How Do Small Firms Accommodate Minimum Wage Increases? Evidence from Matched Employer-Employee Tax Returns*

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Abstract

Using new data matching the universe of U.S. tax returns of pass-through firms and their workers over a 15 year period, we examine the impact of higher state minimum wages on small and medium sized businesses. We find that small firms incur significant wage bill increases when minimum wages are raised. Higher minimum wages do not increase the exit rate of small firms or pass-through firms overall. Instead, pass-through entities accommodate higher minimum wages through higher revenue. For small firms these revenue increases outpace wage bill increases, leading to higher average profits in the years after a minimum wage increase. We show that these surprising findings can be rationalized in a framework where smaller firms operate in product markets alongside a larger firm with price-setting power that is more affected by a given cost shock, as is the case with minimum wages. Our findings highlight the importance of understanding the heterogeneous impacts of wage floors on firms of different sizes and the how product market dynamics affect the eventual incidence of these policies.

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1. Introduction

Minimum wages are a popular tool for redistribution. Since the last federal minimum wage increase in 2009, more than half of U.S. states have increased their statutory minimum wage. One common concern is that small businesses may be particularly vulnerable to minimum wage increases.[1] Fear that small businesses operate on margins too tight to accommodate cost increases or face demand too elastic to allow for cost pass-through motivates proposals to exempt small firms from minimum wage policies and wholesale opposition to raising wage floors. Despite the public salience of this issue, the impact of minimum wage policies on small and medium-sized businesses has been less studied in the economics literature.

Our paper examines the impact of six 2014 state minimum wage increases on privately-owned firms known as pass-throughs that comprise the vast majority of small and medium enterprises in the U.S. We assemble a linked employer-employee data set that merges the business tax returns of the universe of U.S. pass-throughs between 2010 and 2018 with the individual returns of all employees of these firms over the nine year period. Using these data we find little evidence that small firms are particularly vulnerable to minimum wage increases. Raising the minimum wage does not meaningfully increase closure rates. We can rule out increases in firm exit rates larger than 0.36% and even among the smallest firms employing 15 workers or fewer, we can reject closure increases larger than 0.58% with 95% confidence. Pass-through firms do respond to higher minimum wages by moderately reducing employment by roughly 0.36 workers on average. Among firms in the leisure/hospitality and retail (LHR) industries, which employ 69% of minimum wage workers according to the BLS, the employment impact is somewhat larger, amounting an average reduction of 0.85 employees, though these impacts are mostly concentrated among larger firms employing 50

[1]For example, https://www.wsj.com/articles/as-minimum-wages-rise-smaller-firms-get-squeezed-1434054188 and https://www.forbes.com/sites/williamdunkelberg/2021/04/12/15-federal-minimum-wage-attacks-on-small-businesses/?sh=134153df4e21 .

employees or more. Across all industries, elasticity estimates indicate that a 10% wage increase caused by state minimum wage increases leads to a 2% decline in employment. These elasticities are very similar across firms of different sizes, and also similar to aggregate estimates reported in Harasztosi and Lindner (2019),Eriksson and Pytlikova (2004), Fang and Lin (2015), Card and Kreuger (1995), implying that workers at small firms are not differentially vulnerable to increases in the wage floor. Limited responses on external margins mean that wage bills rise sharply when states raise their minimum wages. For the average firm wage costs are 5.2% (0.007) higher four years after the 2014 policy change. The minimum wage effectively raises the compensation of low income workers with no discernible impact on the earnings of their higher income colleagues. To finance these added wage costs, which amount to roughly $20,700 for the average pass-through firm, firms turn to new revenues. Net revenue rises by 3.2% (0.006) four years after the state minimum wage increase. The average LHR firm, too, is able to fully offset their higher wage costs with net revenue increases. In short, minimum wages effectively raise the pay of low income workers employed by pass-through firms and are financed by consumers.

This paper makes three key contributions to the minimum wage literature. First, we bring compelling, new data to the question of how minimum wages affect small firms and their workers. In many ways these data are ideal to assess how minimum wages affect small firms. Most importantly, they actually describe small firms, which are hard to capture in worker-level surveys used in most prior work, and are swamped in aggregate analysis. Because these data describe both workers and the firms that employ them over time, we can measure any heterogeneity in responses by firm and worker characteristics. The breadth of our data is also valuable. Because our data cover the universe of U.S. pass-through firms our findings are representative of the economic activity of U.S. small and medium firms. This breadth also affords precision, letting us detect even small effects and estimate reasonably precise zeros.

Second, we provide uniquely comprehensive measures of the impact of minimum wages on small firms. Our data allow us to take a less-common firm perspective on the impacts of minimum wages, measuring the effect of higher minimum wages on exit rates, revenue and turnover, but also examine the consequences for workers, and even by worker characteristics such as income history, and tenure. We are able to capture some of these characteristics, like firm tenure and turnover, only because of our unusual linked employer-employee data.

Finally, our identification strategy allows us to capture the heterogeneity in impacts of minimum wages on firms with different exposure to wage floors and describe market-level impacts of raising the minimum wage. We exploit sub-national policy changes, allowing us to compare treated firms to similar but wholly untreated firms in states that did not adjust their wage regulations. As a result, firms with low exposure to minimum wages are not our baseline. By comparing similar firms across exposed and unexposed markets, our estimates incorporate any market-level impact netted out when comparisons are drawn across more- and less-treated firms. Instead, we estimate the effect on the average firm, within any subgroups of interest, including those that are more or less exposed to the minimum wage through their labor cost structure.

This heterogeneity in impacts is important. The wage bill changes that reduce employment are not evenly borne by firms of different sizes. The workforce composition of large firms increases their exposure to minimum wage changes.[2] As such, raising the minimum wage, somewhat surprisingly, has a smaller impact on the costs of small firms relative to large firms. Wage bills rise by 3.6% (0.016) among the smallest firms but rise by 5.9% (0.011) among the largest firms employing 250 workers or more. This lighter burden makes higher minimum wages easier for smaller firms to bear. Like all pass-through firms, the smallest employers finance these added costs with new revenues. What might be surprising is that

[2]Larger firms nonetheless have higher average compensation, but this is driven by pay in the middle and upper end of the income distribution.

revenues rise similarly for small and large firms despite the fact that large firms sustain heavier cost increases. These patterns, however, are consistent with a model dating back to Forchheimer (1908) and furthered by von Stackelberg (1934) and Stigler (1937), where larger firms exercise some degree of pricing power and smaller firms are price-takers. Paired with larger firms experiencing relatively larger cost shocks due to the minimum wage as we document, this market dynamic can generate the rising profits among small firms that we observe.

As an example consider a business like Chipotle[3], a large national chain, which may rely more on minimum wage workers than mom-and-pop burrito restaurants because it employs a different mix of capital, labor of different skill levels, and intermediate goods like pre-made beans or salsas. Due to its well-known brand and likely lower marginal costs due to scale and automation, Chipotle likely exercises some pricing power while mom-and-pops produce more commodity-like meals at higher marginal costs and compete. When Chipotle raises its prices to offset higher labor costs due to minimum wage increases, mom-and-pop burrito purveyors will similarly be able to raise prices despite facing smaller cost shocks. If the Chipotles of the market experience large enough increases in marginal costs, smaller firms will see profit rise as the prices they match more than offset the cost shock they experience.

Our findings make clear that minimum wages do not disproportionately harm small firms. While their modest scale might make small businesses seem more vulnerable to cost shocks, in fact, because smaller pass-through firms rely less on low income workers, they are less affected by minimum wage increases than larger firms. Minimum wage increases, in a sense, operate almost like a tax on the competitors of small firms. Though costs rise for small firms, their larger competitors face even larger cost shocks. This market-level impact means

[3]Chipotle is also notable for very publicly indicating that it would raise prices to accommodate higher state minimum wages. For example, https://www.businessinsider.com/chipotle-will-raise-burrito-prices-if-a-15-minimum-wage-passes-2021-4 and https://www.fox29.com/news/chipotle-raising-prices-to-offset-its-15-minimum-wage-hike.

that it is easier for small firms to raise prices to offset the added labor costs arising from a higher wage floor. It can also explain why small firms are not known for lobbying in favor of minimum wage increases despite the fact average profits rise following minimum wage hikes. While any given proprietor may understand the elasticity of the demand she currently faces through experimenting with prices, it is harder for her to know how demand will accommodate price changes once demand for her products has shifted in light of price increases by larger firms. Minimum wage increases have few deleterious impacts on small firms, but because the mediating factors operate at the market level, they are harder to predict for proprietors, and perhaps policymakers, to discern ex ante.

2. Analyzing Firm Responses with Administrative Data

The central question of our analysis is how minimum wage increases are financed by firms and their workers. To understand how compensation changes among workers within a firm and between workers and owners we need a dataset that combines worker level measures of earnings and employment with firm level measures of profit and owner earnings. We assemble such data by linking the annual tax returns of the universe of U.S. pass-through businesses to the yearly individual return and information reports of all workers and owners associated with a firm each year.

2.1. Pass-throughs, Small Firms and Minimum Wage Exposure

For our empirical analysis, we focus on pass-through businesses. Pass-throughs are privately owned businesses with legal forms including S-corporations, Partnerships and Limited Liability Companies (LLCs).[4] In 2015, pass-throughs comprised 78% of non-sole-proprietorship businesses and accounted for 46% of employment and 52% of business income. Pass-throughs

[4]These private business forms are called pass-throughs because of their tax treatment. Business income is not taxed at the entity-level, but is "passed through" to the individual tax returns of the firm owners. This is in contrast to publicly traded C-corporations where the business income is subject to the corporate income tax, and shareholders are taxed at the individual level on any distributions of dividends.

are smaller than publicly traded firms on average, but they represent the majority business forms in all 2 digit NAICS industry groups except utilities and management of companies and enterprises. Pass-throughs represent the primary business form for small and medium-sized firms in the U.S. across states and industries. They represent 79% of firms with fewer than 20 employees, 72% with 20-99 employees, 61% with 100-500 employees, and 77% of all firms with fewer than 500 employees. They only represent 18% of firms with more than 500 workers, of which publicly traded C-corporations are the predominant business form.[5]

We focus on pass-throughs for two key reasons. The effect of minimum wage increases on the viability, employment and financial health of small businesses is a top flight concern when it comes to wage floor policy and the vast majority of small and medium-sized business in the U.S. are organized as pass-throughs. Minimum wage studies that use worker-level surveys will implicitly estimate responses among large businesses because they employee half the population, though representing a small subset of firms. Similarly, effects of the minimum wage estimated using scanner data or business administrative data that is size weighted will also be less informative about responses among small and medium sized businesses. Second, and more practically, we are able to establish a comprehensive link between firms, their workers and owners for the population of pass-throughs in the tax data, a task that is more challenging with C-corporations. C-corporations are much more likely to have subsidiaries, to have multiple Employer Identification Numbers (EINs) associated with a single firm, and to have contract payroll service providers listed on worker W-2s (instead of the hiring firm itself). This makes it much more difficult to consistently and confidently match workers to C-corporations and track changes in worker outcomes or firm survival over time. Finally, as described below, we are able to link all owners of pass-throughs to the firm allowing us to

[5]Statistics are from SOI Integrated Business Data (https://www.irs.gov/statistics/soi-tax-stats-integrated-business-data) and Census's SUSM Annual Data Tables by Establishment Industry (https://www.census.gov/data/tables/2015/econ/susb/2015-susb-annual.html). See Smith et al. (2019), Yagan (2015) and Cooper et al. (2016) for further descriptions of pass-throughs and their owners relative to other business forms in the United States.

separately identify responses of employees from firm owners that also provide labor the firm. For C-corporations this is not possible, so responses of employee-owners will be included in any aggregates on employee outcomes. Going forward, we refer to these pass-through businesses as small and medium-sized businesses (SMBs) for simplicity, though some may be quite large and a minority of small businesses are not organized as pass-throughs.

2.2. Administrative Data: Firm-Worker Panel

Firm and worker information is drawn from the universe of de-identified administrative tax data. We start with a 100 percent sample of active pass-throughs with at least one non-owner employee in treatment states (states with legislated minimum wage increases in 2014) in 2013, the year before the minimum wage increase, and a 50 percent sample of pass-throughs in control states that fit the same criteria.[6] The backbone of the panel is the firms' annual income tax returns to which we link the individual income tax returns and information reports of all owners and workers to create a combined firm-worker dataset.[7] The dataset includes individual income variables for all employees in each year, as well as firm-level income, tax, productivity and characteristic variables from the business income tax return.

From the firm tax returns, we use information on production and productivity including, i) net ordinary business income, ii) revenues: gross sales, iii) Net revenues: equivalent to gross profits or sales less cost of goods sold (COGS), iv) total deductions and non-wage deductions, defined as total deductions less deductions for officer and employee compensation. Other firm-level variables collected from the tax return include the NAICS industry code and the state and zip code of operation.

[6] Treated states, as described further in Section 3, are those shown in Figure 1 and the control states are Alabama, Georgia, Iowa, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, North Carolina, North Dakota, New Hampshire, New Mexico, Nevada, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.

[7] "Active" firms are those with some non-zero business income or sales. The business income tax return for S-corporations is Form 1120S and for partnerships (general partnerships or LLCs) it is Form 1065.

The firms' income tax returns are linked to every employee who was issued a W-2 with positive wage and salary income. The firm's wage bill is the sum of wage and salary earnings of all non-owner employees, and the number of employees is the number of non-owners receiving W-2s. Further, we use earnings information to define a subset of workers that are more likely "exposed" to minimum wage changes. We define more "exposed" workers in the base year, 2013, based on their 2011-2015 earnings history to isolate true low earning workers as opposed to those with idiosyncratically low earnings in a given year. We define these low earning workers as those with total earnings (from all jobs) that are less than 40 hours per week for 52 weeks at the minimum wage in each year from 2011-2015. For each firm, we calculate the share of workers and the share of the firm's wage bill in 2013 associated that are potentially exposed by this measure. We note that while this group should contain essentially all minimum wage workers, there may be consistently part time workers that earn wages well above the minimum wage that are included as well.[8]

Pass-throughs are required to file a Schedule K-1 on behalf of each owner, which reports the owner's share of firm income in each year. To identify owners, we match each firm with all filed Schedule K-1 reports. Owners can be active, shareholder-employees, or passive owners. Firm owners earn annual profits or losses from their businesses and active owners may pay themselves wage and salary income as well. We define owner income/profits as net business income plus wage and salary income paid to active owners. This definition provides a measure of the owners' total residual business income from owning the firm, paid as either wages or profits.[9] We further use the K-1 owner link to exclude active owner-employees from

[8]We also include information on the age of each employee and define shares of young workers, those under 26 years old, at each firm.

[9]Guidance on the IRS website states, "S-corporations must pay reasonable compensation to a shareholder-employee in return for services that the employee provides to the corporation before non-wage distributions may be made to the shareholder-employee." Active owners have some discretion over how much "reasonable compensation" to pay themselves and how much they receive as profits. Tax policy affects the relative incentives for owners to compensate themselves through profits or wages. For this reason, a comprehensive measure that includes both is more consistent across time and location.

our worker estimates and to separately estimate the effect of policies on firm owners.

Our primary analysis sample is a balanced panel of active S-corporations from 2010 to 2018. We use the balanced sample to track how exposed firms finance increases in minimum wages. Additionally, we use the full unbalanced panel of firms to estimate any potential effects of the minimum wage in firm exit and for robustness checks. The primary analysis sample consists of 436,605 firms per year, 216,175 in treatment states and 220,430 in control states, and approximately 14-18 million workers per year.

The linked employer-employee data we assemble provides several advantages. Principally, it allows us to estimate various margins of response among affected firms and their workers to provide a comprehensive picture of how small and medium sized businesses respond to minimum wage increases. We can separately estimate how the policy affects workers at these firms, owners of the firms and firm performance and viability. The worker-firm-owner link allow us to observe the full allocation of income within a firm, and to estimate how raising the wage floor affects the distribution of employee compensation within a firm as well as between workers and owners. The firm's tax return discloses many key details of the firms operations so we can observe additional dimensions of firm behavior like revenues, employment relationships and investment. Further, because we draw on the universe of tax returns, we can also track firm viability as any ongoing firm is required by law to file a tax return.[10]

Additionally, the linked data allow us to investigate any heterogeneity in firm responses by firm and worker characteristics. Small average responses may belie large effects among a subset of firms. In addition to comparing firms in industries known to have high and low levels of minimum workers, we also compare firms in which minimum wage employees likely compose a substantial share of employees prior to the minimum wage change to firms

[10]What we cannot track is any shift from the formal to non-formal sector. That is, if increases in the minimum wage lead firms to no longer file returns, we will describe this as a business closure in our analysis. In this sense our viability analysis my overstate the true business closure effects of the minimum wage.

that relied less on minimum wage employees. Further, using the universe of tax returns provides us the power to detect small effects, even for subsets of firms that are informative for understanding heterogeneous responses. Prior research regarding the employment impact of raising the minimum wage has frequently found relatively imprecise zero effects. Finally, because tax returns constitute mandatory financial disclosures for both firms and individuals and the rules regarding the reporting of the items we track are unaltered over our analysis period, the data we draw upon is reported consistently before and after the policy change, and unlike survey data is not susceptible to rounding or recollection issues.

The principle weakness of the tax data for our purposes is that we do not directly observe hourly wages. Tax returns report aggregate earned income and W2 forms report earnings from different employers, but do not separately report hours and wages. As a result we screen potentially minimum wage workers using criteria based on earned income equal to full-time work at the minimum wage as described above. For these reasons, our data are uniquely well suited to taking a firm-level view to understanding the margins by which SMBs respond to minimum wage increases and how this affects their workers, but the data are less well-suited for analyzing the direct effect on the population of minimum wage workers, since they cannot be directly observed in the tax data.

3. State Minimum Wage Changes and Empirical Strategy

3.1. Policy Details

Our analysis centers on the six state minimum wage changes that took effect in 2014. We focus on these legislative changes because they are the most recent policy events that also allow for a multi-year post period to assess the consequences of raising wage floors. Figure 1 plots the minimum wage over time for each of these six states (California, Connecticut, Delaware, Michigan, Minnesota and New Jersey) with with X marks denoting the passage of new legislation

In five of these six states the 2014 minimum wage increase was the first part of a larger, phased-in minimum wage hike. These phase-ins mirror federal proposals to raise the minimum wage over several years. Connecticut and California legislated further minimum wage increases in 2014 and 2016, respectively, which also phased in over time and supplanted minimum wage increases dictated by the 2013 legislation.[11] Delaware and Michigan adopted further increases in the minimum wage in 2018, and though these took effect after our analysis period, we may observe some anticipatory reaction to these policy changes in the last year of our sample. The details of each state's minimum wage schedule can be found in Appendix Table 1.

For the average firm in these six states the total impact of the minimum wage legislation was to increase the minimum wage by 30.6% by 2018. In comparison, recently proposed federal legislation aims roughly double the minimum wage from $7.25 to $15 over four and a half years, an increase of about $1.72 per year.

Our event study analysis traces the collective impact of these wage floor changes over time with the our estimates from 2018 providing our most complete measure of the cumulative effect. Because firms may anticipate scheduled or potential future minimum wage increases, our estimates may attribute too strong a response to the actual change in minimum wages in any given year. Changes in employment, wages, and revenues may also be disproportionate if firms face adjustment frictions. As such, our estimates in any year may be an upper bound on the effect in a frictionless world where policies took effect in a single year.

[11] Connecticut's 2014 law replaced the $9.00 minimum wage that was scheduled to take effect in 2015 with a new $9.15 minimum wage followed by further increases in each of the next two years. California's 2016 legislation built on the minimum wage increases of it 2013 law, and for the first time distinguished between larger and smaller employers. Employers of 26 or more workers face minimum wage increases each year until the minimum wage reaches $15.00 in 2022 when become inflation indexed. Smaller California firms ultimately face the same minimum wage but with a one-year delay in the scheduled increases.

3.2. Identification

Using the policy variation described above, we define a treatment and control group of states exposed and unexposed to minimum wage increases in 2014. The treated states are those shown in Figure 1, which are all states that experienced a minimum wage increase in 2014 and had not had an increase in the previous two years (i.e. the increase in 2014 was not part of a phase-in of a previously legislated increase). The control group consists of all states that did not experience a minimum wage increase anytime between 2012-2018.[12]

To estimate the effect of the 2014 minimum wage increases we use an event-study style approach to compare outcomes of firms and workers in exposed and unexposed states over time. Our workhorse model is a panel difference-in-differences (DD) specification of the form:

$$f(y_{jt}) = \alpha + \sum_{s \neq 2013} \beta_s exposed_j \times year_{s=t} + \delta_t + \psi_j + \nu_{jt} \tag{1}$$

where y_{jt} is a firm-level outcome and β_s is the DD estimator of the differential in the average outcome between firms in exposed and unexposed states relative to the pre-reform base-year, 2013. The primary definition of exposure, $exposed_j$, is an indicator for the firm operating in a state with a minimum wage increase. The event-study style design helps to assess the validity of comparing firms in exposed and unexposed states by estimating whether trends moved in parallel prior to the reforms. The firm fixed effect, ψ_j, controls for time-invariant firm characteristics and year fixed effects, δ_t, capture the conditional time-path of the average outcome for control firms.

[12]Control states are Alabama, Georgia, Iowa, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, North Carolina, North Dakota, New Hampshire, New Mexico, Nevada, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.

3.2.1. Weighting and Winsorizing

To enhance the comparability of treatment and control firms, we use the re-weighting methodology of DiNardo et al. (1996) (DFL) to construct a distribution of firms from states that did not change their minimum wage that is observationally similar to the set firms subject to minimum wage increases in 2014.[13]

To implement DFL re-weighting, we bin firms by three-digit NAICS industry code, tax year, and within-industry size decile, where size is the two-year average of lagged value-added[14] and the deciles are based on the within-industry distribution of firms in treated states in 2013. Then, for each year and set of firms we adjust each bin's weight such that each bin carries the same relative weight as in the 2013 distribution of firms in treated states. Re-weighting the sample this way allows us to flexibly control for time-varying size- or industry-based shocks preventing, for example, time-varying shocks to large retail firms from influencing the results because large retail firms in treated and untreated states in each year will contribute equally to the estimates.

For our regression analyses that examine dollar-valued outcomes, such as the total wage bill or owner's income, we weight by the product of the DFL weight and firm size, so that each observation contributes to all graphs and estimates according to its economics scale and all estimates are representative of U.S. economic activity. We winsorize all raw reported firm values from above and below at the 1% level. Winsorization is standard when working with the population business tax returns. For example, Yagan (2015), DeBacker et al. (2019) and Kline et al. (2019) winsorize all values at the 5% level.

Table 1 shows key characteristics of the sampled firms. Means are presented in the left panel and medians in the right. The first two columns show the raw means for treatment and control firms in the base year 2013 while the third column shows the adjusted means for

[13]Our DFL procedure is similar to Yagan (2015), which re-weights S corporations to make their within-industry size distributions comparable to C corporations.

[14]Value-added is total gross receipts less total wage bill and cost of goods sold.

control firms using the DFL weights. Comparing raw means, the firms in the treatment and control states are very similar in the number of employees but the firms in the treatment states are somewhat larger on average in terms of revenues, total wage bill, gross profit and owner income. Looking at worker characteristics, the average share of likely minimum wage and young workers of treatment and control firms are very close in the raw means. The share of firms in the industries most exposed to minimum wage policies (leisure/hospitality and retail) are nearly identical. Columns 4 and 5 show very similar relationships for the medians.

Applying the DFL weights pulls the means and medians of the control group closer into alignment with the treatment group. Average revenues, wage bill, gross profits and owner income are well balanced across groups after DFL-weighting. Taken together, the summary statistics show that the firms in treatment and control states are not too dissimilar in terms of observable characteristics prior to re-weighting. Also, the DFL weights do an excellent job balancing the baseline firm-level income and expenditure variables, further enhancing the comparability of the exposed and unexposed firms in our data.

3.2.2. Implications of Research Design for Understanding Minimum Wage Responses

Our identification strategy compares firms in states that increase their minimum wages to similar firms in states that left their wage floors unchanged. This, combined with our large sample and detailed linked microdata, provides two related benefits for estimating responses to minimum wages increases. First, it allows us to compare very similar firms in terms of industry, size and cost structure. Studies that rely on a national minimum wage increase often use "exposure designs," identifying effects on firms or workers by comparing the outcomes of firms with different exposure to the policy change (generally some baseline measure of minimum wage workers).[15] Firms more or less exposed to minimum wage increases may

[15]For example, Harasztosi and Lindner (2019) and Drucker et al. (2021)

differ by size, industry or other observable or unobservable characteristics. Even if there is no confounding selection on such characteristics, these designs estimate the direct effect of the minimum wage change on firms of the type that use minimum wage workers more intensively. On the other hand, our design estimates the effect on the average firm in the affected market, and within any subgroups of interest. Since we do not depend on exploiting variation by baseline exposure, we are able to conduct high-powered heterogeneity analysis across subgroups that may be, on average, more or less exposed to the minimum wage change. In particular, "exposure designs" do not allow for estimating heterogeneous responses by exposure to the policy change, whereas we are able to estimate responses among firms with different labor-cost structures.

This points to the second, related, advantage. By comparing firms in exposed and unexposed markets, we can estimate responses among firms that are more and less directly affected by the policy due to their workforce composition, but are simultaneously exposed through the market-level shock. That is, we can estimate effects on firms that may be less exposed to minimum wage changes, but operate in the same product and labor markets as firms that are more exposed, thus providing information about the market-level effect of the policy in addition to the firm-level effect.[16] We use this to explore empirically how impacts vary by exposure, and frame conceptually how market structure can create heterogeneity in how minimum wage policies affect different types of firms.

Of course, our empirical strategy relies on assumptions as well. The principle threat to identification is policy endogeneity. One form of endogeneity is if states that choose to implement minimum wages at a given time are on different paths than those that do not, for example, if minimum wages are increased in states with faster growing economies. This would be a violation of the standard parallel trends assumption for DD designs. This is a

[16]In the U.S., the vast majority of minimum wage workers are in non-tradable, local services industries (leisure and hospitality, retail, administrative services, healthcare services), so it is reasonable to define the relevant market as within-state.

legitimate concern, and we use pre-trend analyses for all of the primary outcomes to assess the plausibility of this assumption in our setting. The second identifying assumption is that there are no other changes, concurrent with the minimum wage change, that would differentially affect the outcomes in treated and control states. This is a general challenge for designs with state-level variation. We provide evidence that our estimates are consistent with responses to minimum wage policies, for example, by investigating the distribution of wage changes and by using within-state, across firm variation in exposure.

Finally, it is important to note the potential limitations of extending the results of our state-level analysis to other contexts. These states may have industry or worker compositions that are not representative of the country as a whole or of other states not in the sample. Also, our results can only speak to comparable minimum wage changes; much smaller or larger changes may have different impacts. Further, our estimates are of short and medium-run responses to these policies, and may not reflect the long-run results of these policies even within these states.

4. Exit and Employment Impacts

4.1. Minimum wages and firm viability

Concerns regarding the cost of higher minimum wages often center on the viability of smaller firms. If smaller firms are less able to substitute away from higher cost labor, or pass the cost shock on to consumers, the fear is that they may shutter. Figure 2 examines the impact of higher minimum wages on firm exit rates where a firm is considered to have exited if it filed a tax return in 2013 but then did not file a return in other years.[17] The plotted coefficients from linear probability models similar to Equation 1 with exit as the dependent variable convey the difference in exit rates between firms in treatment and control states accounting

[17] "Exit" is an indicator for the firm not filing a tax return in year t. Therefore, prior to 2013 this is an indicator for the firm not yet existing and differential trends represent differential entrance rates; post-2013 it is an indicator for the firm having exited and the coefficients represent differential exit rates.

for firm and market characteristics.[18] Estimates for all industries exposed to minimum wage changes are plotted in yellow[19] while the most exposed industries, leisure/hospitality and retail (LHR), are plotted in blue.

We find no evidence of heightened exit among pass-through firms following minimum wage increases. The breadth of our data allow for relatively precise estimates. In all years after the 2013 baseline, exit rate increases exceeding 0.5 percentage points can be ruled out with 95% confidence for firms in all exposed industries as well as for LHR firms. Compared to a mean raw exit rate of approximately 29% between 2013 and 2018 in treated and control states, these estimates imply that higher minimum wages have at most a very small impact on the viability of the small and medium firms that typify pass-throughs.[20] Appendix Figure A.1a reports estimates for firms with fewer than 25 and fewer than 10 employees and Figure A.1b describes estimates for firms in the bottom quartile of profitability in 2013 and neither shows evidence of increased exit even among the smallest and least profitable firms in our sample in the years after a minimum wage increase.

The lack of widespread closures following minimum wage hikes also means that treated firms are not subject to differential attrition. As such, the employment, wage bill and revenue impacts we examine below are not based on a highly selected sample of survivors from which weaker firms have been culled, but instead are broadly representative of the full scope of pass-through firms.[21]

[18] Specifically, we control for interactions of industry, value-added decile, and categories for number of employees, quintile of county job density and quartiles of firm shares of low wage workers.

[19] "All Exposed" industries (in order of minimum wage worker share) are: Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. No other two-digit industry represents more than 1% of minimum wage workers in the U.S. according to BLS.

[20] The average one-year exit rate is 6.6% in 2013 for the Leisure/Hospitality or Retail industries and 5.2% in all exposed industries.

[21] Appendix Figure A.3 repeats our core employment, net revenue and owner income analysis using an unbalanced panel of firms, which includes firms sampled in 2013 that entered after 2010 and exited before 2018. All results are very similar to estimates from the balanced panel that we report in the main text.

4.2. Employment effects of minimum wages

The employment effects of minimum wage laws have been widely studied with many (though certainly not all) recent studies finding small impacts in the near term (CITES), and others pointing to the potential for larger long-run impacts (Meer and West, 2016) MORE CITES. Our goal is to understand how minimum wages affect small and medium-sized firms. Do these non-corporate enterprises have to shed workers in response to increases in the minimum wage? Are they disproportionately at risk? To understand the consequences of the 2014 minimum wage increases for the employees of small and medium-sized firms, we first estimate Equation 1 with total firm employment as the dependent variable. Figure 3 plots the event-time coefficients and shows that pass-through firms subject to higher minimum wages reduced employment by a small, but significant margin. Among firms in all exposed industries, the average firm shed roughly 0.36 (0.07) more workers by 2018, while firms in the most exposed leisure/hospitality and retail industries saw an average relative loss of 0.85 (0.12) workers.[22] These elasticities are small but significant, and in line with previous studies that do not focus on small and medium-sized firms. Appendix Figure A.2 compares our estimates to elasticities from prior work.[23]

To put the small employment decline in context, we estimate elasticities of employment with respect to average firm wages.[24] As reported in Panel A of Table 2, estimated elasticities are -0.215 (0.0068) and -0.172 (0.0038) for firms in LHR industries and all exposed industries, respectively. These elasticities are quite similar for firms of different sizes with the firms with the fewest employees, in fact, showing the smallest responses. Panel A also presents estimates of the employment effect in levels and logs by firm size, again showing more modest

[22]Though the differences are not statistically significant, the dis-employment point estimates grow over time, suggesting that employment adjustment is costly or that the availability of substitutes lags the arrival of cost shocks.

[23]This figure is a facsimile of Figure A.6. of Harasztosi and Lindner (2019) with some additional estimates.

[24]Employment elasticities with respect to average wage using regressions of the form $\Delta ln(E_j) = \alpha + \beta \Delta ln(meanwage_j) \times teat_j + \Delta \epsilon_j$ where the log differences in employment and firm average wages are taken over the 2013 to 2018 period.

employment impacts among smaller LHR firms.

We expect raising the minimum wage to more acutely impact firms that rely heavily on low earning workers. The lower panel of Table 2 looks at how the employment impacts vary by the share of a firm's workforce that is low earning. We estimate the employment impact by quartile of low income worker share, where for the median firm low income workers compose roughly 6.5% of its employees. The estimates reveal that the average employment effects reported above are fully concentrated among firms that rely more than the typical firm on low earning employees.

Collectively, Figure 3 and Table 2 show that firms responded to the 2014 state minimum wage increases with modest, statistically significant employment reductions, but that small firms were not more sensitive to these cost shocks. Combined with the lack of exit shown in Figure 2 and Figure A.3, the results indicate that smaller firms and their workers are not more vulnerable to higher minimum wages. These limited extensive margin responses raise the question of how the small and medium-sized business accommodate the added costs of higher minimum wage.

5. Financing Minimum Wage Increases

5.1. Impact on Firm Wage Bills

To the degree higher minimum wages increase the wages firms actually pay to affected workers, these additional costs must be financed through reducing compensation to other workers, lower spending on other inputs or higher revenues. To understand how small and medium-size businesses accommodate minimum wage increases, we first assess how much total wage bills rise following minimum wage legislation and if firms offset higher pay to minimum wage workers by reducing compensation to non-minimum wage workers.

Figure 4 plots coefficients from a firm-level event study regression of Equation 1 where log annual total wages is the dependent variable. The impact of higher minimum wages

on total wage bills for firms in all exposed industries is shown in yellow while the blue line focuses on LHR industries. Firms in treated and untreated states had very wage bill similar trends in the years prior to the 2014 minimum wage increases. Average wage bills then rose sharply starting in 2014 among firms in all industries, and especially for LHR firms. Wage bills among treated firms grew each year and by 2018 the average firm subject to higher minimum wages was spending 2.9% (0.005) more on cash compensation to employees than in 2013.[25] Higher minimum wages boosted wages paid even more for LHR firms whose wage bills were 5.2% (0.007) higher in 2018 relative to 2013. Wage costs rose meaningfully for the average pass-through firm when states raised their wage floors in 2014, resulting in higher average earnings for workers employed by these typically small and medium-sized firms.

Firms may partly offset the added costs of higher minimum wages by reducing the compensation of workers above the minimum wage or salaried workers not subject to wage regulations. Figure 5 looks at the impact of higher minimum wages on the distribution of compensation to workers in firms exposed to higher minimum wages. Annual compensation rises significantly for workers earning between $15,600 and $25,000 and between $25,000 and $35,000 a year.[26] Point estimates suggest that workers further up the earnings distribution see small compensation increases but these estimates are not statistically significant.[27]

[25]The tax data do not consistently report the value of any in-kind benefits workers may receive. Clemens et al. (2018) show that higher state minimum wages reduce the likelihood individuals report having employer-sponsored health insurance.

[26]Appendix Figure A.4 examines whether the increase in average earnings was driven by firms raising the pay of workers who previously worked at the firm (stayers) or by new workers hired at higher wages (turnover). For workers earning between $15,600 and $25,000 turnover largely drives the increase in average compensation, which may be unsurprising as these employees see high turnover in general. Turnover rates for these workers, however, fell at firms subject to higher minimum wages. Earnings gains are more evenly split between new hires and incumbent employees for workers earning between $25,000 and $35,000. Overall, the decompositions allay the concern that low aggregate employment effects obscure the wholesale replacement of very low wage workers with new hires following minimum wage legislation.

[27]This also serves as a validity test for the results, showing that the wage bill increases are driven by the low earning workers most likely to be affected by minimum wage policies, and not by high earning workers where changes may be more likely to be driven by other policies or market shocks.

5.2. Offsetting Higher Labor Costs with Revenues and the Impact on Owner's Profits

As pass-through firms only modestly adjust employment and do not reduce the compensation of higher income workers in response to minimum wage increases, they must find other ways to accommodate the roughly 5% increase in labor costs caused by higher wage floors. Prior work suggests that firms are often able to pass the cost of minimum wage increases on to consumers through higher prices Harasztosi and Lindner (2019); Ashenfelter and Jurajda (2021); Leung (2021); Renkin et al. (2020) though there is also evidence reduced profits as well Draca et al. (2011); Harasztosi and Lindner (2019); Ganapati and Weaver (2017).[28] Tax data do not allow us to separate quantities and prices but we can examine how revenues evolve to offset higher labor costs following the 2014 minimum wage increases. We focus on net revenue, which is gross revenue less the cost of goods sold.

Figure 6 plots the average change in net revenue since 2013 over time among firms subject to higher minimum wages relative to firms in other states. After following a pre-trend very similar to that of firms in untreated states, net revenue for treated firms in all exposed industries and particularly LHR firms rises starting in 2014 and then plateaus after 2016.[29] By 2018, LHR firms subject to higher wage floors have seen net revenues grow by 3.2% more than firms in states that did not raise their minimum wages. Firms are able to finance the higher labor costs caused by minimum wage increases, at least in part, through higher revenues. To understand the degree to which wage increases are financed with new revenues, and how much is financed by the owners of these firms we next directly examine the effect of minimum wages on owners' residual profits.

[28]Studies using scanner data such as Leung (2021) and Renkin et al. (2020) naturally focus on products made and retailed by large firms and are thus less applicable to small and medium-size firms that are more commonly found in service industries.

[29]The cost of goods sold rose modestly after 2014 among treated firms, which may be due to increased reliance on these intermediate goods or due to the firms producing these products facing higher wage costs themselves. Examining changes in net revenue accounts for these additional cost changes.

We define owner income as the net business income plus wage and salary income paid to active owners. This definition, further detailed in Section 2.2, provides a measure of the owners' total residual business income from owning the firm, paid as either wages or profits. Figure 7 plots the evolution of owner income in dollars among firms subject to higher minimum wages relative to firms that were not. For the average pass-through firm in states that raised their minimum wage, the sharp increase in net revenues outpaced higher wage bills, leading to an increase in owner income.[30] Average increases in owner income were similar for firms in all exposed industries and firms in leisure/hospitality or retail, amounting to roughly $10,00 by 2018. As average owner profit in 2013 were $194,000 in LHR industries and $302,000 in all exposed industries, this represents roughly 5% and 3% increases in profits.[31] In effect, on average firms were able to fully finance the wage increases driven by higher minimum wages through added revenue such that owners on average did not bear the burden of minimum wage increases in either firm closures or lower profits.

5.3. Heterogeneous Responses to Minimum Wage Exposure

These averages, however, belie substantial and important heterogeneity. Figure **??** plots the log change between 2013 and 2018 in wage bills and net revenue (Panel A) as well as owner income (Panel B) due to higher minimum wages by the firm exposure to minimum wages. Exposure is measured as the share of a firm's baseline 2013 wage bill going to low earning workers.[32]

As we move from left to right in these plots, we expect firms to face larger cost shocks due to the minimum wage increase. In Panel A we do in fact see that wage bills increased

[30] Owner income is estimated in levels because of the substantial share of negative values corresponding to firm losses.

[31] Appendix Figure A.3 shows the main results for an unbalanced panel of firms, allowing firms sampled in 2013 to enter after 2010 and exit prior to 2018. The results are quite similar showing that selection on firms that survive to 2018 is not driving the findings.

[32] As described in Section 3.2 exposure is measured as the share of the baseline wage bill going to low earning workers where low earning workers are defined as those earnings less than full-time (40 hours per week, 52 weeks / year) at the prevailing minimum wage in each year from 2011-2015.

more for firms with larger shares of low income workers. Yet, although, the cost shock rises with exposure, net revenue impacts are essentially flat across firms with differing exposure to minimum wage changes. Because less exposed firms face smaller cost increases, these revenue gains translate into higher owner income while the owners of more exposed firms roughly break-even.

It is worth noting that firms with different levels of exposure to the minimum wage likely differ along a number of other dimensions, some observable and some not. As such, we are not drawing comparisons across firms with different exposures to minimum wage changes to make causal inferences regarding the impact of minimum wages on firm responses. Instead, these comparisons are intended to highlight how the impact of minimum wages might manifest differently for firms. Importantly, the most exposed firms tend to be larger than the least exposed firms. Table 3 reports estimates of the wage bill and net revenue increase between 2018 and 2013 for treated firms relative to control firms by number of employees. Firms employing fewer workers on average face more modest wage bill increases when minimum wages rise. Point estimates suggest that the wage bills of firms employing fewer than 15 workers rise by 3.6 percentage points while firms employing more than 250 workers see increases of nearly six percentage points. Revenues, on the other hand, increase similarly for large and small firms as they did for the most and least exposed in **??**. As a result, for the smallest firms revenue increases more than offset wage bill increases while the largest firms roughly break-even. Firms employing fewer than 50 workers add roughly two to four dollars in revenue per dollar of higher wage costs while for firms with 100 workers or more, new revenue roughly dollar-for-dollar matches higher wage bills.

While minimum wage laws apply uniformly to all firms, their impact hinges on the cost structure of each firm. Our data show that on average smaller firms rely less on low wage workers and thus face smaller cost shocks when minimum wages are increased. Nonetheless, these small firms experience revenue increases in line with their larger counterparts. The

result is that rather than being put out of business small pass-through firms see higher profits in the years after a minimum wage increase. The next section shows that these differing impacts between smaller and larger firms are consistent with a model where larger firms enjoy pricing power in the product market but are hit harder by minimum wage increases.

6. Understanding Heterogeneous Impacts of Cost Shocks

Minimum wages affect the wage bills of large and small firms differently. Smaller firms typically rely less on low income workers than larger firms and thus experience smaller wage bill increases when states raise their minimum wages. Among the larger pass-through firms, on the other hand, low income workers account for a greater share of the workforce and thus wage bills rise more sharply with minimum wages. In short, small and large private firms have different cost structures with low income workers a consistently more commonly used input among large firms.

In contrast, revenue increases are much flatter across the firm size distribution with point estimates suggesting smaller revenue gains among the largest firms. The end result is that new revenue outpaces wage bill increases among smaller firms, yielding profit gains. The largest S-corps, on the other hand, roughly break even with revenue rising roughly in parallel with wage bills. Approximately full pass-through among large firms mirrors the findings of Ashenfelter and Jurajda (2021) who focus on McDonald's restaurants and find full pass-through of minimum wages into Big Mac prices.

While surprising, this pattern of rising profits for smaller firms paired with close to full pass-through among larger firms is broadly consistent with the classic dominant firm model. Dating back to Forchheimer (1908) and furthered by von Stackelberg (1934) and Stigler (1937), this simple framework posits that the large firm in the market with a marginal cost advantage behaves as a price leader in anticipation that its smaller rivals will behave as price takers. As such, the large firm with market power derives the demand curve it will

face as the residual demand resulting from subtracting its rivals' aggregate supply from market demand. The large firm maximizes its profit by producing a quantity that equates its marginal revenue (derived from its residual demand curve) and its marginal cost, and pricing according to its demand curve. The fringe of rival firms behaves as price-takers and in equilibrium the expectations of all firms are fulfilled.

Figure 9 illustrates how these market dynamics can yield higher profits among smaller firms in a stylized setup where one firm exerts market power while all other firms are price-takers. Assuming that all firms face quadratic cost functions, but the large firm has a cost advantage such that $d_L < d_F$, the cost functions$C(Q_L) = \frac{d_L}{2}Q_L^2$ and $C(Q_F) = \frac{d_F}{2}Q_F^2$ yield upward-sloping marginal cost curves $MC_L^0 = MC(Q_L) = d_L Q_L$ and $MC_F^0 = MC(Q_F) = d_F Q_F$.

Market demand is linear: $P = 1 - Q_T$. The larger firm wields a degree of pricing power, facing the downward-sloping demand curve, D_L^0, equal to market demand (D_M) less the supply readily provided by the competitive fringe of smaller firms (S_C^0). In this framework, the large firm's position stems from its cost advantage, but more broadly pricing power may be enhanced by brand reputation such as when branded fast-food or hotel chains compete alongside smaller operators whose products and services are viewed by consumers as imperfect substitutes for the branded version. Before the minimum wage increase, the large firm produces Q_L^0, which equates its marginal revenue and marginal cost and sets price P_0. Smaller firms respond to this price by supplying Q_C^0 and total quantity supplied equals market demand ($Q_L^0 + Q_C^0 = Q_T^0$) at price P_0.

We model higher minimum wages as increasing costs for all firms, but consistent with our finding that larger firms are more exposed to wage floor changes, marginal cost rises more for the large firm. Raising the minimum wage shifts the large firm's marginal cost curve up by v to MC_L^1 and shifts the supply curve of the fringe by u to S_C^1 where $v > u$. The new equilibrium price, P_1, reflects the higher costs the large firm now faces. The competitive

fringe reacts to this higher price by increasing its output such that collectively all firms deliver Q_T^1. Intuitively, if a large chain with brand power like Chipotle faces an increase in marginal costs when minimum wages rise, it will pass part of these added costs on to consumers through higher prices. Other smaller eateries will also have to comply with the new minimum wage law, but as they rely less on low wage labor, their marginal cost increases will be smaller. The new market price has increased by more than the marginal costs of these smaller firms, leading them to sell more burritos and potentially earn higher profits. The minimum wage is borne by consumers who now purchase a lower quantity ($Q_T^1 < Q_T^0$) at a higher price ($P^1 > P_0$).

Profits will rise among small firms if the cost shock to the price-setting large firm is sufficiently large relative to the shock experienced by the smaller firms. The large firm will pass on part of this cost shock by raising the price, which can then lead to revenue gains among small firms that more than offset their smaller cost increases. Profits will rise for small firms if the area of the yellow region of Figure 9 exceeds the red area below the new fringe supply curve, S_C^1. More specifically, for the setup here it will be the case that profits among fringe firms will rise as long as[33]

$$\frac{v}{u} > \frac{1 + 2d_F + d_D + d_F d_D}{1 + d_F} \tag{2}$$

To understand the plausibility of rising profits among smaller firms after minimum wage increases, we calibrate this expression for a range of cost parameters. We focus on cost parameters that yield Lerner index values for the large firm that are consistent with industry estimates from Kalnins (2006) (also used in Butters (2020)), De Loecker et al. (2020) and

[33]Appendix B details equilibrium prices and quantities before and after the minimum wage increase and provides the derivation of (2).

Hall (2018).[34]

Figure 10 presents a heat map of the minimum ratio of v to u, that is the size of the large firm cost shock relative the cost shock of smaller firms, that would generate higher profits for fringe firms according to (2). The large firm's cost parameter, d_L, increases from left to right while the ratio of the competitive fringe's cost parameter to the large firm's cost parameter, $\frac{d_C}{d_L}$ rises as we move upward. Because small firms are assumed to be less efficient than the large firm, $\frac{d_C}{d_L}$ always exceeds unity. Bluer areas correspond to lower threshold ratios while the darkest red regions of the upper right register ratios as high as 2.10, meaning that for profits to rise for smaller firms following a minimum wage increase, raising the minimum wage would have to increase marginal cost more than twice as much for the large firm as small firms.

The heat map shows that when the large firm's marginal cost curve is steeper, which corresponds to the right side of the map, the threshold ratio of large firm to small firm cost shocks must be higher for profits among small firms to rise when the minimum wage is increased. A steeper marginal cost curve means that the large firm is less able to pass any cost increases on to consumers, resulting in a smaller price increase, necessitating a bigger difference in large firm and small firm cost shocks for profits among small firms to rise after a minimum wage increase. While the impact is less stark, when small firms are relatively less efficient, for the same large firm marginal cost slope, the ratio of large firm to small firm cost shocks must be greater for higher small firm profit gains to arise from minimum wage increases.[35]

[34]Kalnins (2006) reports prices and marginal costs for accommodations that imply a Lerner index of 0.54. Using detailed Census data De Loecker et al. (2020) find that the 75th percentile of retail markups reaches 3 in 2012, the last year of their analysis, which corresponds to a Lerner index of 0.67. Hall (2018) estimates somewhat lower industry-wide average Lerner indices for the accommodations and food service sector, 0.34, and retail, 0.31, using aggregate data. As the large firm will have more market power than the average firm in its industry, we use a range of cost parameters that yield a Lerner index for the large firm of at least 0.4.

[35]Lerner indices are highest, reaching 0.71, at the upper left of the heat map and lowest and the bottom right, hitting 0.40. When the large firm enjoys high markups due to its own marginal costs being low and the fringe being much less efficient, the minimum wage doesn't need to impact the large firm much more than the small firm for profits among small firms to rise after a wage floor increase. On the other hand,

Most importantly, the heat map shows that for many reasonable relative efficiencies and large firm cost parameters, raising the minimum wage can effectuate higher profits among small firms. Following the 2014 minimum wage increase, wage bills rose for larger firms by roughly 50% more than they did for smaller firms. If average cost changes approximate relative marginal cost shocks, the observed cost shock ratio corresponds to the white band of figure Figure 10. This means that cost parameters along the white band and the blue region to its left could all generate rising profits among small firms in this model.

Of course this heat map and the underlying model that generates it are stylized versions of the markets in which the firms we examine operate. These markets are unlikely to be dominated by a single large firm, but likely feature many firms that have some brand reputation and host of more generic firms. In truth our data do not describe the largest firms in any market, which are almost certainly establishments owned by a C-corporation. Nonetheless, this model helps illustrate how profits could rise amongst the smaller firms in our sample following a cost shock like the minimum wage that hits their larger competitors harder. If firms with pricing power arising from marginal cost advantages and brand reputation are more exposed to wage floor increases and thus face bigger cost shocks when policy changes, their effort to pass these costs on to consumers effectively allows their smaller competitors to raise prices beyond the cost shocks they themselves face. As a result, profits among small firms can rise.

We might wonder why the owners of small firms aren't known for advocating for wage floor increases that could potentially raise their profits. While the owners and managers of small firms may have experience with individually varying their prices and observing the elasticity of current demand, he or she may have much less experience with how demand will accommodate price increases once demand for her products or services has shifted due

when the Lerner indices are under pressure due to high marginal costs for the large firm and close relative efficiencies, for minimum wages to generate increased profits for the small firms, the wage floor increase must hit the large firm much harder.

to price increases by larger firms. The minimum wage in a sense acts like a tax on the larger competitors of small and medium-size firms that make up the bulk of U.S. pass-throughs; while minimum wages raise the costs of small firms, the hit large firms harder.

There are of course alternative explanations consistent with rising profits among small firms. For example, raising prices might antagonize customers less after a well-publicized minimum wage increase. Or, infrequent, lumpy price changes may lead to prices that temporarily more than cover cost increases. The key, however, is that these or other potential explanations would have to hold more strongly for small firms than large firms to fit the patterns we document.

7. Conclusion

The smallest of businesses are hard to track. Since most workers work for larger firms, worker-level surveys and aggregate data tend to obscure the impacts of policy on small firms. Assembling a data set that links the tax returns of pass-through firms, which comprise the vast majority of smaller firms, to the individual returns of the workers they employ, affords us a unique lens on how minimum wage increases affect these ostensibly vulnerable firms and the workers they employ.

Perhaps surprisingly, we find no evidence that small firms are particularly vulnerable to minimum wage increases. We can robustly rule out meaningful increases in closures and find that while small firms do layoff workers in response to minimum wage increases, the employment adjustments are modest and wage-employment elasticities are not larger for small firms. This is true overall and among the leisure/hospitality and retail firms that collectively account for the roughly 70% of minimum wage workers. These modest exit and employment responses mean that minimum wages substantially increase the compensation of low income workers at these firms. Wage bills rise by more than 5% on average, wholly driven by higher pay to low income workers. Firms finance these additional costs with

new revenues. Revenue gains fully offset higher wage costs on average, but among the smaller firms revenues rise further than wage bills, netting owners higher profits on average. Minimum wages effectively act like tax on the competitors of small firms, leading to small profit gains for small firms.

We show that these higher profits are consistent with a model where larger firms with brand reputation exert some degree of pricing power while smaller firms act as price-takers. When a cost shock hits these larger firms harder, they raise prices in proportion to their escalated wage bills. Smaller firms are thus able to increases prices beyond their cost increase. Consistent with this dynamic, we document that while the cost shock is larger for larger firms, revenue increases are similar for firms more and less exposed to the cost shock, giving rise to average increases in profits among the smaller and less exposed firms. Further research into the pricing dynamics between small and large firms would help explain the heterogeneity in how firms of different sizes respond to policy changes. This is a key component to understanding how small firms are able to pass the cost of minimum wage increases on to consumers and an open question.

There are also important limitations to our findings. First and foremost, these estimates are based on states that legislated minimum wage increases. It is unlikely that a state on the precipice of an economic slowdown would raise its wage floors. As such, this evidence comes from places likely more able to withstand labor cost increases. To the degree that other proposed minimum wage increases are or are not similarly cyclical, the local average treatment effect we estimate may be more or less applicable. Our findings are also most pertinent to minimum wage changes of similar magnitude.The mild impacts on small firms are predicated on their lack of reliance on workers directly affected by minimum wage increases. Substantially larger minimum wage increases will drive up the labor costs of small firms more and may erode their wage floor cost advantage relative to larger firms. As such, much larger minimum wage increases, or minimum wage increases that come on the heels of prior

substantive wage floor lifts may be more detrimental to small firms. Finally, these estimates come from one particular era. Production functions change over time and how many and how flexibly firms employ minimum wage workers will change with them.

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Tables and Figures

Table 1: Summary Statistics

	Means			Medians		
	Treatment	Control Unweighted	Control DFL Weighted	Treatment	Control Unweighted	Control DFL Weighted
Employees	35.6	36.8	39.0	9	10	10
Revenue ($)	3,623,049	3,320,229	3,585,778	999,966	918,478	1,005,680
Wage Bill ($)	597,486	555,709	590,161	176,960	172,448	180,054
Avg. Wages ($)	29,080	26,870	27,345	24,110	23,233	23,690
Net Revenue ($)	1,395,798	1,257,769	1,337,117	583,451	520,331	570,220
Owner Income ($)	313,542	290,281	309,594	117,301	105,371	116,253
Share Likely MW Employees	14.3%	14.6%	14.1%	6.2%	7.0%	6.6%
Share Young Employees	22.5%	22.8%	22.6%	16.7%	17.4%	17.4%
Share of Firms in Leisure, Hospitality or Retail	27.0%	27.6%	27.6%	0.0%	0.0%	0.0%

Note: The table above reports means and medians from our estimation sample for key firm variables in the pre-reform year 2013. The first and fourth columns report raw means and medians for firms in treatment states. The second and fifth columns report raw means and medians for firms in control states. The third and sixth columns report DFL re-weighted means and medians where the DFL weights are based on the distribution of two-year lagged value-added within three-digit NAICS industries. For confidentiality, medians are the average value of the 10 firms around the median.

Table 2: Further Analysis of Employment Responses

Panel A: Heterogeneity by firm size

	All	< 15 empl	$15 - 49$ empl	$50 - 99$ empl	> 100 empl
Leisure/Hospitality & Retail					
Level (DD_{2018})	-0.854***	-0.130*	-0.509**	-1.719**	-1.993
	(0.120)	(0.057)	(0.162)	(0.559)	(1.328)
Log (DD_{2018})	-0.0105***	-0.0085	-0.0167***	-0.0180**	-0.0113*
	(0.0031)	(0.0054)	(0.0049)	(0.0069)	(0.0055)
Elasticity (DD_{2018})	-0.215***	-0.214***	-0.223***	-0.190***	-0.257**
	(0.0068)	(0.0073)	(0.0163)	(0.0462)	(0.0866)
N Firms	52,685	27,692	15,642	5,418	3,993
All Exposed					
Level (DD_{2018})	-0.358***	-0.068*	-0.091	-1.683***	0.212
	(0.071)	(0.030)	(0.116)	(0.471)	(1.026)
Log (DD_{2018})	-0.0025	-0.0023	-0.0052	-0.0202***	0.0021
	(0.0022)	(0.0029)	(0.0034)	(0.0057)	(0.0039)
Elasticity (DD_{2018})	-0.172***	-0.168***	-0.176***	-0.187***	-0.353***
	(0.0038)	(0.0039)	(0.0125)	(0.0360)	(0.0512)
N Firms	148,620	93,107	36,539	10,292	8,682

Panel B: Employment effects by share of low earning workers (all exposed)

	None	Q1	Q2	Q3	Q4
Log (DD_{2018})	-0.0042	-0.0045	-0.0084	-0.0116**	-0.0154**
	(0.0043)	(0.0038)	(0.0047)	(0.0041)	(0.0058)
N Firms	57,514	20,514	22,738	27,627	20,065

Note: This table shows DD estimates of the employment effect of the minimum wages increase. The changes are from the base year (2013) to 2018, i.e. $\beta_2 018$ from Eq. 1. The first column presents results using all firms and columns 2-5 show results by baseline firm size (employees). In Panel A, the top set of results are for firms in the Leisure/Hospitality or Retail industries and the second set is for firms "All Exposed" industries, defined as those that account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. In the first row, the outcome is the number of employees, the second log employees and the third the elasticity of employment with respect to log average wages, using regressions of the form $\Delta ln(E_j) = \alpha + \beta \Delta ln(meanwage_j) \times teat_j + \Delta \epsilon_j$. Panel B shows estimates for all exposed firms, by those that were more or less exposed to the minimum wage change, measured by the baseline share of low earning workers, where low earning workers are defined as those with total earnings (from all jobs) that are less than 40 hours per week for 52 weeks at the minimum wage in each year from 2011-2015. The first column shows results for firms with no low earning workers. Columns 2-5 show results by quartile of the base year distribution of firms' share of low earning employees, where Q1 are the lowest share and Q4 the highest share.

Table 3: DD: treated v. control states by firm size (# employees)

	All	< 15	$15 - 50$	$50 - 100$	$100 - 250$	> 250
Wage bill (DD_{2018})	0.052***	0.036*	0.046***	0.048***	0.045***	0.059***
	(0.007)	(0.016)	(0.011)	(0.013)	(0.013)	(0.011)
Net revenue (DD_{2018})	0.032***	0.037**	0.034***	0.035***	0.029*	0.029*
	(0.006)	(0.010)	(0.009)	(0.011)	(0.013)	(0.010)
$\frac{\Delta \text{net revenue}}{\Delta \text{wage bill}}$	1.40	4.37	1.97	1.48	1.1	0.91
N Firms	148,620	93,107	36,539	10,292	6,142	2,540

Note: This table shows DD estimates of the effect of the minimum wages increase on log wage bills and net revenues. The changes are from the base year (2013) to 2018, i.e. β_{2018} from Eq. 1. The first column presents results using all firms and columns 2-6 show results by baseline firm size (# employees). The results are for firms in the Leisure/Hospitality or Retail (LHR) industries. The third row shows the implied ratio of the change in net revenues to the change in wage bill, or the extent to which the revenue increase covers the wage cost increase. We calculate the implied dollar value of the increase in outcome Y by constructing a counterfactual value in year t according to $\Delta Y = \sum_j Y_{jt} - Y_{jt}/(Y_{jt} * e^{\beta_t})$, where j indexes treatment firms and β_t is the estimated coefficient for outcome Y in year t from equation (1).

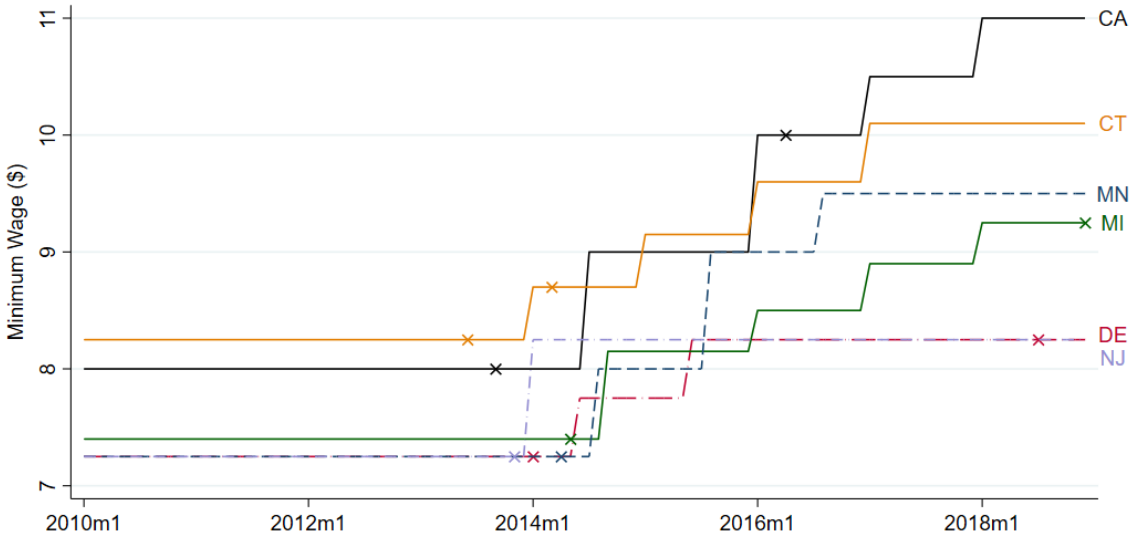


Figure 1: State Minimum Wage Changes

Note: The figure above tracks the statutory minimum wage in California, Connecticut, Delaware, Michigan, Minnesota and New Jersey from 2010 through 2018. The date of enactment for minimum wage legislation is denoted with an X. In fix of six states legislated increases were phased in over time, leading to multiple increases following enactment. Connecticut and California legislated further minimum wage increases in 2014 and 2016, respectively, which supplanted 2013 minimum wage legislation and were phased-in over time. Delaware and Michigan passed new minimum wage legislation in 2018 that took effect after our analysis period, though we may observe some anticipatory impacts.

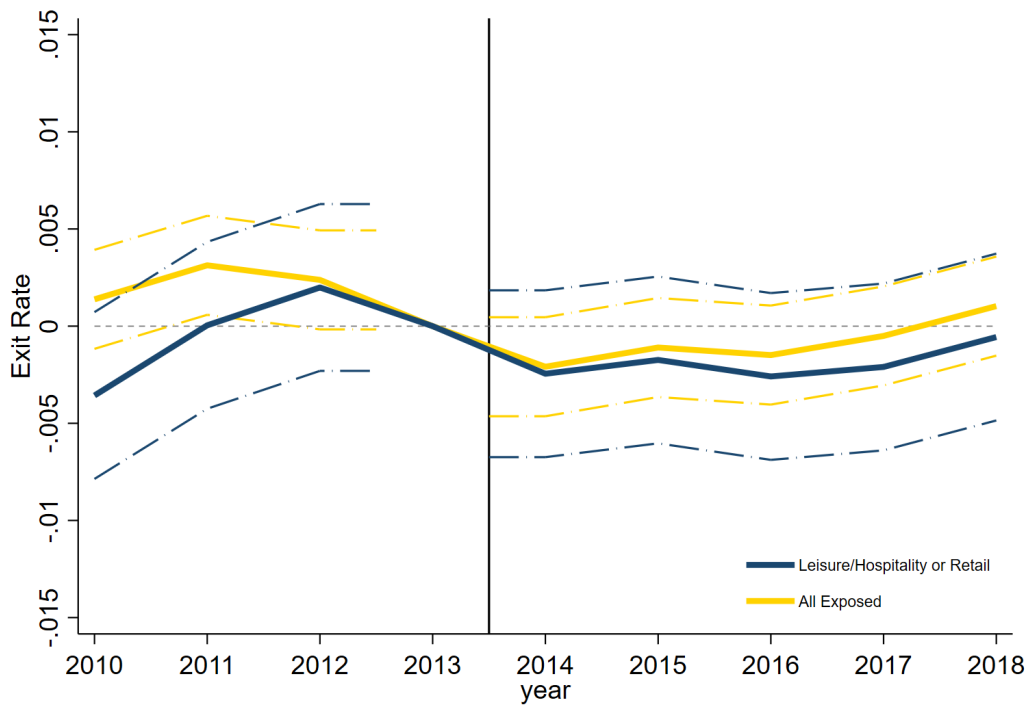


Figure 2: Impact of Minimum Wage Increases on Firm Exit

Note: The figure above plots estimates from linear probability models where firm exit is the dependent variable and an interaction of a treated state indicator and year fixed effects are the regressors of interest. The coefficients on these interaction terms trace out the difference over time in the average change in exit rates relative to the 2013 base year between firms in treated and untreated states. "All Exposed" in yellow is the difference in exit rates for firms in industries that each account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. Collectively, these industries employ 90% of minimum wage workers. Estimates for the most exposed industries, leisure/hospitality and retail, which employ 55% and 14% of minimum wage workers according to BLS are plotted in blue. These regressions control for quartile of low wage worker workforce share and interactions of industry dummies with value-added decile and number of employee categories in the 2013, the baseline year. Employee categories are 1-15, 15-49, 50-99, 100-249 and >500. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

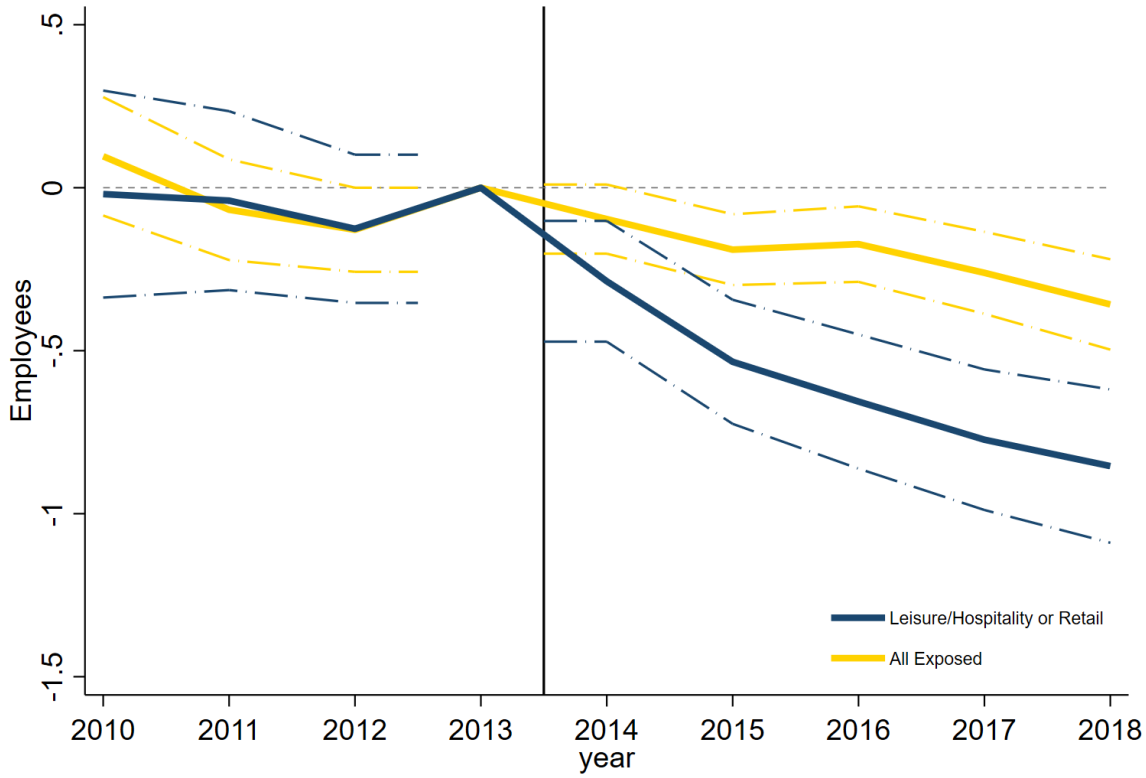


Figure 3: Employment Impact of Minimum Wage Increases

Note: The figure above plots the estimated effects of the 2014 increases in state minimum wages on firm employment. Each set of estimates is from a regression of total employment on firm fixed effects, year fixed effects and the interaction of a treated state indicator and year fixed effects. The coefficients on these interaction terms trace out the difference over time in average total employment relative to the 2013 base year between firms in treated and untreated states. "All Exposed" in yellow is the difference in employment for firms in industries that each account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. Collectively, these industries employ 90% of minimum wage workers. Estimates for the most exposed industries, leisure/hospitality and retail, which employ 55% and 14% of minimum wage workers according to BLS are plotted in blue. Point estimates in 2018 are -0.854 (0.120) for Leisure/Hospitality or Retail and -0.358 (0.071) for All Exposed. Baseline average employment was 43 per firm for Leisure/Hospitality or Retail and 38 per firm for All Exposed. Baseline share of MW workers were 23% and 15.5% respectively. The regressions flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. Employment is winsorized at the 99th percentile. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

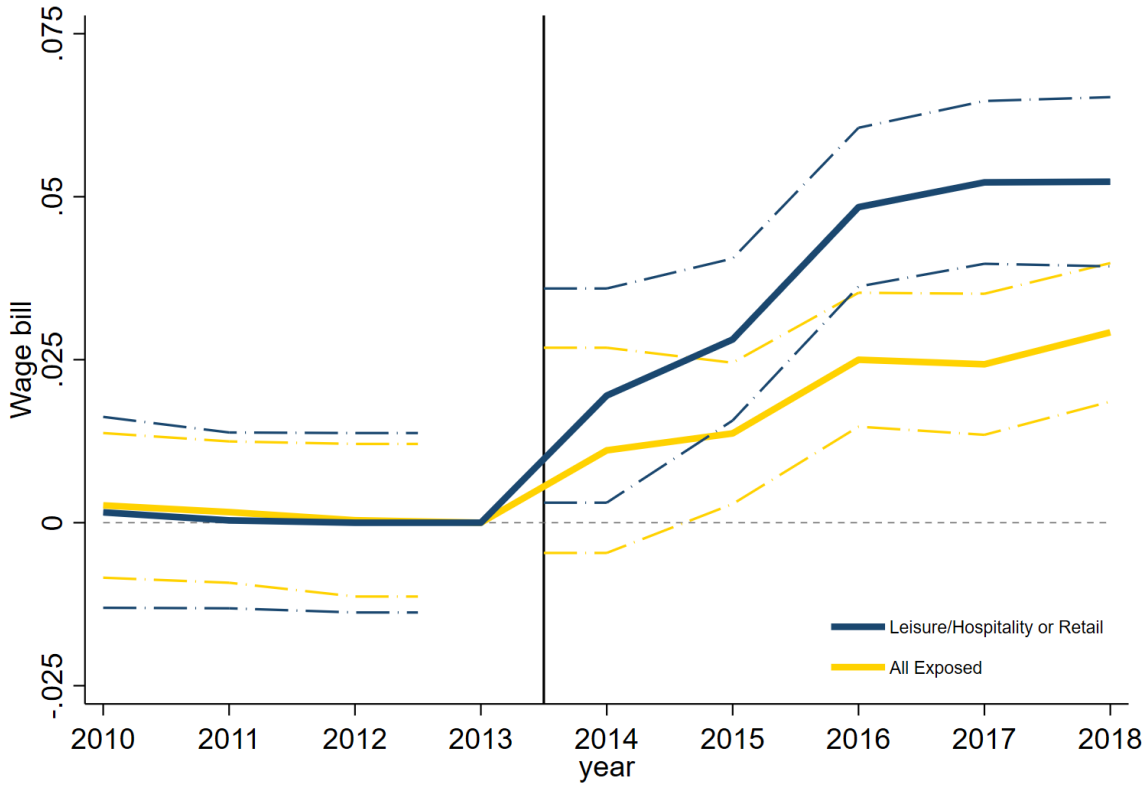


Figure 4: Wage Bill Impact of Minimum Wage Increases

Note: The figure above plots the estimated effects of the 2014 increases in state minimum wages on firm aggregate wage bills. Each set of estimates is from a regression of log total wages paid on firm fixed effects, year fixed effects and the interaction of a treated state indicator and year fixed effects. The coefficients on these interaction terms trace out the difference over time in average total wages paid relative to the 2013 base year between firms in treated and untreated states. "All Exposed" in yellow is the difference in wage bills for firms in industries that each account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. Collectively, these industries employ 90% of minimum wage workers. Estimates for the most exposed industries, leisure/hospitality and retail, which employ 55% and 14% of minimum wage workers according to BLS are plotted in blue. The regressions are dollar-weighted (each observation is weighted by the average of the lagged and twice lagged value-added), and flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. Wage bill values are winsorized at the 99th percentile. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

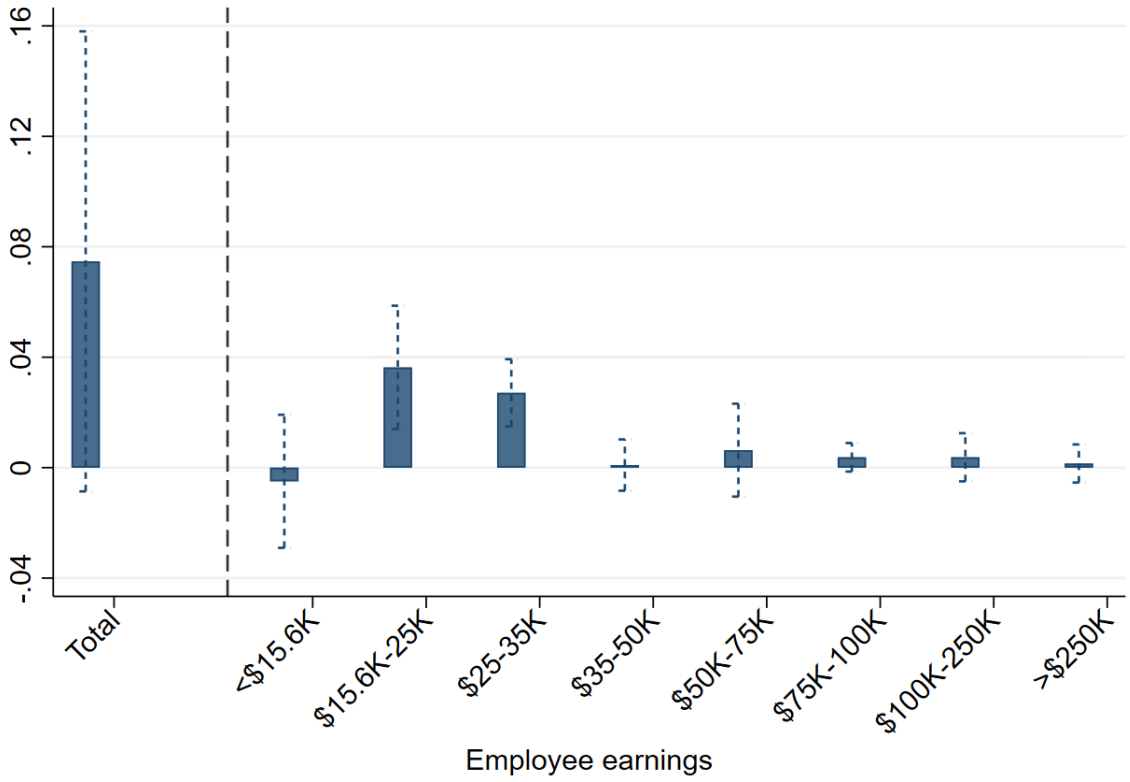


Figure 5: Share of 2013-2018 Wage Bill Increase by 2013 Income Range

Note: The figure above shows the decomposition of the total earnings response across the earnings distribution. The total wage bill effect is shown on the left, and the gains by 2013 earnings range are on the right. Each bar is the DD coefficient estimate from 2013 to 2018, where the outcome is the change in the total wage bill in each earnings bin over the total 2013 wage bill for firm j. The regressions are dollar-weighted (each observation is weighted by the average of the lagged and twice lagged value-added), and flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. The percent change in wage bill values are winsorized at the 99th percentile. Standard errors are clustered by firm.

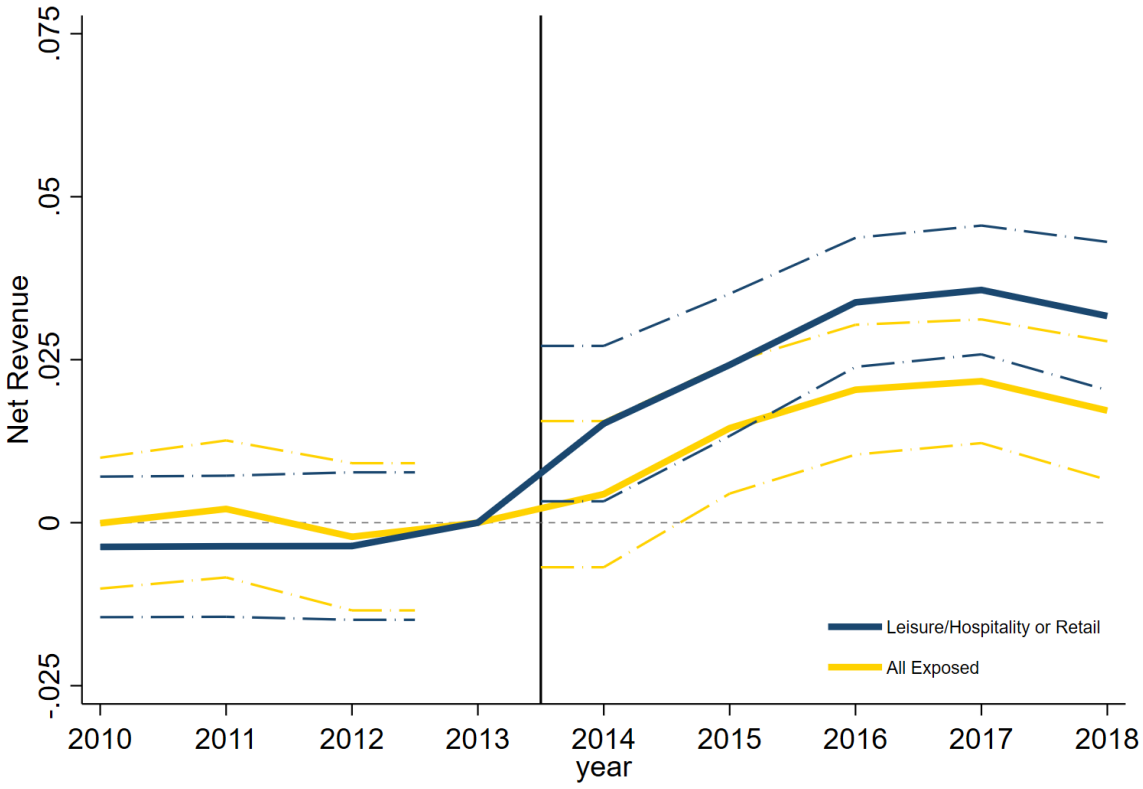


Figure 6: Net Revenue Impact of Minimum Wage Increases

Note: The figure above plots the estimated effects of the 2014 increases in state minimum wages on firm net revenue. Each set of estimates is from a regression of log net revenue on firm fixed effects, year fixed effects and the interaction of a treated state indicator and year fixed effects. The coefficients on these interaction terms trace out the difference over time in average net revenue relative to the 2013 base year between firms in treated and untreated states. "All Exposed" in yellow is the difference in wage bills for firms in industries that each account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. Collectively, these industries employ 90% of minimum wage workers. Estimates for the most exposed industries, leisure/hospitality and retail, which employ 55% and 14% of minimum wage workers according to BLS are plotted in blue. The regressions are dollar-weighted (each observation is weighted by the average of the lagged and twice lagged value-added), and flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. Net revenue values are winsorized at the 99th percentile. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

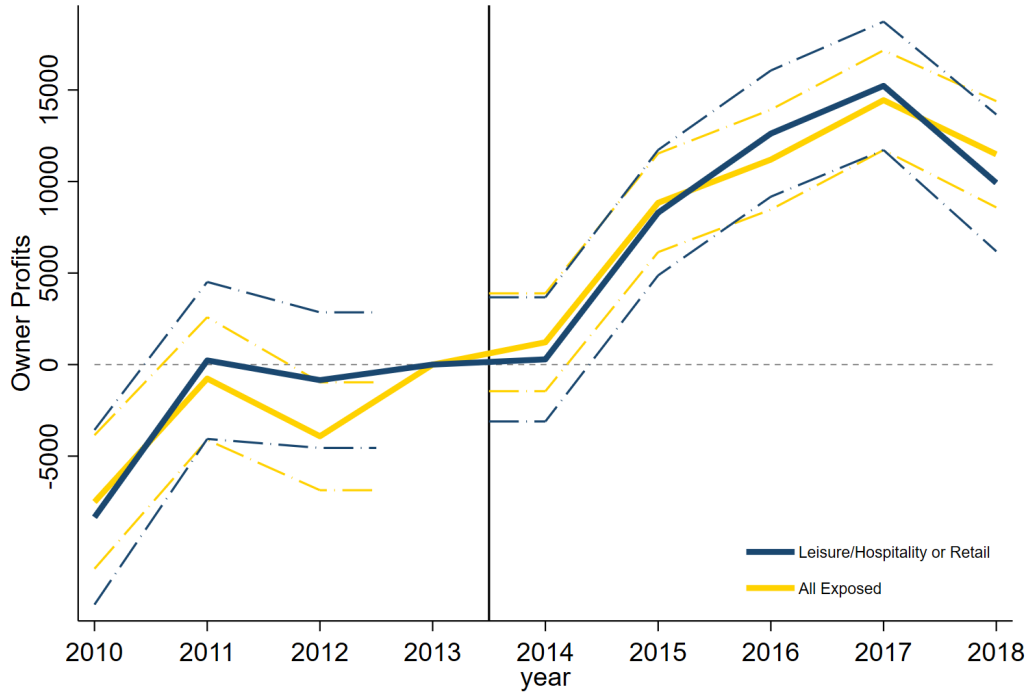
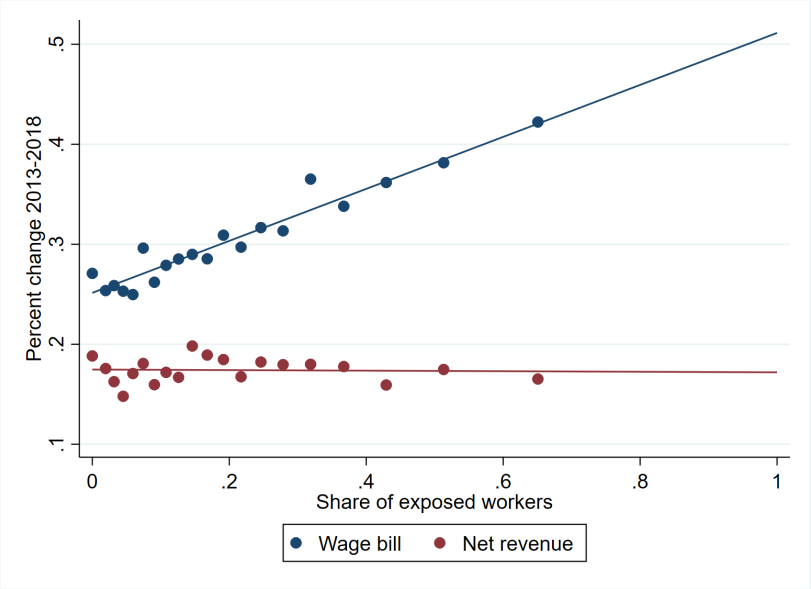


Figure 7: Impact of Minimum Wage Increases on Firm Owner Income

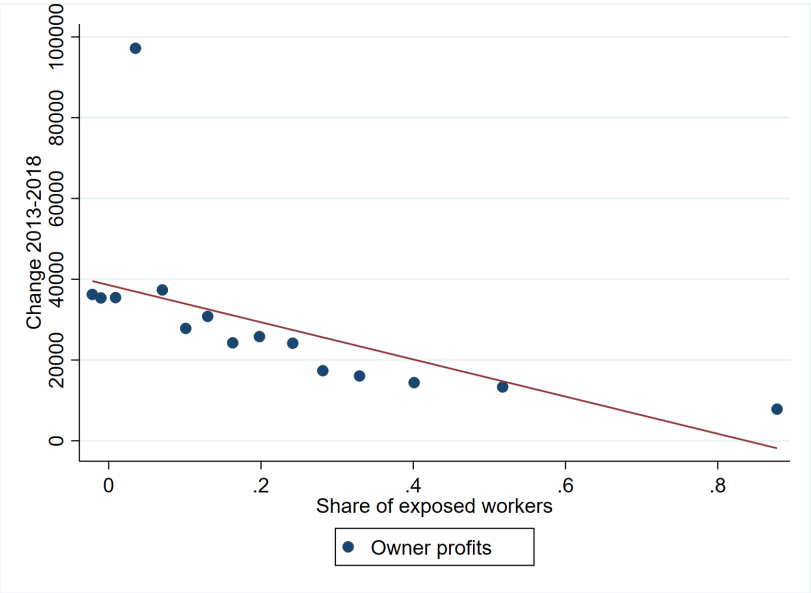
Note: The figure above plots the estimated effects of the 2014 increases in state minimum wages on owner income. Each set of estimates is from a regression of owner income on firm fixed effects, year fixed effects and the interaction of a treated state indicator and year fixed effects. The coefficients on these interaction terms trace out the difference over time in average owner income relative to the 2013 base year between firms in treated and untreated states. "All Exposed" in yellow is the difference in wage bills for firms in industries that each account for at least 1% of minimum wage workers according to the BLS. These industries (in order of minimum wage worker share) are Leisure/Hospitality, Retail, Education and Health Services, Other Services, Professional and Business Services, and Manufacturing. The corresponding NAICS codes are: 71-72, 44-45, 61-62, 81, 54-56, 31-33. Collectively, these industries employ 90% of minimum wage workers. Estimates for the most exposed industries, leisure/hospitality and retail, which employ 55% and 14% of minimum wage workers according to BLS are plotted in blue. The regressions are dollar-weighted (each observation is weighted by the average of the lagged and twice lagged value-added), and flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. Owner income values are winsorized at the 99th percentile. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

Figure 8: Firm Responses by Exposure to Minimum Wage Increases

(a) Wage Bill and Net Revenues



(b) Owner Profits



Notes: The figure above examines how firm minimum wage responses vary with the exposure of the firm. Exposure is measured as the share of the baseline wage bill going to low earning workers where low earning workers are defined as those earnings less than full-time (40 hours per week, 52 weeks / year) at the prevailing minimum wage in each year from 2011-2015. The upper panel of the figure above plots the average percentage change in wage bill and net revenue between 2013 and 2018 by firm exposure. The lower panel plots the average change in owner profit between 2013 and 2018 by firm exposure. The solid lines represent the best linear fit through the estimates. The slopes of these lines are 0.26 (s.e.=0.022) for wage bill, -0.003 (s.e.=0.017) for net revenue and -46,025 (s.e.=6,416) for owner profit.

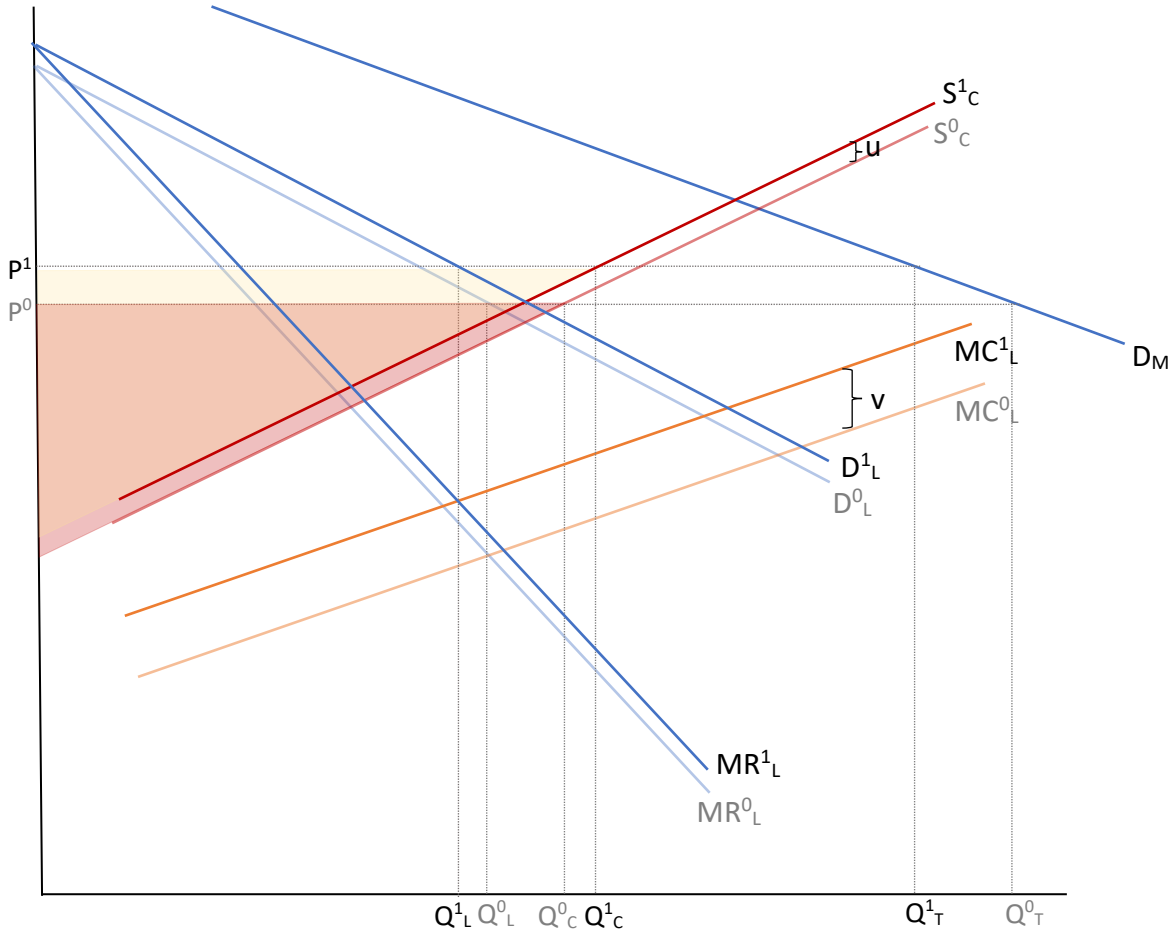


Figure 9: Minimum Wages As Differential Cost Shocks to Price-Setting and Competitive Firms

Notes: The figure above depicts a stylized model where demand is linear and the market features a large firm with some pricing power and a fringe of price-taking smaller firms. All firms have quadratic costs but the large firm has an overall marginal cost advantage ($MC_L^0 = d_L Q_L$ and $MC_C^0 = S_C^0 = d_C Q_L$ where $d_L < d_C$). Before the minimum wage increase, the large firm maximizes its profit by producing quantity Q_L^0 and setting price P^0 to which fringe firms react and collectively produce Q_C^0. A minimum wage increase raises marginal costs for all firms but shifts the marginal cost curve of the large firm more than the fringe ($v > u$). The resulting market price set by the large firm (P_1) can be high enough that profits of the fringe rise, that is the yellow region can exceed the area of the red strip below the new fringe supply curve (S_C^1).

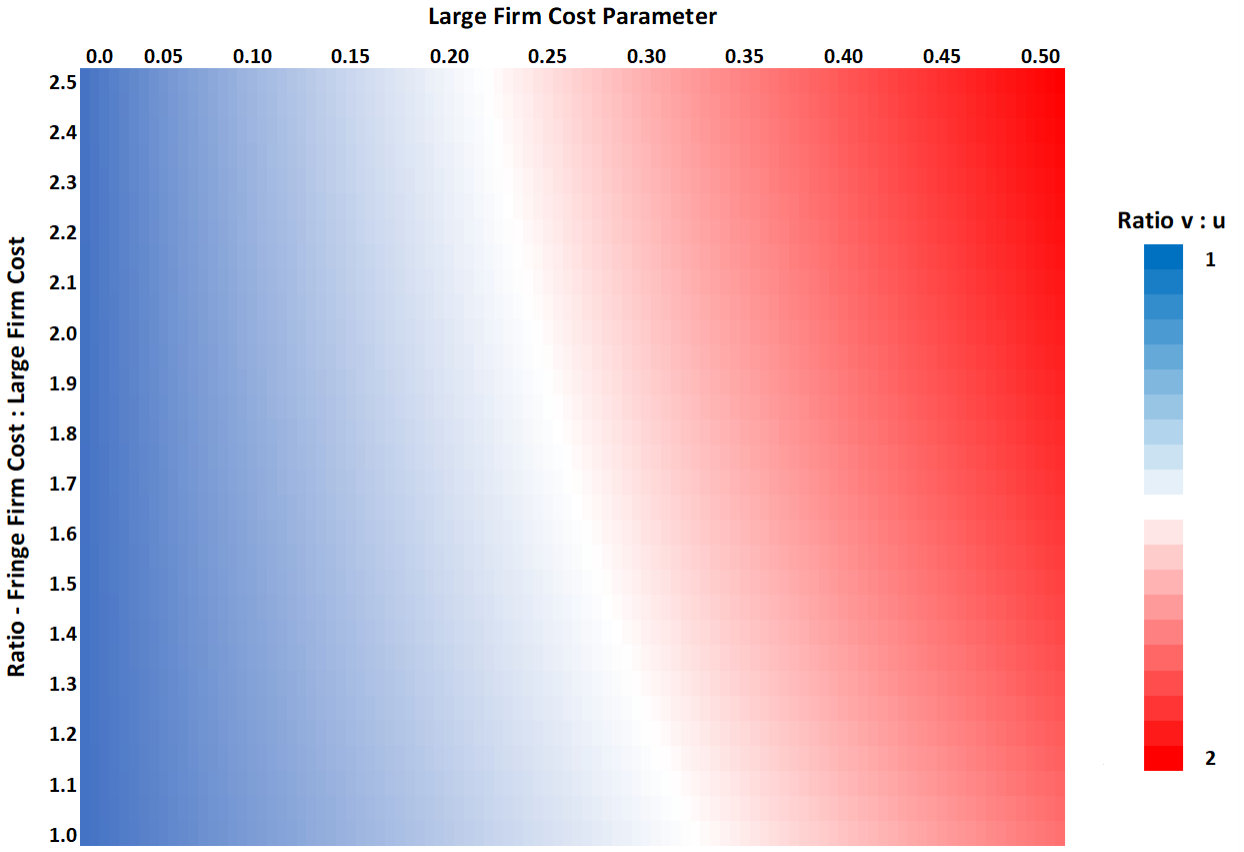


Figure 10: Minimum Ratio of Cost Shocks Required for Small Firm Profit Gains

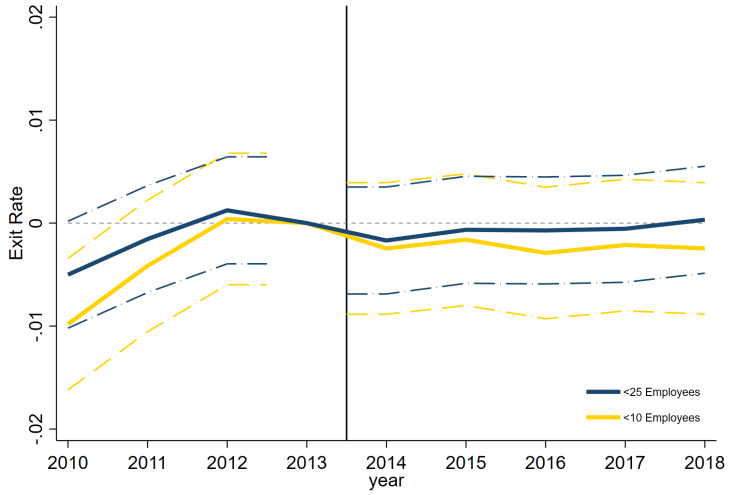
Notes: The heat map above reports the minimum ratio of the magnitude of the large firm's cost shock to the smaller firm's cost shock ($\frac{v}{u}$) necessary for higher minimum wages to increase the profits of smaller fringe firms. As this threshold varies with the large and small firm cost parameters according to equation (2), the map reports the v/u threshold as a function of the large firm's cost parameter, which increases from left to right, and the relative inefficiency of the fringe, which increases from the bottom to top. As the large firm is assumed to have a marginal cost advantage over its rivals, the ratio of v to u always exceeds unity. The data show that wage bills rose roughly 50% more for larger firms than smaller firms, which if average cost changes approximate marginal cost shocks, corresponds to the white band. This means that cost parameters along the white band and the blue area to left of the white band could all generate rising profits among small firms. In other words for reasonable relative efficiencies of small and large firms, the rising profits we observe could be the result of raising the minimum wage. The cost parameter ranges plotted here are limited to those that yield Lerner index values for the large firm that are consistent with industry estimates from Kalnins (2006) (also used in Butters (2020)), De Loecker et al. (2020) and Hall (2018). Please see the main text for more details.

A. Appendix Tables and Figures

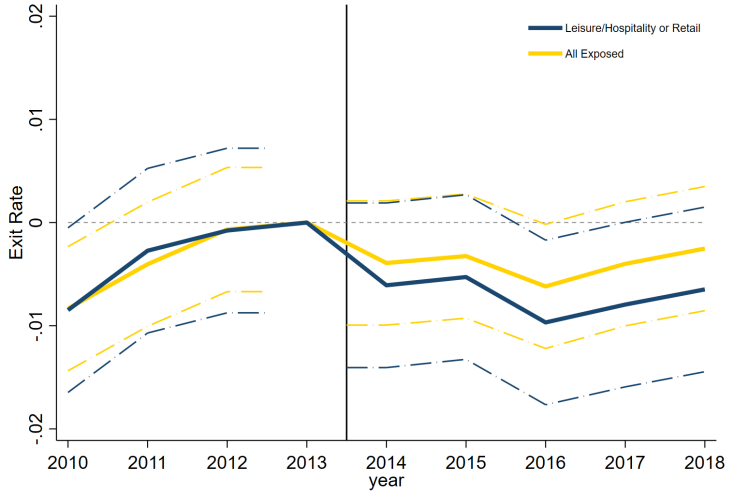
State	Enactment	Effective	2014 MW	Prior MW	Phase-In	Exclusions	Next MW Change	
							Date	Details
CA	09/25/2013	07/01/2014	$9.00	$8.00	$10.00 on 01/01/16	–	04/04/2016	MW increases to $10.50 on 01/01/17 and $11 on 01/01/18 for employers with 26+ employees, then increases by $1.00 a year through 2022 when it reaches $15 and is then inflation indexed; employers with 25 or fewer employees have a 1 year delay for all increases.
CT	06/06/2013	01/01/2014	$8.70	$8.25	$9.00 on 01/01/15	–	03/27/2014	MW increases to $9.15 on 01/01/15, then to $9.60 on 01/01/16, and finally to $10.10 on 01/01/17.
DE	01/30/2014	06/01/2014	$7.75	*$7.25*	$8.25 on 06/01/15	–	07/01/2018	MW increases to $8.25 on 10/01/18, to $9.25 on 10/01/19, to $9.75 on 10/01/20 and then to $10.25 on 10/01/21.
MI	05/27/2014	09/01/2014	$8.15	$7.40	$8.50 on 01/01/16, $8.90 on 01/01/17 and $9.25 on 01/01/18	Firms with only a single employee	12/04/2018	MW increases to $9.45 on 03/29/19, then potentially rises to $12 in 2030.
MN	04/14/2014	08/01/2014	$8.00	*$7.25*	$8.00 on 08/01/14, $9.00 on 08/01/15 and $9.50 on 8/01/16	Firms with gross revenues less than $500K required to pay roughly 80% of standard minimum wage	–	–
NJ	11/05/2013	01/01/2014	$8.25	*$7.25*	–	–	02/04/2019	MW increases to $10.00 on 07/01/19, $11.00 on 01/01/20, with $1.00 increases until 01/01/24 when MW will be 2024. Indexed to inflation with annual increases either $1.00 or inflation.

Figure A.1: Robustness - Exit Rates

(a) Small Firms (Leisure/Hospitality or Retail)



(b) Low Margin Firms



Notes: xxxxxxxxxxxThe figure above plots estimates from linear probability models where firm exit is the dependent variable and an interaction of a treated state indicator and year fixed effects are the regressors of interest. The regressions are the same as those used for Figure 2, Panel B, but focusing subsets of the smaller firms in our sample. Panel A shows results for all firms with less than equal to 10 employees (blue) and for firms with fewer than 25 employees (red) in base year 2013. Panel B shows results for highly exposed firms, those in the retail and leisure/hospitality industries with at least 10% of their 2013 workforce being potential minimum wage workers. The coefficients on these interaction terms trace out difference in the average change in exit rates relative to the base year between firms in treated and untreated states. Estimates are from a model that non-parametrically controls for time-varying factors that differentially affect firms of varying sizes operating in different industries by including interactions of industry dummies with firm-size category dummies and year fixed effects. Standard errors are clustered by firm. The solid line is the best unweighted linear fit through the coefficients. Dashed lines represent 95% confidence intervals.

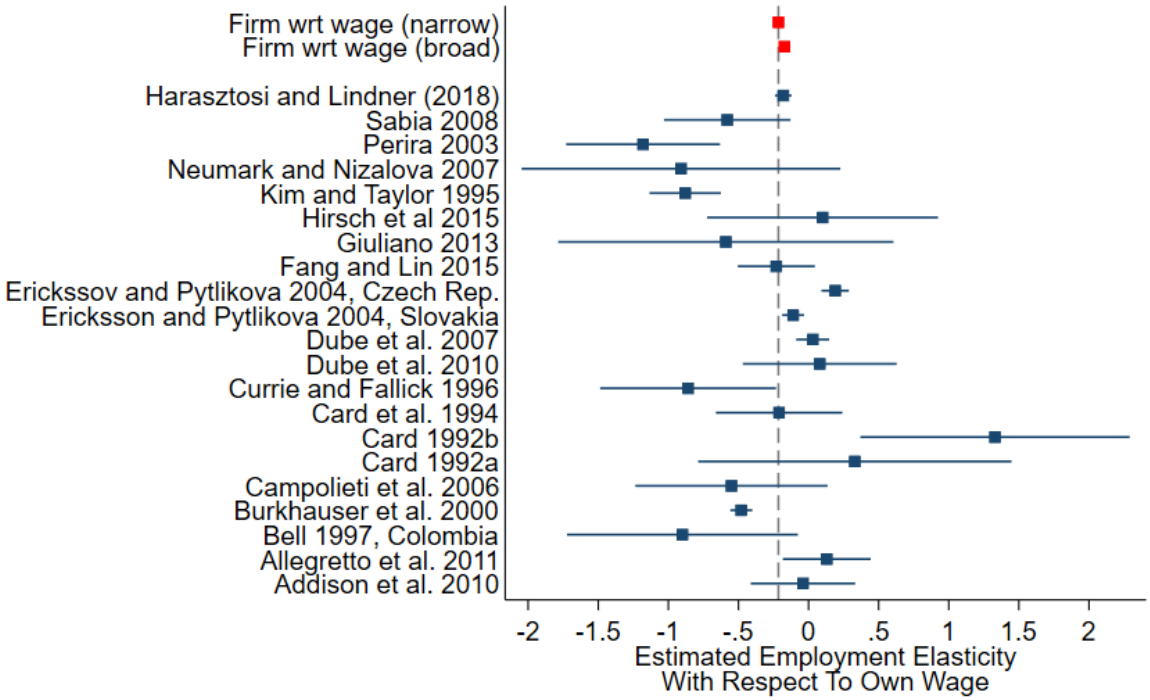
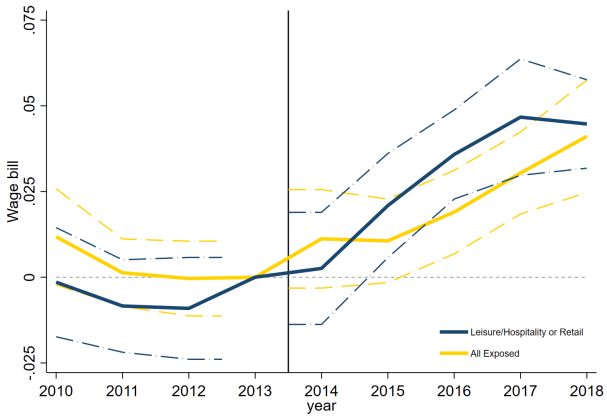


Figure A.2: Employment Elasticity Estimates From Literature

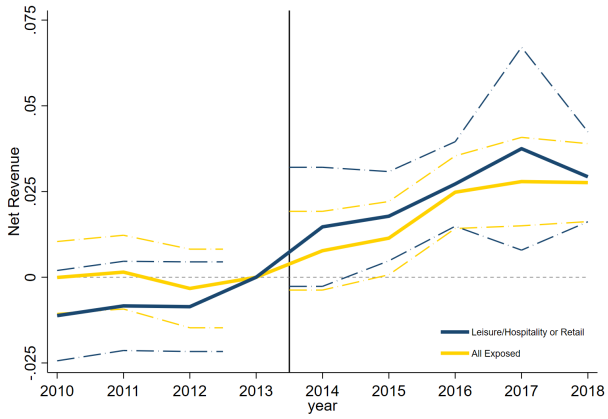
Note: This figure replicates Figure A.6 of Harasztosi and Lindner (2019) with the addition of our estimates using firms in leisure/hospitality and retail (narrow) and all industries exposed to minimum wage increases (broad). Our preferred estimate from the two most exposed industries, -0.215 (0.0068) is marked by the dashed line.

Figure A.3: Robustness - Unbalanced Panel

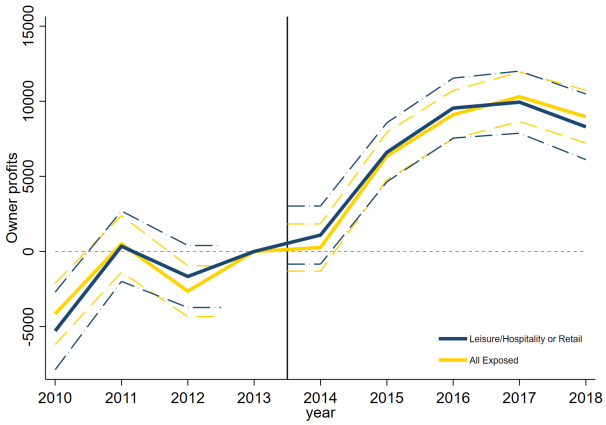
(a) Wage Bill



(b) Net Revenues



(c) Owner Profits



Notes: The figure replicates the results in Figures 4, 6, 7 using an unbalanced panel. The unbalanced panel includes all active firms sampled in 2013, including those that enter after 2010 and allowing them to exit after 2013. See above referenced figures notes for specification details.



Figure A.4: Share of 2018 Wage Bill Increase Attributable to Stayers and Turnover

Note: The figure above shows the decomposition of the total earnings response across the earnings distribution for both workers previously employed by the firm (stayers) and new workers (turnover). The total effect for each group is shown in the first set of bars (Total), and the decomposition of the change in the earnings distribution across fixed earnings bins is shown to the right. The dark blue bars show the portion of the total earnings response attributable to workers in each earnings bin listed on the x-axis. The red and grey bars show the decomposition of the total response into the portion attributable to changes in earnings among stayers (red), those who were with the firm in 2013 and remained with the firm in 2018, and the portion attributable to turnover (grey), or differences in total earnings paid to those leaving and entering between 2013-2018. The stayers and turnover coefficients sum to the total earnings response within each earnings bin and and across all bins. Each coefficient is the DD estimate from 2013 to 2018, where the outcome is the change in the total / stayers / turnover wage bills in each earnings bin over the total 2013 wage bill for firm j. The regressions are dollar-weighted (each observation is weighted by the average of the lagged and twice lagged value-added), and flexibly control for time-varying industry or firm-size shocks by non-parametrically reweighting firms in untreated states within each year to match the distribution of treated firms in the base year across 1,150 industry-firm-size bins as detailed in Section 3.2.1. The percent change in wage bill values are winsorized at the 99th percentile. Standard errors are clustered by firm.

B. Understanding Rising Profits Among Small Firms

Also known as the Stackelberg Model, the Dominant Firm model features one large firm that accounts for the major share of total sales, and a set of smaller firms that supplies the remainder of the market. In our context, we'd envision, for example, a large firm like McDonalds as the dominant firm and a fringe of mom-and-pop diners as the smaller firms also serving the market. The model's key features include:

- The large firm has the power to set a price that maximizes its own profits. This dominant firm has this ability to set its price because its marginal cost is lower than the marginal costs of the fringe firms.
- The competitive fringe firms react to the dominant firm's profit-maximizing price by producing a quantity where their marginal cost just equals the price.
- Total quantity sold in the market comprises units sold by the dominant firm and the quantity produced by the competitive fringe.

Impact of the Minimum Wage Increase

Raising the minimum wage increases labor costs for all firms, but the increase should be larger for the dominant firm if minimum wage workers compose a larger share of its labor force compared to the labor forces of smaller firms. The upward shift in marginal cost from MC_D^0 to MC_D^1 increases the dominant firm's profit maximizing price to P_1 from P_0, as the firm partially passes on the cost shock to consumers.

The higher minimum wage also increases marginal cost for the smaller firms that sell alongside the price-setting firm, but the increase is more modest since smaller firms rely less on minimum wage workers. Thus, the difference between S_C^0 and S_C^1, which reflect the marginal costs of smaller firms, is smaller than the change in the dominant firm's marginal cost from MC_D^0 to MC_D^1.

While quantity and surplus weakly decline for the dominant firm (the price-setting firm can at most fully pass-through the cost shock), for the smaller firms, producer surplus could potentially increase, depending on the relative magnitudes of the price and marginal cost increases. If the price increase sufficiently outpaces the change in marginal costs for smaller firms, quantity will increase and surplus will rise as the new surplus represented by the yellow area in Figure 9 is larger than the area of lost surplus represented in red.

Relative Cost Shocks and Rising Profits Among Small Firms

Below we derive the expression for the minimum ratio of large firm to small firm cost shocks necessary for profits to rise among small firms following a minimum wage increase. Suppose market demand follows $Q_T = 1 - P$. Costs are quadratic in output such that the large firm's cost function is:

$$C(Q_D) = \frac{d_D}{2} Q_D^2$$

and the smaller, fringe firms face costs:

$$C(Q_F) = \frac{d_F}{2} Q_F^2$$

where d_F by assumption is smaller than d_D.

Accordingly, profits for the large firm will be:

$$\pi_D = PQ_D - \frac{d_D}{2} Q_D^2$$

Fringe firms are price-takers, producing a quantity such that price equals marginal cost:

$$P = d_F Q_F$$

$$\mathrm{Q}_F = \frac{P}{d_F}$$

The dominant firm faces residual demand

$$Q_D = 1 - P - Q_F = 1 - P - \frac{P}{d_F}$$

which simplifies to inverse demand

$$P = \frac{d_F}{1 + d_F}(1 - Q_D)$$

Equilibrium Prior to Minimum Wage Increase

Dominant firm profit can be written

$$\pi_D = \frac{d_F}{1 + d_F}(1 - Q_D)Q_D - \frac{d_D}{2}Q_D^2$$

The profit-maximizing first-order condition is thus

$$\frac{d_F}{(1 + d_F)}(1 - 2Q_D) - \frac{d_D}{2}2Q_D = 0$$

so that the dominant firm's profit-maximizing quantity is

$$Q_D = \frac{d_F}{2d_F + d_D + d_F d_D}$$

and price is

$$P = \left[\frac{d_F}{1 + d_F}\right] \frac{d_F + d_D + d_F d_D}{2d_F + d_D + d_F d_D}$$

At price P the fringe will collectively supply

$$Q_F = \left[\frac{1}{1 + d_F}\right] \frac{d_F + d_D + d_F d_D}{2d_F + d_D + d_F d_D}$$

For a total market quantity of

$$Q_T = \frac{2d_F + d_F^2 + d_D + d_F d_D}{(1 + d_F)(2d_F + d_D + d_F d_D)}$$

Equilibrium Following Minimum Wage Increase

Increasing the minimum wage increases costs to both the dominant firm and the fringe:

$$C(Q_D) = \frac{d_D}{2} Q_D^2 + v Q_D$$

$$\mathrm{C}(\mathrm{Q}_F) = \tfrac{d_F}{2} Q_F^2 + u Q_F$$

Market demand remains $Q_T = 1 - P$ but the fringe's marginal cost has risen to

$$C'(Q_F) = d_F Q_F + u$$

rendering fringe supply

$$Q_F = \frac{P - u}{d_F}$$

and dominant firm residual inverse demand

$$P = \frac{d_F(1 - Q_D) + u}{1 + d_F}$$

The large firm's profit can be written

$$\pi_D = \frac{d_F(1 - Q_D) + u}{1 + d_F} Q_D - \frac{d_D}{2} Q_D^2 - v Q_D$$

with the profit-maximizing first-order condition

$$\frac{d + F}{1 + d_F}(1 - 2Q_D) + \frac{u}{1 + d_F} - d_D Q_D - v = 0$$

The large firm's profit-maximizing quantity will be

$$Q_D = \frac{d_F + u - v(1 + d_F)}{2d_F + d_D + d_F d_D}$$

and it will set price

$$P = \frac{d_F}{1 + d_F}\left[\frac{d_F + d_D + d_F d_D - u + v(1 + d_F)}{2d_F + d_D + d_F d_D}\right] + \frac{u}{1 + d_F}$$

Price-taking fringe firms will supply

$$Q_F = \frac{1}{1 + d_F}\left[\frac{d_F + d_D + d_F d_D - u + v(1 + d_F)}{2d_F + d_D + d_F d_D}\right] - \frac{u}{1 + d_F}$$

Compartive Statics

A marginally larger fringe firm cost shock (u), results in a higher price since the dominant firm will face more residual demand.

$$\frac{dP}{du} = \frac{d_F + d_D + d_F d_D}{(1 + d_F)(2d_F + d_D + d_F d_D} > 0$$

The dominant firm will supply a larger quantity

$$\frac{dQ_D}{du} = \frac{1}{2d_F + d_D + d_F d_D} > 0$$

and fringe firms will supply a smaller quantity

$$\frac{dQ_F}{du} = \frac{-1}{(1+d_F)(2d_F+d_D+d_Fd_D)} - \frac{1}{1+d_F} < 0$$

A larger dominant firm cost shock also raises P

$$\frac{dP}{dv} = \frac{d_F}{2d_F+d_D+d_Fd_D} > 0$$

but results in lower dominant firm supply

$$\frac{dQ_D}{dv} = \frac{-(1+d_F)}{2d_F+d_D+d_Fd_D} < 0$$

and higher fringe supply

$$\frac{dQ_F}{dv} = \frac{1}{2d_F+d_D+d_Fd_D} > 0$$

Relative cost shocks and rising fringe profit

Profit of the fringe firms will rise following the minimum wage increase if profit after the cost shock

$$\pi_F^1 = \frac{d_F}{2(1+d_F)^2}\left[\frac{(1-u)(d_F+d_D+d_Fd_D)+(v-u)(1+d_F)}{2d_F+d_D+d_Fd_D}\right]^2$$

exceeds profit prior to the policy change

$$\pi_F^0 = \frac{d_F}{2(1+d_F)^2}\left[\frac{d_F + d_D + d_F d_D}{2d_F + d_D + d_F d_D}\right]^2$$

Profit will rise if and only if the per unit cost shock of dominant firms relative to the per unit cost shock of smaller firms is

$$\frac{v}{u} > \frac{1 + 2d_F + d_D + d_F d_D}{1 + d_F}$$