The Labor Market Impact of Shareholder Power: Worker-Level Evidence*

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Abstract

Using worker-level data from the US Census Bureau's LEHD program from 1993 through 2015, we show that shareholder power leads to large earnings losses for employees. We track the earnings of employees up to five years after their firms experience a material increase in concentrated ownership by block institutional shareholders, relative to employees of other firms that experience a similarly sized increase in ownership by diffused institutional shareholders. We find that over the next six years, the cumulative earnings of the affected employees decline by 10% of their pre-event annual earnings on average. Workers with "high skills" (such as those with earnings in the top tercile) and top managers (such as chief executives) bear the brunt of the negative impact, with the cumulative earnings declining by 16% and 63%, respectively. In contrast, shareholder power does not affect the earnings of employees with relatively low pay. There is also a negative impact on hiring but neither on employee departures nor on differential earnings losses conditional on departures, suggesting that separation is not be the main channel underlying the earnings losses. The collection of evidence is consistent with concentrated ownership increasing shareholders' bargaining power, which in turn reduces employees' rents.

Key words: Shareholder power; institutional ownership; concentration; worker earnings; rent sharing; bargaining

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1. Introduction

Public corporations, which account for half of private employment in the US, underwent radical changes in their ownership structure with the rising importance of large institutional shareholders. Figure 1 shows how one common measure of concentrated ownership for US public firms, block institutional ownership (defined as more than 5% stock holdings), increased threefold from 1980 to 2014. By the end of the period, the concentrated institutional shareholders held on average over 13% of the equity shares of US public corporations. At the same time, wage stagnation and falling employment have been well-documented stylized facts of US labor markets (see, e.g., Autor and Katz, 1999; Pierce and Schott, 2016).

Classical theory of the firm based on agency conflicts between shareholders and workers suggests that there may be a direct link between the ownership structure of public corporations and their employees' earnings. In fact, prominent commentators in the popular press and CEOs of large corporations have recently expressed concerns that the so-called "shareholder capitalism" – i.e., the North American style of governance that since the 1980s has centered around the maximization of shareholder value as the main objective of the firm – may have hurt workers.[1] Growing evidence on the impact of governance on employment (e.g., Bertrand and Mullainathan, 2003; and Davis et al., 2014) and on the effect of declining worker power on wages (e.g., Stansbury and Summers, 2020; and Farber et al., 2021) suggests that the impact of increases in shareholder power on labor could be substantial. Yet, even though concentrated institutional shareholders now control a large share of publicly traded firms, there is a dearth of systematic evidence on their impact on worker earnings.

To study the earnings' impact of increases in shareholder power, proxied by concentrated institutional ownership, this paper uses representative, longitudinal data on individual earnings by employer from the US Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) databases, which we combine with detailed firm-level information on institutional ownership for the universe of publicly-traded US corporations.

[1] See, for example, Business Roundtable Statement on the Purpose of the Corporation (2019) at https://opportunity.businessroundtable.org/ourcommitment/, Posner (2019), Krugman (2015), and Stiglitz (2019).

Specifically, we assemble a rich worker-level data set that spans the 1993 to 2015 period and contains quarterly information on workers' employment status, earnings, and on their employers' ownership structure. Using this data set, we show that increases in shareholder power, measured by ownership of large and concentrated institutional shareholders, lead to reductions in worker-level earnings over the medium to long run.

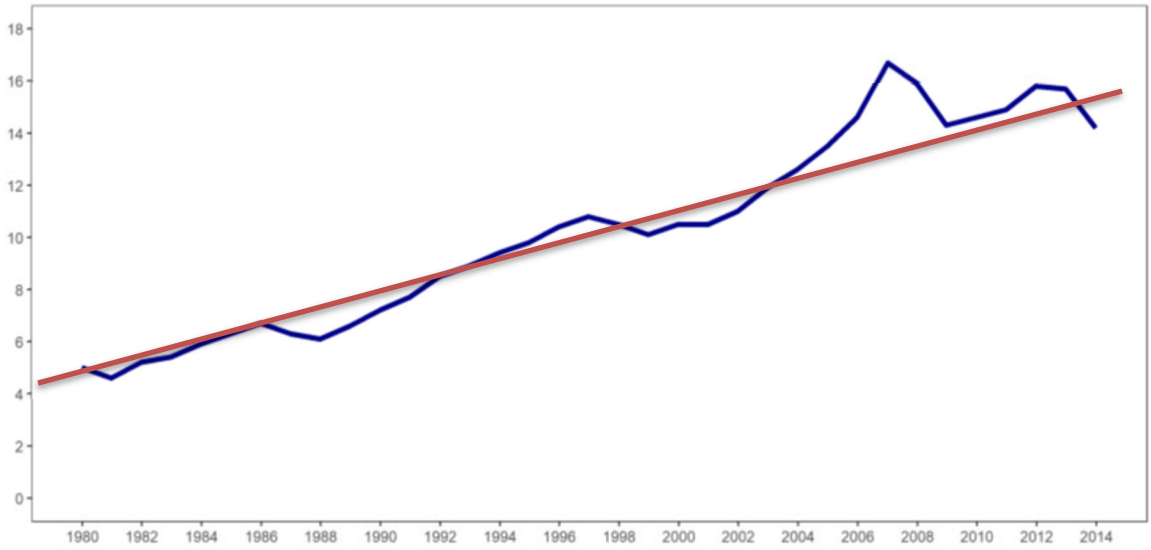


Figure 1: Trends in Concentrated Institutional Ownership of Public Firms in the US, 1980–2014. This figure plots the average block institutional ownership for public firms (blue solid line) in the US for the period 1980–2014. The red line shows a linear time trend. Institutional ownership is from Thomson Reuter 13F filings. Block institutional ownership is the percentage owned by institutional blockholders, defined as the institutional investors with more than 5% holdings as filed through Form 13D, 13F, or 13G. The average block ownership is calculated excluding firms in the agriculture, financial, utilities, and public administration sectors.

The LEHD data allow us to follow individual workers across firms over time and observe their earnings and other characteristics of employment, such as industry and geographical location. This high-quality administrative data, combined with the universal data on ownership of US public firms provide two main advantages. First, on the measurement side, we can construct measures of earnings changes for a given set of individuals over the medium to long run. Second, we employ a research design that addresses identification concerns. To account for possible correlation between shareholder power and other firm characteristics such as growth prospects, we use a difference-in-differences design that exploits large increases in block institutional ownership. Specifically, we examine firms that experience

an at least 5% increase in block institutional ownership as our "treatment" group, and track the earnings trajectories of their employees relative to employees of a "control" group of firms that experience an at least 5% increase in overall institutional ownership but not block institutional ownership. As shareholder power is but one of the many forces that may have impacted the earnings of US workers in recent decades, we further refine the design by adding a rich set of controls for other determinants including time-varying industry and local market conditions to address confounds related to technological progress or labor market competition, as well as standard set of worker characteristics. We also use heterogeneity analysis to examine which workers bear the brunt of the impacts.

Our analysis is guided by the classical agency theory of the firm, which dates back to Jensen and Meckling (1976) (see Shleifer and Vishny, 1997; and Stein, 2003, for comprehensive reviews). In this class of theory, there is a fundamental conflict of interests over the allocation of firm resources between shareholders and stakeholders, including workers. Shareholders with large and concentrated ownership could hurt workers through two distinct but related channels. First, they have more bargaining power and can more easily renege ex post on implicit contracts not to fire workers, as in the "breach of trust" hypothesis of Shleifer and Summers (1988). Second, they can more easily monitor managers and force them to fire workers or extract rents from them, as per the "quiet life" hypothesis of Bertrand and Mullainathan (2003). In both cases, the presence of powerful shareholders leads to reductions in workers' earnings.

Consistent with this agency view of the firm, we find that an increase in shareholder power due to growing concentration among institutional shareholders is associated with lower worker earnings. Importantly, we find the negative impact in a difference-in-differences (DD) design that exploits large changes in powerful institutional ownership to address selection issues. The DD design tracks employees up to five years after firms experience a material increase in ownership of their block institutional shareholders, relative to employees of other firms that experience a similarly sized increase in ownership by diffused institutional shareholders. The average cumulative earnings of the affected employees decline by about 10% of their pre-event annual earnings over the next six years. The cumulative earnings decline is about 4% over the first two years, suggesting that there is both short-term and long-term

impacts. The relation is robust to several alternative specifications, which include controlling for time-varying industry and local market conditions and individual characteristics, as well as using propensity-score reweighting to address residual selection issues. Corroborating a causal interpretation, when we repeat the analysis for up to five years before the treatment, the estimated effects on earnings are economically small and statistically insignificant, pointing to no differential pre-trends between employees of treated vs. control firms.

After establishing the negative impact of shareholder power on earnings, we take a step toward clarifying the mechanism by determining which workers bear the brunt of the impact of shareholder power. We find dramatic heterogeneity by worker type. Employees with "high skills" (such as those with earnings in the top tercile) and top managers (such as chief executives) experience the largest earnings cuts, with average cumulative earnings declining by 16% and 63%, respectively. In contrast, shareholder power does not affect the earnings of employees with relatively low pay. We also find interesting heterogeneity in the impacts by employee hiring vs. separation margins, with the latter being muted relative to the former. These findings have two important implications. First, the decline in employment due to increased ownership concentration shown in previous work (Falato, Kim, and von Wachter, 2022) is driven by a slowing down in hiring as opposed to increasing separation (such as layoff). Second, separation margins are unlikely to be the main driver of the employee earnings losses we find, except for the very highest earners who experience somewhat larger losses conditional on separation. Overall, the evidence is in line with a wealth transfer (or rent extraction) from higher-earning workers to shareholders in the presence of powerful shareholders. The heterogeneity across workers also indicates that shareholder power has not only a largely reallocative impact between workers and shareholders, but also across different types of workers.

Our paper provides the first evidence of the impacts of concentrated institutional ownership on worker earnings for the universe of institutional shareholders and publicly traded firms in the US. We thereby contribute to the literature on the employee effects of corporate ownership, much of which focuses on the effects of institutional ownership on

wages and employment at the firm or establishment level.[2] This paper contributes to the literature by shifting the focus from aggregate firm or establishment-level responses to adjustments at the worker level. In particular, our analysis complements Falato, Kim, and von Wachter (2022), who show declines in employment and payroll at business establishments in response to increased concentration of ownership by institutional investors. Because that paper uses employment and payroll information aggregated at the establishment level, it cannot examine how individual workers adjust to the increasing concentration of corporate ownership accounting for changes in work compositions, nor heterogeneity across workers.

Another primary contribution is to assess the impact of the substantial growth of powerful institutional shareholders in the US over recent decades on the sluggish earnings growth in the US. Our finding that the rise in concentrated stock ownership has helped to depress earnings complements a number of important explanations set forth, including technology (Acemoglu, 2002), import penetration (Autor, Dorn, and Hanson, 2013; Acemoglu, Autor, Dorn, Hanson, and Price, 2016; and Pierce and Schott, 2016), industry concentration and superstar firms (Autor, Dorn, Katz, Patterson, and Van Reenen, 2020), and labor market concentration (Benmelech, Bergman, and Kim, 2022). A related recent literature also examines the role of firms in wage-setting (see, for example, Card, Heining, and Kline, 2013; and Song, Price, Guvenen, Bloom, and von Wachter, 2019). Our results reinforce these findings by providing a novel rationale for the role of firms in wage-setting decisions.

2. Data and descriptive statistics

This section describes the datasets used in the empirical analysis, sample selection procedures, and resulting samples.

2.1. Data sources

2.1.1. Longitudinal Employer-Household Dynamics

To measure individual earnings and demographic characteristics, we employ the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program, which is a

[2] See Davis et al. (2014; 2021), Brav, Jiang, and Kim (2015), and Falato, Kim, and von Wachter (2022) on private equity, activist hedge fund, and concentrated institutional ownership and establishments.

comprehensive matched employer-employee dataset for the US labor market. The earnings data are based on state unemployment insurance (UI) records and correspond to the report of an individual's UI-covered earnings. According to the Bureau of Labor Statistics (BLS), UI coverage is comprehensive and comparable across states. Among the databases available from the LEHD infrastructure, we use the Individual Characteristics Files (ICF), which provide worker-level demographic variables including age, gender, imputed education, and race, and the Employment History Files (EHF), which contain annual and quarterly earnings records, locations (state and county), and industries for each worker-firm pair.

The LEHD draws the demographic information from several federal government sources, including the Decennial Census and the Social Security Administration's Numident file. Some demographic characteristics, such as education, are imputed for a subset of individuals, due to incomplete coverage of the data sources and imperfect linkages (Vilhuber, 2018). The reported earnings in the EHF include gross salaries and wages as well as bonuses, exercised stock options, and other cash pay. In some states, employer contributions to certain deferred compensation plans, such as 401(k)s, are included in total earnings.[3]

We focus on the LEHD databases from 1993 to 2015 covering 23 participating US states (see Appendix Table 1 for the list). The annual earnings records in a given state's LEHD-EHF are non-missing as long as an individual reports positive earnings in that state in any of the four quarters in a given year.

2.1.2. Thomson Reuters 13F

To measure the power of shareholders, we use Thomson Reuters 13F Securities and Exchange Commission (SEC) filings, from which we obtain data on institutional common stock holdings. All institutional investment managers with greater than $100 million in equity assets under discretionary management are required to file a Form 13F with the SEC on a quarterly basis. All common stock holdings of 10,000 or more shares or having a value of $200,000 or more must be reported. Qualified securities include stocks listed for trading on US exchanges. The quarterly holdings reported in the Form 13F represent the aggregate holdings of an institution (e.g., the Vanguard family of funds), rather than the holdings of any

[3] See https://www.bls.gov/opub/hom/cew/pdf/cew.pdf at the BLS.

individual portfolio (e.g., the Contra fund in the Fidelity family of funds). Throughout the paper, an institutional investor (or shareholder) is defined as an institution that files a form 13F report.

The main ownership variables of interest are defined as the holdings in a given firm's equity shares by a given type of institutional investors as a percentage of shares outstanding. *Overall institutional ownership* is the percentage owned by all institutional investors. *Total block ownership* is the percentage owned by all blockholding institutions defined as the institutional investors with more than 5% holdings as filed through Form 13D, 13F, or 13G.

2.1.3. Firm-level data from LBD and Compustat

In addition to our worker-level data from the LEHD, we use the Longitudinal Business Database (LBD) to obtain variables for firm employment and payroll. The LBD covers all private firms with at least one employee (Jarmin and Miranda, 2002 and Chow et al., 2021). The relevant variables in the database include employment, annual payroll, and parent firm identifiers. We supplement the LBD variables with other firm characteristics from Compustat including book and market values of assets, the market-to-book ratio, and return on assets (ROA).

We use the Census Bureau's bridge file to match firms in the LEHD, LBD, and Compsutat/13F databases. Firms are matched to institutional ownership variables from Thomson Reuters 13F as of the second quarter of a given year. We then construct a worker-level data set with individuals' demographic characteristics and cumulative earnings (from the LEHD) after changes in the employing firm's ownership (from Thomson Reuters), and relevant firm characteristics from the LBD and Compustat.

2.2. Sample construction

A key challenge to identifying the effect of concentrated institutional ownership on individual worker earnings is that institutional investors may choose to invest in firms with specific characteristics such as size, profitability, and market valuation, which may be correlated with the employees' outcomes. To address this challenge, we employ an event-study approach that exploits large increases in institutional ownership. More specifically, we

designate firms that experience an at least 5% increase in total block ownership in a given year relative to the previous year as our treatment group. The control group includes firms that experience an at least 5% increase in overall institutional ownership and a less than 5% increase in total block ownership in a given year relative to the previous year.

In our analysis, we track full-time employees of these treated and control firms as of one year before the events, our baseline year. We define workers as full-time in a given year if they earn above the quarterly earnings of a "full-time minimum-wage worker" in their respective states in all of the following six quarters: the fourth quarter of the previous year, all four quarters of the current year, and the first quarter of the following year (e.g., Bloom et al., 2021). The quarterly earnings of a full-time minimum wage worker in a given state-year are calculated as follows: the state's minimum hourly wage in the year × 35 (hours/week) × 13 (weeks/quarter). When the state's minimum wage is less than the prevailing federal minimum wage, we use the federal in place of the state minimum wage. We also require that the workers have at least one year of post-event earnings.

We allow firms (and workers) to be in the treatment and control groups multiple times. To allow for the workers to have (up to) five years of pre- and post-event observations, we restrict our event years from 1998 to 2010 (vs. the 1993-2015 data period for the LEHD). This sample selection procedure results in approximately 9,000,000 worker-year observations employed by 15,000 treated and control firm-years. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

2.2. Descriptive statistics

2.2.1 Firm characteristics

Table 1, Panel A shows descriptive statistics for treatment and control firms one year before they experience large increases in block and overall institutional ownership, respectively (year "t-1"). The statistics are weighted by the firms' number of workers in the LEHD data, which represent the unit of our empirical analysis (see Tables 2 and onward). Perhaps not surprisingly, the average public firms in the sample are large, highly profitable, and have high institutional ownership with the average overall ownership higher than 60% across the treatment and control firms. Importantly, most firm characteristics, including the book value

of assets, total payroll, and ROA, are comparable between treatment and control firms with the differences being insignificant. The variables that are significantly different include the pre-event overall and block institutional ownership and total employment. We implement a procedure that reweights the observations to account for these differences potentially affecting the estimated treatment effect of an increase in block institutional ownership (Busso, DiNardo, and McCrary, 2009).

[Insert Table 1 here.]

2.2.2 Employee characteristics

Table 1, Panel B shows descriptive statistics for the employees of treatment and control firms in the year before the increases in institutional ownership. The sample consists of approximately 6,203,000 treated and 2,835,000 control firm employees. The workers in the two groups are generally comparable along observable characteristics including education, race, age, tenure, and pre-event earnings. All earnings variables are CPI-adjusted to 2005 dollars. One year before the changes in institutional ownership, treated full-time workers on average earn $66,420 annually with a standard deviation of $178,000, while control workers earn $69,570 with a standard deviation of $250,800. These balanced worker characteristics show that the employees of treated and control firms are similar *ex-ante*, in the absence of large changes in ownership. Our sample employees mostly consist of college-educated White men.

3. Effects of large institutional ownership on employee earnings

This section provides baseline estimates for the impact that large institutional shareholders have on the cumulative earnings of firm employees.

3.1 Effects of large institutional ownership on employee earnings – Baseline estimates

Our baseline empirical model to estimate the effects of increased ownership by large shareholders on employee earnings takes the form:

$$Y_{ijkct} = \alpha_{kct} + \beta Treat_{ijt} + X'\Gamma + \varepsilon_{ijkct}, \quad (1)$$

where $Y_{ijkct} = \frac{\sum_{\tau=0}^{5} y_{ijkct\tau}}{\bar{y}_{ijkct-1}}$ is (up to) six years of cumulative earnings from the year of ownership changes, scaled by the pre-event average earnings of worker *i* employed by firm *j* in three-digit NAICS industry *k*, county *c*, and event year *t*. The pre-event average earnings, $\bar{y}_{ijkct-1}$, are calculated by taking the mean of annual earnings of worker *i* from as far as years *t-5* to *t-1*. For a worker who holds multiple jobs in a given year, we use the worker's total earnings aggregated across all her jobs in that year. a_{kct} represents industry-by-county-by-year fixed effects; $Treat_{ijt}$ is an indicator equal to one if worker i is employed by firm j that experiences an at least 5% increase in total block institutional ownership, and zero if an at least 5% increase in overall institutional ownership in year *t* relative to *t-1*; *X* is a vector of worker-level controls including age, tenure, indicators for race, ethnicity, education,[4] and gender; and ε_{ijkct} is the residual. Standard errors are clustered at the firm level.

Table 2, Panel A presents baseline estimates of Equation (1). Columns (1) through (6) use specifications that include increasingly stringent controls including fixed effects. Columns (1) through (5) include no worker-level controls and different levels of fixed effects namely, year fixed effects, industry-by-year fixed effects, county-by-year fixed effects, industry-by-year and county-by-year fixed effects, and industry-by-county-by-year fixed effects, respectively. The coefficient of interest β represents the estimated change in an employee's cumulative earnings as a fraction of her pre-event average annual earnings due to an increase in large institutional ownership relative to the control group that experiences an increase in overall but not large institutional ownership. We use column (6), which controls for time-varying industry-by-local market conditions as well as worker-level demographics, as the preferred specification.

Across all columns, we find that the coefficient estimates on *Treat* are significantly negative at the 10% level or less, indicating that employees of firms that experience an increase in block institutional ownership lose significant earnings, relative to employees of firms that experience an increase in defused institutional ownership. In column (6), which uses the preferred specification, the coefficient on *Treat* is -0.102 and significant at the 1% level. This estimate implies that relative to the control group, treated workers lose 10.2% of their average

[4] Education is measured by the following categories in the LEHD-ICF: less than high school, high school graduate, some college, and college graduate and above. Categories for race are (all non-Hispanic) White, Black, Asian, and all other races. Ethnicity is an indicator for Hispanic.

annual earnings over the six-year period (from years t through t+5) as a result of the increase in block institutional ownership. This result is consistent with the interpretation that increased bargaining power allows blockholders to extract more rents from workers on average.

Columns 7 through 9 use the preferred specification to provide additional perspective on the dynamics of the impacts as well as economic magnitudes for annual employee earnings (instead of cumulative). The coefficient on *Treat* is -0.042 and significant at the 1% level in the first two years (column 7), suggesting that there is both short-term and long-term impacts on earnings. The estimate for annual earnings is -0.014 and -0.017 in the first two years and in the overall window, respectively, both significant at the 1% level (columns 8 and 9). These estimates imply that relative to the control group, treated workers lose 1.7% of their average annual earnings over the six-year period (from years t through t+5) as a result of the increase in block institutional ownership.

[Insert Table 2 here.]

The identifying assumption behind our research design is that there are no differential trends for treated vs. control workers before the treatment. Table 3 provides a formal test by repeating our analysis for up to five years before the treatment. Specifically, we estimate a variant of Equation (1) on a sample of the treat and control firms' employees in year t-5. We then calculate cumulative earnings for these workers from years t-4 through t-1, scaled by their earnings in year t-5. The estimate on *Treat* is economically small at about -0.010 and is statistically insignificant, pointing to no differential pre-trends between the two groups.

[Insert Table 3 here.]

3.2 Estimates using propensity-score reweighting

Table 1, Panel A shows that the treated and control firms differ in some characteristics (such as total employment), even though these differences are not large in economic magnitude. To control for the potential effect of large institutional shareholders selecting firms based on those observable characteristics, we use a propensity-score estimator to reweight worker observations in Equation (1). This approach allows us to disentangle the treatment effect from other factors captured by the observables and to assume that conditional on these observable characteristics, treatment assignment is random. Therefore, changes in treated

workers' earnings estimated in the weighted regressions are likely to be attributed to treatment status.[5]

To employ the estimator, we first pool all treatment and control workers across all years and estimate the propensity score $\hat{p}$, the probability of being treated as a function of overall and block institutional ownership and log employment, which are significantly different between the treated and control groups. Next, we assign inverse probability weights using this estimated propensity score as follows: Treated workers receive a weight of $\frac{1}{\hat{p}}$ and workers in the control group receive a weight of $\frac{1}{1-\hat{p}}$. Intuitively, treated workers with a low propensity score are more similar to observations in the control group and therefore are given a bigger weight. Similarly, control group workers with a high propensity score are given a larger weight as they are more similar to observations in the treatment group. Before reweighting, the two groups are over-represented by observations that are unlike each other in terms of observable characteristics. This reweighting procedure makes the treatment and control groups more comparable on observables thereby reducing selection bias.

The results of the weighted regressions in Panel B of Table 2, columns (1) through (6) show that the coefficients on *Treat* range from -0.141 to -0.072 with most being significant at the 1% to 5% levels, which are very similar in magnitude and significance to the estimates in Panel A. Estimates in columns (7) through (9) are also little changed after reweighting. This robustness of the estimates to reweighting shows that selection does not have a considerable influence on the estimated effects of large institutional ownership on worker earnings.

4. Heterogeneity in workers' cumulative earnings changes

Next, we explore how concentrated institutional ownership affects workers' future earnings across different subsets of our baseline sample. We form these subsamples based on their pre-event earnings, education level, gender, and whether they stay or leave the (treated or control) firm. Through this analysis of heterogeneity in the estimated effect, we aim to take

[5] See Busso, DiNardo, and McCrary (2009) and King and Nielson (2019) for evidence that the finite sample properties of this propensity-score reweighting estimator are superior to the propensity score matching techniques. Also, Dehjia and Wahba (1999) show that this reweighting procedure yields a consistent estimate of the parameter of interest.

a first step toward clarifying the mechanism at play in our baseline results. We continue to use the preferred specification as in column (6) in Table 2 (with industry-by-county-by-year fixed effects and worker-level controls included) in the subsequent analyses.

4.1. High vs. low earnings

We begin the heterogeneity tests by analyzing how the effect of increased block institutional ownership on employee earnings differs by pre-event earnings level. We split the sample into terciles of the pre-event average annual earnings distribution. Table 4, Panels A and B present our unweighted and weighted estimates of the treatment effect for each tercile. Column (1) in Panel A shows that treated firm employees in the top earnings tercile experience the greatest losses – over the six years since the increase in block ownership, their cumulative earnings on average decrease by 16.4% relative to their pre-event average earnings, all compared to the cumulative earnings of the control firm employees. Treated workers in the middle tercile also experience a statistically significant decrease in earnings of 9.1%. These estimates are significant at the 1% and 5% levels, respectively. However, we find an insignificant change in cumulative earnings for employees in the bottom earnings tercile. The results are robust to employing the inverse probability weights as indicated by the little differences in the magnitude and significance of estimates across the two panels (e.g., -0.164 and -0.161 in column (1), both of which are significant at the 1% level).

[Insert Table 4 here.]

A plausible explanation for this heterogeneity in the treatment effect across earnings levels is that large institutional investors may view cutting wages of highly paid employees as the most effective way to reduce costs and boost profits because those workers earn the largest rents among all employees. Several mutually non-exclusive models of the labor market could justify higher rents for higher-earning workers. First, "monopsony" models suggest that if the labor market for higher-earnings workers is characterized as less competitive (in that their labor supply to the firm is more upward-sloping) than that for lower-earnings workers, then the wedge between the worker's productivity at the current firm and outside option (i.e., rents) would be larger (e.g., Manning, 2003). Second, learning or "specific human capital investment"

models posit that workers with high ability tend to accumulate greater rents ex-post (e.g., Jovanovic, 1979; and Neal, 1998). We further explore these mechanisms below.

4.2. Top managers and rank-and-file employees

In this section, we explore the rent-sharing explanation further by comparing the earnings patterns of top managers and rank-and-file employees after an increase in blockholder ownership. Given that the LEHD data do not have information on job titles, we infer whether workers are chief executive officers (CEOs), executives, or rank-and-file employees based on earnings levels as follows: "CEOs" are defined as the top earner of the firm, "executives" are the top five earners including CEOs, and "rank-and-file employees" make up the rest. Table 5, columns (1) through (3) show the estimates for CEOs with increasingly stringent fixed effects. Given that the analysis of the firm's CEO (and executive) earnings is essentially at the firm level, we prefer the specification in column (1) with industry-by-year fixed effects and worker-level controls to those including county-by-year or industry-by-county-by-year fixed effects as in columns (2) or (3).

Estimates in column (1) show that the highest earner of the treated firm (the "CEO") loses 63.4% of her annual earnings over the six years (or 10.6% per year) relative to the top earner of the control firm, which is significant at the 1% level. Similarly, estimates in column (4) show that the top five earners of the firm ("executives") experience a 42.9% reduction in cumulative earnings across the six years (or 7.2% per year) on average, which is significant at the 1% level. In contrast, rank-and-file employees of the treated firm experience a decrease in their cumulative earnings of 9.6%, more in line with the average effect for the full sample (e.g., -10.2% in column (6) in Table 2, Panel A). Panel B shows that the results for top managers and rank-and-files are robust to the reweighting approach.

[Insert Table 5 here.]

These patterns of earnings losses across the job ranks (proxied by within-firm earnings rank) are broadly consistent with the finding in the previous section that higher earners experience larger cuts in earnings after the increase in shareholder power. Thus, a plausible explanation is that managers had earned the largest rents among all workers before the increase in block ownership, which are then cut as shareholders' bargaining power increases. The larger

rents for top managers relative to rank-and-files could be due to their generally higher and more specialized skills, which imply higher mobility costs.

4.3. Other measures of worker skills and firm leavers vs. stayers

Next, we subset our baseline sample by conditioning on other measures of human capital or worker skills. Beginning with education, we compare workers with at least some college education versus those with no college. The estimates in column (3) in Table 6, Panel A show that college-educated workers experience a significant (at the 1% level) decrease in cumulative earnings of 11.6%. In contrast, column (4) shows that non-college educated workers experience an insignificant decrease of 5.1%. Columns (5) and (6) show that male employees of the treated firm experience a significant decrease in earnings of 12.4% (at the 1% level), whereas female employees experience a smaller reduction of 6.9% (significant at the 10% level).

These results are broadly consistent with the results above that higher-earning employees and top managers experience larger earnings cuts after the increase in block ownership, given that high earnings, high education level, and male status are all typically associated with high skills (e.g., Katz and Murphy, 1992). Therefore, the results reinforce the implication that high-pay employees bear the brunt of the negative impact, likely due to a greater loss of rents after an increase in the bargaining power of shareholders.

Lastly, we compare earnings outcomes for employees who stay or leave the firm in year t+3 in columns (1) and (2), respectively. Both the stayers and leavers experience significant decreases in cumulative earnings of around 11%. Combined with the finding in Table 1, Panel B that the propensity to leave the original firm (and industry) does not differ between the treated and control firm employees, the result that earnings losses do not differ by firm leaver status suggests that separation may not be the main channel underlying the earnings losses experienced by treated firm employees.

Estimates from the weighted regressions in Panel B are generally similar in magnitude and significance. The exception that the estimated decrease in cumulative earnings for firm stayers becomes -0.062 and insignificant in column (2).

[Insert Table 6 here.]

Table 7 repeats the analysis of leavers vs. stayers for top earners of the firm, for whom the earnings losses are concentrated. The results are largely in line with those in Table 6, columns (1) and (2), with both the stayer and leaver CEOs and Top 5 earners experiencing significant decreases in cumulative earnings. That said, the estimates are a bit larger for leaver CEOs, suggesting that the separation margin may contribute to the earnings losses at the very top.

[Insert Table 7 here.]

5. Effects of large institutional ownership on firm-level employee hire and departure

Our results so far show that the presence of large institutional investors significantly reduces future earnings of highly-paid employees including top managers. To shed further light on the impact of increased shareholder power on the firm's employees and human capital, we analyze whether an increase in block ownership leads to significant changes in the pace at which the firm hires new employees and existing employees leave the firm using our event study framework. For example, a slowdown in hiring new employees and/or existing employees leaving the firm would indicate reduced churning in the firm's human capital.[6] Our specification to estimate the effect of shareholder power on firm-level employee hiring and departure takes the form:

$$Y_{jkt} = \alpha_{kt} + \beta Treat_{jt} + \varepsilon_{jkt}, \quad (2)$$

where $Y_{jkt} = \frac{\sum_{\tau=0}^{5} y_{jkt\tau}}{\bar{y}_{jkt}}$ is the cumulative number of new hires or employee departures from years *t* through *t*+5, scaled by the pre-event average number of new hires or employee departures for firm *j* in three-digit NAICS industry *k* in year *t*, calculated by taking the means from as far as year *t-5* to *t-1*. a_{kt} represents industry-by-year fixed effects; $Treat_{jt}$ is an indicator equal to one if firm *j* experiences an at least 5% increase in total block ownership, and zero if an at least 5% increase in overall institutional ownership in year *t* relative to *t-1*; and ε_{jkt} is the residual. Standard errors are clustered at the firm level.

[6] The LEHD data do not allow us to distinguish whether an employee's departure from a firm is voluntary or involuntary (i.e., due to a layoff).

Table 8, Panels A and B present the unweighted and weighted estimates for Equation (2). The coefficient of interest β represents the estimated change in the firm's cumulative number of new hires (or employee departures) as a fraction of the pre-event average annual number of new hires (or departures) due to an increase in concentration of institutional ownership relative to the control group. Columns (1) and (2) use the scaled numbers of new hires and employee departures as the dependent variable, respectively.

[Insert Table 8 here.]

The coefficient on *Treat* in column (1) in Panel A is -4.038 and significant at the 1% level, indicating that over the six years post-event, treated firms reduce new employee hires by about four times of their pre-event annual average number. This magnitude represents a considerable slowdown in the treated firms' hiring activities relative to the control firms. Further, the coefficient on *Treat* in column (2) is -1.109 but insignificant. This result indicates that the treated firms maintain their existing employees similarly to the control firms, consistent with the similar fractions of employees staying with the treated and control firms as shown in Panel B of Table 1. Therefore, the result reinforces the earlier implication that worker separation may not be the main driver of treated firm employees' earnings losses.

Moreover, the firm-level results in this section help understand how blockholders affect firm employment. The results are consistent with the idea that block institutional investors on average may take a "conservative" approach to cutting employment in an effort to improve shareholder value (see Falato, Kim, and von Wachter, 2022 for establishment- and firm-level evidence) – instead of actively laying off employees, it appears that the blockholders may push for a significant slowing down of hiring new workers. Combined with the considerable earnings cuts for high-skill employees shown above, this significant reduction in new employee hiring points toward significant losses in the treated firm's human capital, and thus potentially explains a stagnation in productivity that Falato, Kim, and von Wachter (2022) documents.

6. Conclusion

In the past few decades there have been dramatic increases in concentration of ownership for US public firms, while wages of typical workers were stagnant. Using worker-

level data from the US Census Bureau's LEHD program over the 1993-2015 period, we show that increasing concentration of firm ownership leads to large earnings losses for workers. Those with "high skills" (such as those with earnings in the top tercile) and top managers (such as chief executives) bear the brunt of the losses. We also show that concentrated institutional ownership significantly reduces the firm's hiring. The collection of results is consistent with concentrated ownership increasing shareholders' bargaining power, which in turn reduces the rents shared by employees.

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Table 1: Descriptive Statistics

Panel A: Firm Characteristics

	(1)	(2)	(3)	(4)	(5)
	Treated, t-1		**Control, t-1**		**Treated-Control**
	Mean	**STD**	**Mean**	**STD**	***t*-stat.**
Overall IO (%)	67.48	21.99	60.08	20.98	7.95
Block IO (%)	13.90	12.99	16.30	12.73	-3.46
Total employment	37,050	55,390	29,990	44,740	1.82
Total payroll ($m)	2,053.0	3,266.0	1,769.0	2,671.0	1.05
Book value of assets ($m)	33,500	115,800	36,780	129,400	-0.37
ROA	0.138	0.098	0.142	0.100	-0.73
Market-to-book	2.282	1.804	2.438	2.073	-1.12
Observations	10,000		5,000		-

Panel B: Worker Characteristics

	(1)	(2)	(3)	(4)	(5)
	Treated, t-1		**Control, t-1**		**Treated-Control**
	Mean	**STD**	**Mean**	**STD**	***t*-stat.**
Age	42.07	10.90	41.76	10.90	1.99
Fraction of males	0.613	0.487	0.624	0.484	-1.59
Tenure	5.297	3.426	5.222	3.373	0.91
Fraction of leavers (firm)	0.393	0.488	0.400	0.490	-0.81
Fraction of leavers (Industry)	0.323	0.468	0.327	0.469	-0.55
Fraction high school	0.235	0.424	0.229	0.420	1.31
Fraction some college	0.306	0.461	0.301	0.459	1.55
Fraction college and above	0.374	0.484	0.385	0.487	-1.12
Fraction non-Hispanic White	0.727	0.446	0.720	0.449	1.24
Fraction non-Hispanic Black	0.076	0.265	0.074	0.262	1.21
Fraction non-Hispanic Asian	0.077	0.266	0.083	0.277	-2.05
Fraction Hispanic	0.105	0.306	0.107	0.310	-0.66
Pre-event average earnings ($)	66,420	178,100	69,570	250,800	-1.23
Observations	6,203,000		2,835,000		-

Note: This table presents descriptive statistics on and diagnostic tests examining covariate balance between the treated and control firms and workers from the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program. The sample consists of employees of firms that experience an at least 5% increase in total block ownership (treatment) and firms that experience an at least 5% increase in overall institutional ownership and a less than 5% increase in total block ownership (control) over the previous year ("t-1"). Panel A presents firm characteristics weighted by the firms' workers in the LEHD data. "Overall IO" is the percentage of shares owned by all institutional investors and "Block IO" is the percentage of shares owned by blockholders, which are defined as institutional investors with more than 5% holdings from Thomson Reuters 13F SEC filings. "Total employment" is the total number of firm employees and "total payroll ($m)" is the total wage bill in million dollars across all firm employees from the Census Bureau's Longitudinal Business Database (LBD). "Book value

of assets ($m)" is total book assets in million dollars; "Return on Assets (ROA)" is operating income before depreciation and amortizations scaled by lagged book assets; and "Market-to-book" is the sum of total debt (which is the sum of long term and short-term debt) and market equity, scaled by the sum of total debt and book equity from Compustat. Panel B presents worker characteristics from the LEHD databases. "Tenure" is the number of years the employee has worked at the firm; "Fraction of leavers (firm/industry)" is the fraction of workers who no longer work for the firm/three-digit SIC industry three years after the large increase in block or overall institutional ownership; "Fraction education" is the fraction of workers whose highest level of education is in a given category; "Fraction race" is the fraction of workers who identify as of a given race; "Pre-event average earnings" is the annual average earnings before the large increase in block or overall institutional ownership. All earnings variables are CPI-adjusted in 2005 constant dollars. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 2: Baseline Estimates – Effects of Large Institutional Ownership on Worker Earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.:	Scaled Cumulative Earnings							Scaled Cumulative Earnings/post-event years	
Years Used in Dep Var.:	t – t+5						t – t+2	t – t+5	t – t+2
Panel A: Unweighted									
Treatment	-0.111**	-0.097***	-0.076*	-0.090***	-0.106***	-0.102***	-0.042***	-0.017***	-0.014***
	(-0.054)	(-0.032)	(-0.04)	(-0.029)	(-0.038)	(-0.035)	(0.015)	(0.004)	(0.004)
R^2	0.004	0.057	0.052	0.086	0.166	0.234	0.227	0.238	0.230
Panel B: Weighted									
Treatment	-0.141**	-0.095***	-0.072*	-0.081***	-0.110***	-0.104***	-0.045***	-0.017***	-0.015***
	(-0.056)	(-0.032)	(-0.038)	(-0.028)	(-0.039)	(-0.036)	(0.015)	(0.004)	(0.004)
R^2	0.005	0.061	0.055	0.091	0.17	0.237	0.231	0.239	0.231
Worker-level Controls						Y	Y	Y	Y
Year FE	Y								
Industry × Year FE		Y		Y					
County × Year FE			Y	Y					
Industry × County × Year FE					Y	Y	Y	Y	Y
Observations	9,037,000	9,037,000	9,037,000	9,037,000	9,037,000	9,037,000	9,037,000	9,037,000	9,037,000

Note: This table presents the estimated effects of large institutional ownership on employee earnings. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. The dependent variable for columns (1) through (7) is the cumulative post-event earnings (from t to t+5 for columns (1) – (6) and t to t+2 for column (7)) scaled by the pre-event average earnings. The dependent variable for columns (8) and (9) is the cumulative post-event earnings (from t to t+5 for column (8) and t to t+2 for column (9)) scaled by the pre-event average earnings and the number of post-event years worked. "Treatment" is an indicator equal to one if a worker is employed by a firm that experiences an at least 5% increase in total block ownership, and zero if an at least 5% increase in overall institutional ownership and a less than 5% increase in total block ownership. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules

Table 3: Worker Earnings Pre-trends Test

	(1)
Dep. Var.:	Pre-event Scaled Cumulative Earnings
Panel A: Unweighted	
Treatment	-0.010
	(0.025)
R^2	0.247
Panel B: Weighted	
Treatment	-0.009
	(0.024)
R^2	0.242
Worker-level Controls	Y
Industry × County × Year FE	Y
Observations	6,895,000

Note: This table tests for differences in the earnings trajectories of workers in treatment and control firms before a large change in institutional ownership. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. This sample differs from Table 2 in that this table uses the set of employees who worked at treated or control firms five years before the event (t-5). The dependent variable is the cumulative earnings of these workers from t-4 to t-1 scaled by their earnings at t-5. "Treatment" is defined as in Table 2. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 4: Heterogeneity of Effects of Large Institutional Ownership by Earnings Level

	(1) Top Tercile	(2) Middle Tercile	(3) Bottom Tercile
Dep. Var.:	Scaled Cumulative Earnings		
Panel A: Unweighted			
Treatment	-0.164***	-0.091**	-0.039
	(0.042)	(0.036)	(0.058)
R^2	0.255	0.287	0.254
Panel B: Weighted			
Treatment	-0.161***	-0.096**	-0.066
	(0.039)	(0.039)	(0.059)
R^2	0.258	0.292	0.259
Worker-level Controls	Y	Y	Y
Industry × County × Year FE	Y	Y	Y
Observations	3,073,000	2,982,000	2,982,000

Note: This table presents the estimated effects of large institutional ownership on employee earnings conditional on the tercile of the pre-event average earnings distribution in which the worker is. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. The dependent variable is the scaled cumulative post-event earnings as defined in Table 2. "Treatment" is defined as in Table 2. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 5: Top Managers and Rank-and-File Employees

	(1) CEOs	(2) CEOs	(3) CEOs	(4) Top 5	(5) Top 5	(6) Top 5	(7) Rank-and-file
Dep. Var.:	Scaled Cumulative Earnings						
Panel A: Unweighted							
Treatment	-0.634***	-0.586***	-0.696**	-0.429***	-0.429***	-0.440***	-0.096***
	(0.084)	(0.104)	(0.271)	(0.046)	(0.049)	(0.084)	(0.035)
R^2	0.193	0.347	0.751	0.115	0.190	0.459	0.235
Panel B: Weighted							
Treatment	-0.618***	-0.560***	-0.716**	-0.408***	-0.394***	-0.435***	-0.099***
	(0.088)	(0.108)	(0.281)	(0.048)	(0.051)	(0.085)	(0.036)
R^2	0.203	0.360	0.756	0.120	0.198	0.466	0.239
Worker-level Controls	Y	Y	Y	Y	Y	Y	Y
Industry × Year FE	Y	Y		Y	Y		
County × Year FE		Y			Y		
Industry × County × Year FE			Y			Y	Y
Observations	15,500	15,500	15,500	74,000	74,000	74,000	8,963,000

Note: This table presents the estimated effects of large institutional ownership on earnings of the top earner of the firm ("CEO"), the top five earners ("managers"), and workers not in the top five ("rank-and-file"). Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. The dependent variable is the scaled cumulative post-event earnings as defined in Table 2. "Treatment" is defined as in Table 2. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 6: Heterogeneity in Effects of Large Institutional Ownership by Worker Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Leavers	Stayers	Some college+	No college	Males	Females
Dep. Var.:	Scaled Cumulative Earnings					
Panel A: Unweighted						
Treatment	-0.112***	-0.115**	-0.116***	-0.051	-0.124***	-0.069*
	(0.041)	(0.057)	(0.035)	(0.047)	(0.036)	(0.038)
R^2	0.266	0.290	0.232	0.255	0.258	0.221
Panel B: Weighted						
Treatment	-0.106**	-0.062	-0.114***	-0.071	-0.124***	-0.073*
	(0.042)	(0.056)	(0.034)	(0.050)	(0.037)	(0.039)
R^2	0.266	0.294	0.236	0.257	0.261	0.224
Worker-level Controls	Y	Y	Y	Y	Y	Y
Industry × County × Year FE	Y	Y	Y	Y	Y	Y
Observations	3,568,000	5,469,000	6,161,000	2,876,000	5,571,000	3,466,000

Note: This table presents the estimated effects of large institutional ownership on employee earnings conditional on worker characteristics. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. Columns (1) and (2) show the effect for workers who leave and stay at the firm, respectively, by three years after the events. Columns (3) and (4) show the effect for workers who have at least some college and no college education, respectively. Columns (5) and (6) show the effect for male and female workers, respectively. The dependent variable is the scaled cumulative post-event earnings as defined in Table 2. "Treatment" is defined as in Table 2. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 7: Heterogeneity in Effects of Large Institutional Ownership for High-Earning Stayers and Leavers

	(1)	(2)	(3)	(4)	(5)	(6)
	CEO Leavers	CEO Stayers	Top 5 Leavers	Top 5 Stayers	Top Tercile Leavers	Top Tercile stayers
Dep. Var.:	Scaled Cumulative Earnings					
Panel A: Unweighted						
Treatment	-0.711***	-0.626***	-0.407***	-0.440***	-0.163***	-0.160**
	(0.142)	(0.118)	(0.061)	(0.061)	(0.046)	(0.063)
R^2	0.276	0.257	0.156	0.143	0.282	0.305
Panel B: Weighted						
Treatment	-0.734***	-0.612***	-0.373***	-0.434***	-0.158***	-0.109*
	(0.148)	(0.122)	(0.065)	(0.063)	(0.043)	(0.060)
R^2	0.286	0.272	0.160	0.152	0.284	0.307
Worker-level Controls	Y	Y	Y	Y	Y	Y
Industry × Year FE	Y	Y	Y	Y		
Industry × County × Year FE					Y	Y
Observations	6,200	9,100	32,000	42,000	1,167,000	1,906,000

Note: This table presents the estimated effects of large institutional ownership on earnings for employees who stayed or left the firm by income level. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. Columns (1) and (2) show the effect for CEOs, (3) and (4) for managers, and (5) and (6) for workers in the top tercile earnings distribution who stay and leave the firm by three years after the events, respectively. The dependent variable is the scaled cumulative post-event earnings as defined in Table 2. "Treatment" is defined as in Table 2. Worker-level demographic controls are age, tenure, indicators for race, ethnicity, education, and gender, as defined in Table 1, Panel B. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Table 8: Effects of Large Institutional Ownership on Firm-Level Employee Hiring and Departures

	(1)	(2)
Dep. Var.:	Scaled Cumulative New Hires	Scaled Cumulative Departures
Panel A: Unweighted		
Treatment	-4.038***	-1.109
	(1.544)	(1.429)
R^2	0.249	0.290
Panel B: Weighted		
Treatment	-4.072**	-1.308
	(1.567)	(1.372)
R^2	0.245	0.275
Industry × Year FE	Y	Y
Observations	14,000	13,000

Note: This table presents the estimated effects of large institutional ownership on firm-level employee hiring and departure. Panel A shows unweighted estimates and Panel B uses inverse probability weights to control for selection on overall and block institutional ownership, and total employment. The dependent variable in column (1) is the cumulative number of new hires post-event scaled by the pre-event average number of new hires. The dependent variable in column (2) is the cumulative number of employee departures post-event scaled by the pre-event average number of departures. "Treatment" is an indicator equal to one if a firm experiences a more than 5% increase in total block ownership and zero if more than 5% increase in overall institutional ownership and a less than 5% increase in total block ownership. Standard errors adjusted for sample clustering at the firm level are in parenthesis. ***, **, and * represent significance at the 1%, 5%, and 10% levels. The numbers of observations are rounded to follow the Census Bureau's disclosure rules.

Appendix

Table A1: LEHD Coverage by State

State	State abbreviation	First year	Last year
Arizona	AZ	1992	2015
Arkansas	AR	2002	2015
California	CA	1991	2015
Colorado	CO	1990	2015
Delaware	DE	1998	2015
District of Columbia	DC	2002	2015
Hawaii	HI	1995	2015
Idaho	ID	1990	2015
Illinois	IL	1990	2015
Indiana	IN	1990	2015
Iowa	IA	1998	2015
Kansas	KS	1990	2015
Maine	ME	1996	2015
Maryland	MD	1985	2015
Montana	MT	1993	2015
Nevada	NV	1998	2015
New Mexico	NM	1995	2015
New York	NY	1995	2015
Oklahoma	OK	2000	2015
Oregon	OR	1991	2015
Pennsylvania	PA	1991	2015
Tennessee	TN	1998	2015
Washington	WA	1990	2015

Note: This table presents the coverage of states and years by the US Census Bureau's Longitudinal Employer-Household Dynamics (LEHD)-Employment History Files (EHF). See Vilhuber (2018) for details of the LEHD infrastructure.