP in 1929. Black error bars represent 90 percent confidence intervals.

The signs of the coefficients and their significance levels generally hold with this subsample. These tables and the others mentioned in this section can be found in Appendix B.

I additionally altered the main sample and reran the results after excluding all 1935 observations. This is to ensure that the year when there are the fewest treated firms and establishments is not driving the results. The key results remain consistent with this 1929 to 1933 subsample, and this should alleviate concerns that the firms with plans expiring post-1935 are greatly affecting the results.

Going back to the full sample of establishments, I also adjust the main regression by interacting the control variables with year fixed effects. This ensures that changes in the work force or number of branches over time are not driving the effects of employee stock ownership. The main results are again robust to this more rigorous specification, as shown in Table A13 in Appendix B.

Previous iterations of this project have also studied the entire, unbalanced sample of firms and establishments. That is, all branches in the Census of Manufactures data regardless of their history with employee stock ownership programs were included, and the coefficients were measured by interacting ESOP and active indicators. For the sake of space, these results are not presented but are available upon request. Except for a few differences in the level of significance, they are consistent with the results discussed in above, albeit these results cannot be interpreted causally due to the unbalanced nature of the entire CoM sample.

With these robustness tests completed, the reader should feel confident about the reliability of the main results on productivity.

Arguably the most prominent question in the theoretical literature on employee stock ownership is if and how these programs can increase worker effort for the firm. Tables 5 and 6 present results counter to principal–agent theory. Instead of aligning workers’ payoffs with firm profitability, the results suggest employees were less productive as a result of having part ownership of the firm during the Great Depression. Overall real output and average days worked controlling for firm size and hours of operation fell because of these active programs.

Any firm profit model seeking to reflect worker behavior when participating in this type of program should account for the worker’s personal value of the stock. This includes the real return on the investment and the employee’s standing within the company (whether they feel like a vital member of a team or a cog in the proverbial machine). Table 7 suggests that a negative return on investment can disincentivize workers. Table 8 shows, however, that workers may value stock more in smaller firms where they feel they can have more of an effect on its price movements. Additionally, when employees give up their wage to purchase stock that rapidly loses its value, this further discourages them. These results provide a cautionary tale for profit-maximizing firms: offering stock to incentivize employees can have negative ramifications when aspects like returns, firm size and wage growth are not taken into account.

The introduction suggests another theory beyond solving the principal–agent problem that could explain a firm’s motivation to offer an employee stock-ownership program: efficiency wage theory. In the traditional sense, efficiency wages, that is wage rates above market-clearing, should increase worker effort since the opportunity cost of being fired is higher (Shapiro and Stiglitz 1984).

The historical setting analyzed here allows me to understand if this relationship changes when the real benefit to working falls below the market level. Recall that ‘efficiency wages’ here consist of a worker’s real wage plus their payoff from stock ownership. Instead of this package surpassing the value of market wages as intended, the drastic fall in stock prices often led to a cut in total benefits in real terms (National Industrial Conference Board, Inc. 1930). This is precisely what Table 7 reflects, specifically column (3). In column (3), the effect of having an active program on its own is not statistically significant, but its interaction with having a negative annual return is negative and statistically significant. The unexpected, low realized payoff thus served to disincentivize employee effort. This empirical study of employee stock ownership during the Great Depression thus provides an example where uncertainty in the realized employee benefits package can have negative consequences.

Furthermore, there is reason to believe my results may be attenuated for the later sample years. A few of these firms did renew their programs after their pre-Depression plan expired, but based on the identification discussed, these firms and their establishments are still considered inactive (Davis 1933). Therefore, firms that actually have ongoing employee stock-ownership programs would be included in the control group and could be influencing those results. While plan renewals often had different prices and installment schedules that may have made the programs more

favorable to employees, this suggests that the true negative effects of employee stock ownership on production could be greater.

At first, these productivity results seem to contradict the well-documented claim that the 1930s were the most productive decade in the twentieth century (Field 2003). Field's paper, however, emphasizes the second half of the decade and notes high productivity being concentrated in specific industries, particularly novel sectors for the 1930s. Recall that the majority of employee stock-ownership firms in this period had a long history and were concentrated in developed industries. Further, the data coverage for my productivity results is for the early period of the Great Depression, not the entire decade. The results in this article thus provide a more nuanced perspective on how the first employee stock-ownership programs may have stunted productivity early in the 1930s.

V

The novel data collected and the results discussed in this article have shed additional light on the complexities of employee stock ownership. During the Great Depression, employee stock-purchase programs did have an effect on production. Using the long-term structure of stock contracts and the quasi-random variation in their expiration for identification, I document a negative effect on real output and hours worked that has not been reported in the previous literature in any context. As a whole, and for large firms especially, the Great Depression results suggest employee stock ownership does work through price appreciation and efficiency-wage-type incentives and not primarily through group cohesion or pride in ownership.

A profit-maximizing firm should, thus, take into account their employees' value of stock ownership when deciding to implement a program. This setting shows workers may have various responses to these programs depending on the asset's return, their ability to affect the price and what they are sacrificing to become shareholders. The Great Depression provides a unique environment where the real payoff to working continued to fall and suggests most employees were disincentivized to work their hardest. Employees at smaller firms may have valued their individual stocks more since they felt they could alter the price through increased productivity going forward. However, this mechanism only mitigates the negative productivity results seen in this period.

The results and accompanying discussion suggest that one model or theory alone cannot fully explain the various effects of employee stock ownership across firms. This article makes strides at applying an alternative efficiency-wage theory to ESOPs during the Great Depression and shows that the theory is consistent with the results for large companies, but incentive-compatibility more accurately explains some of the differing effects exhibited by smaller firms. Further narrowing down cases where the effects of employee stock ownership align with specific theories in the historical or modern setting is a promising area for future research.

In many ways, this research introduces additional questions regarding the popularity of these types of programs today. It is unclear if any lessons were learned from this early experience and why these programs continue to gain popularity. While I have mentioned some parallels to the early employee stock programs during the Great Depression and modern ESOPs, investigating these precise relationships and their evolution is left to future research.

Additional study should also be given to the various motives that led companies to reintroduce employee stock programs later in the twentieth century. The role of labor unions has been mentioned as driving these programs, but to my knowledge no empirical analysis has been conducted (Ott 2011). Further, this article focuses solely on manufacturing establishments, but employee stock-ownership plans were prevalent in other industries, such as banking and financial services. Comparing the manufacturing results to other sectors of the economy could highlight key differences in employee stock programs, in practice.

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Appendices

Data collection process

The two main datasets which form the foundation for this empirical study are the ‘United States Census of Manufactures, 1929–1935’ and ‘Employee Stock Purchase Plans in the United States’ (Vickers and Ziebarth 2018; National Industrial Conference Board, Inc. 1928). For this article, it was important to correctly group establishments with other establishments in the same company to correctly assign the treatment of ESOP to the whole company, where appropriate. Due to the handwritten nature of the original survey data, typos and inconsistencies were present throughout the original digitized dataset.

First, only establishments labeled as branches/subsidiaries of a larger company were kept in the main sample. Any establishment not identified as a subsidiary of another company was dropped. Then, I used basic cleaning codes in Stata to fix the straightforward issues in the dataset, such as varying capitalization, extra spacing and punctuation in the owner name. Then using the plant name, owner name and parent firm information, I was able to go through the branched sample by hand and correct any typos, which were most commonly misspellings.

An additional issue to deal with is the large number of mergers and acquisitions throughout the 1920s. Therefore, I had to determine which subsidiaries were owned by parent firms in the dataset, which was not always obvious. It was also necessary to understand whether these subsidiaries had access to the ESOP at the time of acquisition. Historical annual company reports which I accessed through ProQuest Historical Annual Reports and various editions of *Moody's Investment Manual* provided information on subsidiaries and often had a line item which allowed me to determine if employees of subsidiaries had the same access to the employee stock ownership program.

The National Industrial Conference Board, Inc. (1928) data provide extensive information on who had active or inactive ESOPs in 1928, when it was published. However, I had to extend these data to match the period covered by the Census of Manufactures. An additional study by the National Industrial Conference Board as well as other contemporary sources on ESOPs were used to fill in these data as well as understand when exactly these programs were active. Historical newspaper articles also were utilized as companies often advertised new stock offerings for their employees in the local publications. The published studies and books were the first stage of filling in these data on ESOPs in specific companies. The next stage was reading through historical annual company reports and letters to stockholders. Often, these reports and letters contained data about the latest offering and sometimes provided insight into how many employees were currently participating in the program. Figure A2 shows an example of a balance sheet which lists the precise number of employee stock contracts in 1930. Where available, data on participation were collected, but reporting methods differ substantially from company to company. Finally, newspapers were the final stage to understand the length and the

terms of the various ESOPs. Figure A3 provides an example of how newspaper articles were used to complete the dataset or cross-reference dates.

Once each separate dataset was cleaned and expanded to address the main research question about firm productivity, the final major step was to merge the two data sources together. This was done by hand by searching through the Census of Manufactures dataset for specific company names. To confirm the ESOP company was the same firm present in the Census of Manufactures data, I made sure the company's main industry and the headquarter location match across both datasets. Similarly, I matched the data on which firms were listed on a major stock exchange from Jovanovic and Rousseau (2001) manually by searching the company names in the cleaned Census of Manufactures data.

As much of the data was collected and cleaned by hand, there is the potential for human error. The most likely form would be an error in matching establishments to their parent firm. As mentioned, these schedules were written by hand and encoded at the establishment level (Vickers and Ziebarth 2018). I went through each establishment line by line to determine if it was a part of a larger firm. If an incorrect match occurred and the incorrectly matched firm had an active ESOP, this would cause an establishment to be incorrectly 'treated'. I believe this type of incorrect match would bias my results closer to the null of ESOPs having no effect.

A second possible measurement error is that I incorrectly coded the timing of the ESOP's active period (either a program ends too early in the data or goes on too late). I find this unlikely because I did cross-reference with other sources for the timing data where possible, but I cannot fully rule it out. Nevertheless, I have no reason to suspect that one timing scenario is more likely than the other. I believe this type of timing error would further attenuate the results, and thus the significance of the treatment variable in the main tables should be robust to any random, unintentional measurement errors in the data.

Appendix A. *Additional figures*

Form S. N. 518-I

**STATEMENT OF ACCOUNT UNDER
SUBSCRIPTIONS FOR CAPITAL STOCK OF THE
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
UNDER 'EMPLOYEES' STOCK PLAN DATED MAY 1, 1921**

Name *Alice Gray* **Date** *December 31, 1925.*

Month in Which Deductions from Pay Began	Number of Shares	Price	Amount Deducted to Date	Interest Credit to Date at 7% (See Note)	Total Credit to Date
<i>April, 1924</i>	<i>1</i>	<i>118.00</i>	<i>63.00</i>	<i>3.98</i>	<i>66.98</i>
<i>March, 1925</i>	<i>2</i>	<i>121.00</i>	<i>60.00</i>	<i>1.78</i>	<i>61.78</i>
<i>August, 1925</i>	<i>3</i>	<i>125.00</i>	<i>45.00</i>	<i>.66</i>	<i>45.66</i>
This amount represents your accumulated savings to date on the above subscriptions					\$174.42

NOTE: If subscriptions are canceled before completion the interest credit will be computed at 6% instead of 7%.

Figure A1. *Sample employee stock ownership form*

Source: National Industrial Conference Board, Inc. 1928.

The Firestone Tire & Rubber Company		
CONSOLIDATED BALANCE SHEET		
<u>ASSETS</u>		
<u>Current</u>		
Cash	\$11,613,286.89	
Customers' Notes and Accounts Receivable, less Reserve	19,134,779.73	
Inventories of Finished and In Process Products at cost, Materials and Supplies at the lower of cost or market	<u>35,995,720.15</u>	\$ 66,743,786.77
<u>Other Assets</u>		
Employees' Stock Contracts secured by 236,515 shares of Common Stock of The Firestone Tire & Rubber Company	\$ 3,346,880.07	
Securities owned—at cost (\$391,750 deposited in escrow)	2,624,140.77	
Miscellaneous Accounts and Advances, less Reserve	<u>1,828,172.04</u>	7,799,192.88

Figure A2. Sample of consolidated balance sheet for Firestone Tire & Rubber Company

Source: The Firestone Tire & Rubber Company Annual Report, 1930.

Employees Get N. J. Standard Stock at \$34.18

More Than 400,000 Shares
Distributed to 16,500 in
Fourth Acquisition Plan

Buy 2,117,000 Since '21

Cost Under Program Below
Current Price of 41½

Marking the fourth time such a distribution has been made, a large group of employees of the Standard Oil Company of New Jersey yesterday received shares of the company's common stock of a total value of \$16,000,000. The stock has been accumulating in the hands of trustees in behalf of employees who elected to participate in the company's stock acquisition plan over the last three years ended December 31. Distribution will be made to 16,500 men and women of more than 400,000 shares of New Jersey common stock, which closed yesterday at 41½.

The company's first stock acquisition plan, begun in 1921, ran for five years. Two subsequent plans each were concluded in three years and, with the completion of the fourth plan, a fifth, which also is to run for three years, was initiated on January 1.

Figure A3. Sample of articles used to cross-reference dates of programs
Source: ProQuest Historical Newspapers: New York Tribune.

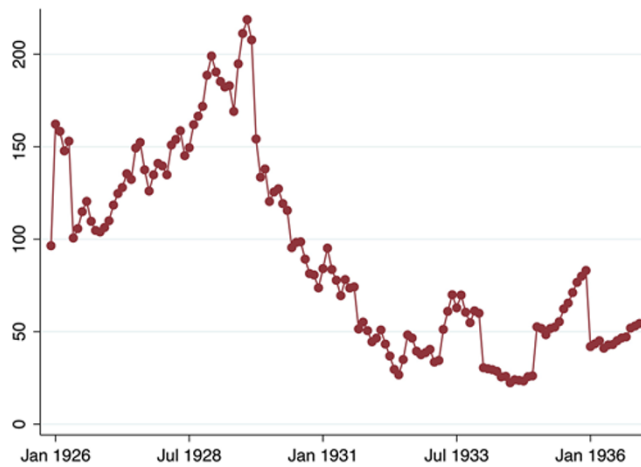


Figure A4. *Stock prices in listed sample over period of interest*

Notes: Monthly data extracted from Center for Research in Securities Prices (CRSP) and averaged to get annual data. Prices deflated to 1929 USD.

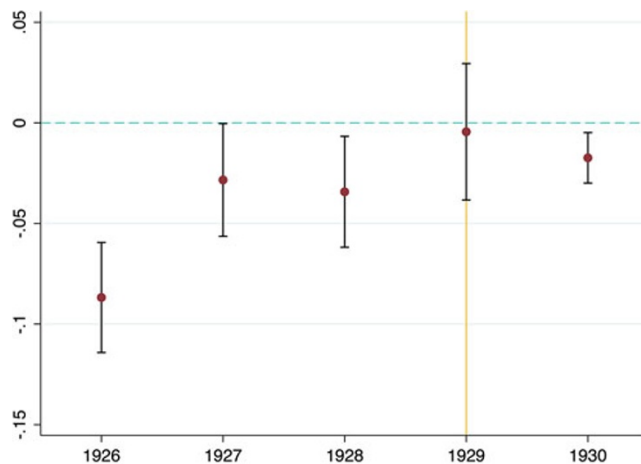


Figure A5. *Parallel trends in stock volatility between active and inactive firms*

Notes: Monthly data extracted from CRSP. Volatility measured using standard deviation of monthly price data according to Schwert (1989). Prices deflated to 1929 USD. Coefficients are from a difference-in-difference regression, and Inactive1929 firms in 1926 is omitted category. Black error bars represent 95 percent confidence intervals.

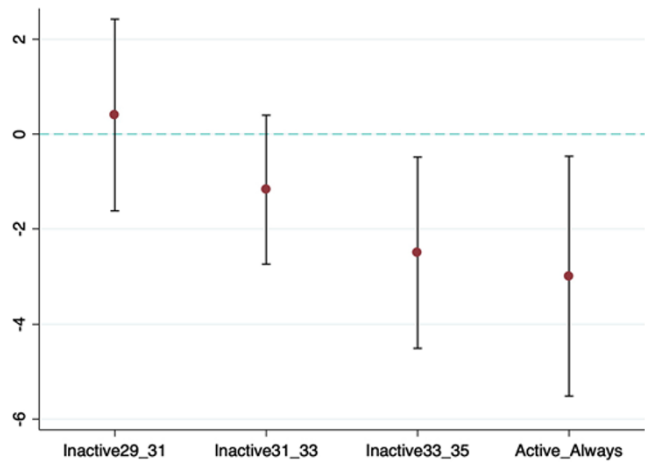


Figure A6. *Intensity of treatment on output growth over time, excluding largest firm*
Notes: Graphical representation from column (3) of Table A8. The omitted category is establishments which had an inactive ESOP in 1929. Black error bars represent 95 per cent confidence intervals.

Appendix B. *Additional tables*

Table A1. *Years companies adopted employee stock purchase programs*

Year	No. of companies
1900 or earlier	3
1901–5	14
1906–10	13
1911–15	30
1916–20	111
1921–5	162
1926–7	17
No information	39

Source: National Industrial Conference Board, Inc. (1928), p. 2.

Table A2. *Installment periods and prices of securities by employees*

	Rank and file	Selective	Total
Installment period			
No deferred payments	12	2	14
One year or less	44	2	46
Over one year	151	13	164
No information	144	21	165
Price			
Par	121	15	136
Percentage below par	20	1	21
Flat reduction from par	3	0	3
Market	115	16	131
Percentage below market	15	4	19
Flat reduction from market	63	3	66
Not specified	15	1	16

Source: National Industrial Conference Board, Inc. (1928), pp. 72, 83.

Table A3. *ESOPs and firm survival by industry*

Industry	Firms	ESOPs	Year earliest ESOP	Survive	% surviving
Beverages	67	0	NA	11	16
Ice cream	149	1	1914	36	24
Ice, manufactured	240	10	1919	67	28
Macaroni	4	0	NA	2	50
Malt	3	1	1923	3	100
Sugar, cane	2	0	NA	1	50
Sugar, refining	3	1	1918	2	67
Cotton goods	99	3	1900	37	37
Linoleum	1	0	NA	1	0
Planing mills	181	0	NA	27	15
Bone black	4	0	NA	2	50
Soap	17	4	1886	5	29
Petroleum refining	43	6	1920	12	30
Rubber tires	5	1	1924	1	20
Cement	14	1	1903	5	36
Concrete products	87	1	1923	17	20
Glass	20	1	1924	10	50
Blast furnaces	18	2	1918	7	39
Steel works	44	2	1920	18	41
Agricultural implements	16	3	1909	10	63
Aircraft and parts	18	1	1917	5	28
Motor vehicles	15	1	1923	4	27
Cigars and cigarettes	5	1	1919	4	80
Radio equipment	25	1	NA	2	8
Total	1,080	41		289	

Note: Firm-level data aggregated up from establishment-level data digitized by Vickers and Ziebarth (2018). ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by author.

Table A4. *Summary of rank-and-file employee stock ownership programs*

Company name	Stock type	Start date	End date	Program duration
Allegheny Steel Co.	Both	1927	1934	7 years
American Ice Co.	Common	1927	1930	4 years
American Rolling Mill Co.	Common	1929	1931	1.5 years
American Sugar Refining Co.	Both	1929	1931	2.5 years
American Tobacco Co.	Preferred	1929	1935	7 years
Arkansas Power	N/A	1926	1929	3 years
Bethlehem Steel Co.	Preferred	1929	1932	3 years
Bemis Brothers	N/A	1928	1930	2 years
Colgate-Palmolive-Peet Co.	Both	1928	1934	6 years
Firestone Tire and Rubber Co.	Common	1929	1935	6 years
General Motors Corp.	Preferred	1928	1929	2 years
H. P. Hood & Sons	Common	1926	1930	4 years
International Harvester	Preferred	1929	1935	6 years
Kansas City Power	N/A	1928	1930	2 years
Long-Bell Lumber	Common	1925	1930	5 years
Middle West Utilities	Common	1928	1930	2 years
Monongahela West Penn	N/A	1925	1929	4 years
Procter & Gamble Co.	Common	1929	1 January 1935	6 years
Public Service Co. of Oklahoma	N/A	1928	1930	2 years
Simmons Company	N/A	1925	1929	4 years
Sears, Roebuck & Co.	Common	1926	1931	5 years
Standard Oil Co. (Indiana)	Both	31 March 1929	31 March 1932	3 years
Standard Oil Co. (New Jersey)	Both	1 January 1929	31 December 1931	3 years

(Continued)

Table A4. (Continued)

Company name	Stock type	Start date	End date	Program duration
Standard Oil Co. (New York)	Both	1927	31 July 1931	4 years
Standard Oil Co. (California)	Both	1926	1930	4 years
Swift & Co.	Both	1928	1935	7 years
Tampa Electric	Both	1926	1930	4 years
Tide Water Oil Co.	Both	1929	1931	1.5 years
Union Oil Co. of California	Both	1928	1930	2 years
United States Steel Corp.	Common	1928	1934	6 years

Notes: Company data on employee stock ownership for firms with active programs that appear in main dataset. Various sources used including National Industrial Conference Board, Inc. (1928, 1930); Baker (1932); Davis (1933); and various company annual reports for 1929–35.

Table A5. *Mean-difference tests of firm stock characteristics*

	Mean	SD	$\overline{\text{Active}} - \overline{\text{Inactive}}$	Uncond. T	Cond. T	N
Stock price	128	14.97	16.56	0.54	-0.59	57
Stock returns	-0.02	0.13	0.05	0.19	0.15	57
Stock volatility	108	2.96	1.82	0.30	-0.86	57

Note: Monthly data extracted from Center for Research in Securities Prices (CRSP) and averaged to get annual data. Prices deflated to 1929 USD. ESOP and plan activity data from National Industrial Conference Board, Inc. (1928) and various sources collected by author. All firms ever having ESOPs in CoM data included. T-statistics for equality of means based on whether ESOP active in 1929. Stock volatility is measured using the monthly standard deviation of stock prices over the year according to Schwert (1989). Conditional t refers to outcome on active 1929 dummy with industry fixed effects as controls. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A6. *Effects of ESOP activity on establishment productivity without district FEs*

Dependent variable:	$\mathcal{L}^{RealValueProduct}_{i,t}$			$\mathcal{L}^{AveDaysWorkedPerWorker}_{i,t}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Active	-1.065 [★] (0.595)	-1.065 [★] (0.595)	-1.143 [★] (0.581)	-0.144 ^{★★} (0.058)	-0.170 ^{★★} (0.085)	-0.178 ^{★★} (0.082)	-0.178 ^{★★} (0.082)
Initial value	-1.115 ^{★★★} (0.158)	-1.115 ^{★★★} (0.595)	-1.123 ^{★★★} (0.160)	-0.531 ^{★★★} (0.163)	-0.449 ^{★★★} (0.090)	-0.437 ^{★★★} (0.090)	-0.404 ^{★★★} (0.087)
Listed		1.438 ^{★★★} (0.431)	-0.047 (0.804)		-0.037 (0.052)	-0.042 (0.049)	-0.040 (0.049)
No. wage earners			0.697 ^{★★} (0.340)			0.006 (0.006)	0.007 (0.006)
Hours of operation							-0.024 (0.015)
Establishment FE?	Yes	Yes	Yes	No	No	No	No
Year×industry FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year×fed district FE?	No	No	No	No	No	No	No
Observations	336	336	335	102	102	102	102
R-squared	0.903	0.903	0.906	0.480	0.495	0.498	0.504

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment-level data from (Vickers and Ziebarth 2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. Columns (5) through (7) only present a cross-section due to missing data and do not include establishment or year fixed effects. Robust standard errors are given in parentheses. ★, ★★ and ★★★ denote significance at the 10, 5 and 1 percent levels, respectively.

Table A7. *Effects of ESOP activity on establishment productivity, excluding largest firm*

Dependent variable:	$\mathcal{L}RealValueProduct_{i,t}$			$\mathcal{L}AveDaysWorkedPerWorker_{i,t}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Active	−0.832 (1.084)	−0.832 (1.084)	−0.436 (0.781)	−0.233*** (0.054)	−0.215*** (0.064)	−0.196*** (0.065)	−0.197*** (0.058)
Initial value	−0.935*** (0.268)	−0.935*** (0.268)	−0.921*** (0.267)	−0.305 (0.719)	−0.444 (0.657)	−0.572 (0.672)	−0.322 (0.551)
Listed		1.211** (0.604)	0.025 (1.326)		0.030 (0.052)	0.044 (0.046)	0.035 (0.038)
No. wage earners			0.522 (0.490)			−0.019 (0.027)	−0.017 (0.026)
Hours of operation							−0.105 (0.083)
Establishment FE?	Yes	Yes	Yes	No	No	No	No
Year×industry FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	249	249	248	62	62	62	62
R-squared	0.961	0.961	0.961	0.590	0.593	0.602	0.620

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. US Steel establishments are excluded for robustness. Columns (4) through (7) only present a cross-section due to missing data and do not include establishment or year fixed effects. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A8. *Effects of intensity of ESOP activity on establishment output growth, excluding largest firm*

Dependent variable:	$\mathcal{L}_{\text{RealValueProduct}_{i,t}}$		
	(1)	(2)	(3)
Inactive _{1929–1931}	1.440 (1.136)	−0.246 (1.039)	0.402 (1.006)
Inactive _{1931–1933}	0.400 (0.589)	−1.286 (0.960)	−1.166 (0.779)
Inactive _{1933–1935}	−1.188** (0.581)	−2.874** (1.174)	−2.496** (1.000)
Active 1935	−0.384 (0.422)	−2.069* (1.174)	−2.991** (1.256)
Initial value	−0.924*** (0.257)	−0.924*** (0.257)	−0.914*** (0.258)
Listed		−1.685 (1.272)	−2.588* (1.357)
Total wage earners			0.569 (0.474)
Establishment FE?	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes
R-squared	0.961	0.961	0.961
Obs.	249	249	248

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by author. Firm-level data aggregated up from establishment-level CoM data digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. All firms ever having ESOPs in CoM data are included. US Steel establishments are excluded for robustness. The omitted category is establishments which had an inactive ESOP in 1929. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A9. *Effect of ESOPs on real wage growth, excluding largest firm*

Dependent variable:	$g\text{RealWagesPerWorker}_{i,t}$			
	(1)	(2)	(3)	(4)
Active	0.305 (0.200)	0.305 (0.200)		
Inactive _{1929–1931}			0.656** (0.263)	−0.023 (0.160)
Inactive _{1931–1933}			−0.025 (0.121)	−0.703** (0.285)
Inactive _{1933–1935}			−0.695*** (0.057)	−1.373*** (0.332)
Active 1935			0.116*** (0.022)	−0.563** (0.303)
Initial wages (per worker)	−1.393*** (0.217)	−1.393*** (0.217)	−1.401*** (0.215)	−1.401*** (0.215)
Listed		0.692*** (0.058)		−0.679** (0.303)
Establishment FE?	Yes	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes	Yes
Observations	267	267	267	267
R-squared	0.910	0.910	0.907	0.907

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928). Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. U.S. Steel establishments are excluded for robustness. Robust standard errors clustered at the firm level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A10. *Effects of ESOP activity on establishment productivity, excluding 1935*

Dependent variable:	$\mathcal{L}RealValueProduct_{i,t}$			$\mathcal{L}AveDaysWorkedPerWorker_{i,t}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Active	-1.420*** (0.328)	-1.420*** (0.328)	-1.007 (0.647)	-0.228*** (0.047)	-0.238*** (0.062)	-0.233*** (0.061)	-0.229*** (0.058)
Initial value	-0.784*** (0.234)	-0.784*** (0.234)	-0.807*** (0.263)	-0.263 (0.248)	-0.231 (0.194)	-0.223 (0.196)	-0.166 (0.193)
Listed		-0.828 (0.711)	-2.299* (1.260)		-0.014 (0.046)	-0.010 (0.044)	-0.004 (0.040)
No. wage earners			0.865 (0.586)			-0.006 (0.011)	-0.005 (0.010)
Hours of operation							-0.045 (0.038)
Establishment FE?	Yes	Yes	Yes	No	No	No	No
Year×industry FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	222	222	222	102	102	102	102
R-squared	0.943	0.943	0.949	0.605	0.606	0.608	0.621

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by the author. Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. The 1935 panel is excluded for robustness. Columns (4) through (7) only present a cross-section due to missing data and do not include establishment or year fixed effects. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A11. *Effects of intensity of ESOP activity on establishment output growth, excluding 1935*

Dependent variable:	$\hat{g}RealValueProduct_{i,t}$		
	(1)	(2)	(3)
Inactive _{1929–1931}	0.796 (0.558)	0.055 (0.241)	1.450 (0.891)
Inactive _{1931–1933}	0.032 (0.488)	−0.709 (0.547)	−0.242 (0.637)
Inactive _{1933–1935}	−0.613 (0.583)	−1.355*** (0.457)	−0.527 (0.554)
Active 1935	−0.167 (0.395)	−0.909** (0.380)	−2.298*** (0.824)
Initial value	−0.792*** (0.241)	−0.792*** (0.241)	−0.816*** (0.271)
Listed		−0.741 (0.485)	−2.032** (0.795)
Total wage earners			0.970* (0.536)
Establishment FE?	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes
R-squared	0.939	0.939	0.947
Obs.	222	222	222

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by author. Firm-level data aggregated up from establishment-level CoM data digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. All firms ever having ESOPs in CoM data are included. 1935 panel is excluded for robustness. The omitted category is establishments which had an inactive ESOP in 1929. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A12. *Effect of ESOPs on real wage growth, excluding 1935*

Dependent variable:	$\Delta \text{RealWagesPerWorker}_{i,t}$			
	(1)	(2)	(3)	(4)
Active	0.041 (0.157)	0.041 (0.157)		
Inactive _{1929–1931}			0.883** (0.375)	0.041 (0.126)
Inactive _{1931–1933}			0.452*** (0.165)	−0.390 (0.401)
Inactive _{1933–1935}			−0.424*** (0.052)	−1.266*** (0.372)
Active 1935			0.130*** (0.023)	−0.712** (0.362)
Initial wages (per worker)	−1.538*** (0.228)	−1.538*** (0.228)	−1.544*** (0.222)	−1.544*** (0.222)
Listed		0.464*** (0.149)		−0.842** (0.364)
Establishment FE?	Yes	Yes	Yes	Yes
Year×industry FE?	Yes	Yes	Yes	Yes
Year×fed district FE?	Yes	Yes	Yes	Yes
Observations	258	258	258	258
R-squared	0.911	0.911	0.911	0.911

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928). Establishment-level data from Census of Manufactures digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. Only establishments which are branches of a larger company ever having an ESOP are included in the sample. 1935 panel is excluded for robustness. Robust standard errors clustered at the firm level are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.

Table A13. *Effects ESOP activity on establishment output growth, robust*

Dependent variable:	$g_{\text{RealValueProduct}_{i,t}}$		
	(1)	(2)	(3)
Active	-1.026 [*] (0.556)	-1.026 [*] (0.556)	-1.167 ^{**} (0.522)
Initial value	-1.018 ^{***} (0.156)	-1.018 ^{***} (0.156)	-0.998 ^{***} (0.155)
Small firm		2.629 ^{***} (0.652)	
Small estab.			-1.020 (0.815)
(TotalWageEarners) × 1931	0.697 ^{**} (0.344)	0.697 ^{**} (0.346)	0.566 (0.398)
(TotalWageEarners) × 1933	0.665 [*] (0.374)	0.665 [*] (0.374)	0.499 (0.448)
(TotalWageEarners) × 1935	0.799 ^{**} (0.387)	0.799 ^{**} (0.387)	0.698 (0.428)
Listed	0.543 (1.664)	0.543 (1.664)	0.150 (1.538)
Establishment FE?	Yes	No	No
Year × industry FE?	Yes	Yes	Yes
Year × fed district FE?	Yes	Yes	Yes
R-squared	0.927	0.927	0.929
Obs.	335	335	335

Note: ESOP data collected from National Industrial Conference Board, Inc. (1928) and various sources collected by author. Firm-level data aggregated up from establishment-level CoM data digitized by Vickers and Ziebarth (2018). Due to data availability, data on wage earners is the average of monthly data on wage earners. All firms ever having ESOPs in CoM data are included. The omitted category is establishments which had an inactive ESOP in 1929. Robust standard errors are given in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively.