# Minimum Wage and Corporate Policies

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**Abstract**

Using cross-state and intertemporal variation in whether a state's minimum wage is bound by the federal minimum wage, we provide evidence that minimum wage increases lead firms in minimum wage sensitive industries (i.e., retail, restaurant, and entertainment) to scale down relative to a control group of non-labor-intensive firms. This scaling down effect manifests via less total investment, less capital and mergers and acquisitions expenditures, and more negative total asset and establishment growth. We find no evidence that minimum wage changes affect research and development and little evidence of any significant effects outside of the most minimum wage sensitive industries.

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## 1. Introduction

In 2016, California, New York, and Washington D.C. each passed laws that will raise their minimum wage rate to $15 per hour, which is more than double the current federal minimum wage of $7.25 and historically high in real terms. In the two years since, over twenty other states have followed suit and increased their minimum wages. Yet, there is little evidence on whether and how minimum wages affect corporate policies.

We motivate and empirically test two non-mutually exclusive hypotheses regarding the effect of minimum wage increases on corporate investment. The *Substitution Hypothesis* predicts that minimum wage increases will lead to increased investment as firms seek to become less reliant on labor. Stigler (1946) posits such an effect, which is consistent with existing evidence that minimum wage increases have little or no effect on the employment of minimum wage workers in the short-run (Card and Krueger, 2015), but do lead to less minimum wage employment in the long-run (Meer and West, 2015; Sorkin 2015). By contrast, the *Scale Hypothesis* predicts that minimum wage increases will result in less investment because increased factor prices reduce optimal production. Traditional neoclassical, cost-of-adjustment, and q-theory models of investment support this idea, predicting a negative relation between input costs and capital investment.[1] Intuitively, both the *Substitution* and *Scale Hypotheses* predict the effect of minimum wage changes on investment to be increasing in firms' exposure to minimum wage employees.

To empirically identify which of these hypotheses dominates on average, we exploit intertemporal and cross-state variation in minimum wages as well as within-state differences in firms' exposure to minimum wage labor. To control for the fact that states adjust minimum wages at non-random times, we identify exclusively off of state-level minimum wage changes that are mandated by the federal government. Specifically, we compare how corporate investment differentially changes after increases in the federal minimum wage in states with a minimum wage equal to the federal minimum wage (i.e., bound states) compared to states with a higher minimum wage (i.e., unbound states). To address the fact that bound and unbound states exhibit differential trends in economic growth leading up to federal minimum wage hikes, we introduce non-labor-intensive firms as a benchmark from which to identify the effect of minimum wage changes on minimum wage sensitive firms. Non-labor-intensive firms are an attractive control sample because

[1]See for example Jorgenson (1963), Hall and Jorgenson (1967), Lucas (1967, 1976), Treadway (1969, 1971), Lucas and Prescott (1971), Brainard and Tobin (1968), Tobin (1969).

they exhibit similar investment patterns to minimum wage sensitive firms and are exposed to the same local economic conditions, but are less exposed to minimum wage labor.

Our primary strategy to identify the effect of minimum wage changes on corporate investment integrates the two control groups discussed above—firms in unbound states and non-labor-intensive firms—into a triple differencing framework, which includes state x year fixed effects to control for local economic conditions. For most of our analyses, we define the treatment group of minimum wage sensitive firms as those in the retail, restaurant, and entertainment industries, and the non-labor-intensive control group as firms in Fama-French 49 industry-years with below median employees-to-assets ratios.[2] Descriptive evidence suggests that investment and its primary determinants (i.e., market-to-book and cash flows) are similar in bound and unbound states, while robustness tests using matched samples mitigate the possibility that differences between treatment and control firms along these dimensions affect our inferences. More importantly, the relative investment of firms in bound and unbound states within the treatment and control samples evolves similarly leading up to federal minimum wage changes.

Across our various specifications, we estimate that a 10% increase in minimum wages results in minimum wage sensitive firms reducing total investment (i.e., the sum of capital, research and development (R&D), and mergers and acquisitions (M&A) expenditures) by approximately 14% relative to non-labor-intensive firms in the following year. Approximately 30% of this investment reduction is offset by an increased use of operating leases within minimum wage sensitive industries. Thus, we estimate that a 10% increase in minimum wages leads firms in the most minimum wage sensitive industries to forgo or delay approximately 10% of their projects.

The majority of this investment decline is in the form of capital expenditures, but there is also a statistically and economically significant reduction in M&A expenditures. We find no evidence that minimum wage changes significantly affect R&D spending, although R&D is not a common form of investment within minimum wage sensitive industries. The overall negative relation between minimum wage changes and total investment combined with the fact that there is no positive effect in any of the individual components of investment suggests that the *Scale*

[2] Our minimum wage sensitive definition is motivated by the 2015 Current Population Survey statistic that retail, restaurant, and entertainment employ over 70% of minimum wage labor, with no other industry employing over 10%. We conduct a variety of robustness analyses to ensure that choices regarding treatment and control samples do not materially affect our inferences.

*Hypothesis* is the dominant channel through which minimum wage affects the firm in the short-run.

To further examine this channel, we study the effect of minimum wage changes on establishment growth rates. One prediction of the *Scale Hypothesis* is that minimum wage increases will have the largest negative impact on investments that complement minimum wage workers. In contrast to the accounting-based measures of investment, which represent projects that may either complement or substitute for minimum wage labor, new establishments unambiguously complement the minimum-wage employees that are hired to staff these locations.

Consequently, we test this prediction using county-industry-level data on establishment growth. The geographic detail of this data not only eliminates measurement error with respect to the effect of minimum wage, but it also allows us to improve upon our original identification strategy by estimating the triple-difference specification across counties that lie along the border of bound and unbound states. The geographical proximity of border counties significantly limits the possibility that differences in local economic conditions bias our results. Using this strategy, we first confirm that an increase in the federal minimum wage leads to higher wage growth in minimum-wage sensitive industries in bound states. We then show that this cost shock reduces the establishment growth rate. After a 10% increase in the minimum wage, sensitive industries in bound states decrease their establishment growth rate by 60 basis points relative to non-labor-intensive industries within the county and relative to industries in nearby unbound counties across the state border.

Two additional pieces of circumstantial evidence also support the *Scale Hypothesis* as the driver behind the negative relation between minimum wage changes and corporate investment. First, we find evidence consistent with the hypothesis's prediction that minimum wage sensitive firms will reduce their total asset growth rate following minimum wage hikes. Asset growth declines by approximately the same amount as investment, suggesting that firms do not raise (or pay out) the capital that they would have invested in the lower minimum wage regime. Second, we examine how the investment and asset growth of labor-intensive firms that are not in minimum wage sensitive industries changes around federal minimum wage passages. Replicating our triple differencing approach after replacing minimum wage sensitive firms with other labor-intensive firms, we find little evidence that federal minimum wage changes significantly affect the relative investment of labor-intensive and non-labor-intensive firms. The coefficients consistently suggest

a scaling down of labor-intensive firms that is approximately 30% of the magnitude of that observed among minimum wage sensitive firms, but none of the coefficient estimates are significant at the 5% level or better.

Throughout our analysis we find little evidence that the *Substitution Hypothesis* is economically meaningful—no form of investment is positively related to minimum wage changes and unreported tests indicate that firms do not appear to reduce their employees-to-assets ratio. However, we cannot rule out that such substitutions happen in the long-run. This highlights one limitation to our triple differencing framework. Although it is well suited to estimate the qualitative short-run response of corporate investment to changes in state-level minimum wages, future research is needed to understand the extent to which our findings generalize to other settings and longer horizons as well as to precisely identify the magnitude of the effects we observe.

In addition to being policy relevant, our study contributes to several large strands of academic literature. Our evidence that minimum wage increases affect corporate investment fills an important void in the growing literature investigating the effect of labor market conditions on corporate policy. A large strand of this literature examines the relation between labor market frictions and financial policy. For example, Matsa (2010) shows that firms use their financial policy to influence union negotiations, Agrawal and Matsa (2013) find that firms lower leverage in response to reduced unemployment insurance to reduce their wage bill, and Simintzi, Vig, and Volpin (2014) and Serfling (2016) show that firms reduce their leverage in response to increased firing frictions. In addition, several papers examine how employee rights or firing frictions affect capital expenditures (Autor, Kerr, and Kugler, 2007; Bai, Fairhurst and Serfling, 2018), M&A activity (John, Knyazeva, and Knyazeva, 2015; Dessaint, Golubov, and Volpin, 2017; Chatt, Gustafson, and Welker, 2017), and innovation (Acharya, Baghai, Subramanian, 2014).[3]

We, along with three contemporaneous working papers, provide the first evidence on how minimum wages affect corporate investment. Two of these papers, Geng, Huang, Lin, and Liu (2018) and Hau, Huang, and Wang (2018), examine this effect in China and find evidence that increases in county-level minimum wages lead firms to increase investment, suggesting that minimum wage labor is less complementary with capital investments for private firms in China

[3] Also see Agrawal (2012), Brown and Matsa (2016), Yi (2016), Mueller, Ouimet and Simintzi (2017), Ouimet and Simintzi (2018), Caggese, Cunat, and Metzger, (2018) and Matsa (2018), etc. for recent evidence on other linkages between labor markets and corporate outcomes.

than for the public U.S. firms that we study.[4] Cho (2018) finds that state-level minimum wages are negatively associated with capital expenditures for U.S. public firms; he interprets this finding in the context of downward wage rigidity. Unlike Cho (2018), we focus on federally-mandated changes in state-level wages and use a within state control group to address the endogenous nature of state-level minimum wage changes. Furthermore, we take a broader view of the potential channels through which minimum wage changes may affect corporate policy, providing evidence that minimum wage hikes result in minimum wage sensitive businesses scaling down along a variety of dimensions.

We also add to the vast literature examining the effects of minimum wage on employment and product markets. There is no conclusive evidence that minimum wages have an immediate effect on employment levels, however there does appear to be an effect on wage dispersion.[5] Perhaps because of this ongoing debate regarding the most fundamental effects of minimum wage, the list of other outcomes shown to be affected by minimum wage is relatively short, including price levels, firm profitability, and personal finance decisions.[6] The most related works within this literature examine restaurant entries and exits surrounding minimum wage changes. Aaronson, French, Sorkin, and To (2017) find that minimum wage increases are followed by more restaurant turnover (i.e., exit and entry), while Luca and Luca (2017) add texture to this result by showing that low quality restaurants are most likely to exit. Our findings generalize this literature on two important dimensions. First, we provide evidence that minimum wage increases affect public firms—not only small, private establishments. Second, using a more comprehensive investment measure we show on net minimum wage increases lead to less corporate investment, and in turn a scaling down of minimum wage sensitive firms.

## 2. Conceptual framework

Congress enacted the first federal minimum wage in the 1938 Federal Fair Labor Standards Act (FLSA). The minimum wage was set at $0.25 and the law applied to a relatively

[4] This could be due to differences in the types of corporate investment or differences in the level of minimum wage, which is approximately four times higher in the U.S. relative to China.

[5] See for example Katz and Krueger (1992), Card and Krueger (1994), Neumark and Wascher (2000), Card and Krueger (1995), Dube, Lester, and Reich (2010), Giuliano (2013), Sorkin (2015), Meer and West (2015) for evidence on employment levels and Dinardo, Fortin, and Lemieux (1996), Lee (1999), Macurdy (2015), David, Manning, Smith (2016) for examinations of wage dispersion.

[6] See Aaronson (2001) and Aaronson and French (2007) for evidence on price levels, Draca, Machin, Van Reenen (2011) for evidence on profitability, and Tonin (2011) and Aaronson, Agarwal, and French (2012) for evidence on personal finance decisions.

small subset of employees. Over time, Congress has both increased the minimum wage and expanded the universe of employees covered by the law. Since 1982, the federal government has raised minimum wage seven times through laws passed in 1989, 1996, and 2007, with the current rate of $7.25 becoming effective in 2009.[7] The FLSA also allows states to set their own minimum wage rates, with the higher of the state and federal minimum wage applying to employees working in the state. The solid line in Figure 1 shows that many states began adopting minimum wage rates higher than the federal rate around 1987.

Economic theory generates competing predictions regarding the effect of minimum wage increases on corporate investment. In traditional neoclassical, cost-of-adjustment, and q-theory models of investment, factor prices are an important determinant of investment (see e.g., Jorgenson, 1963; Hall and Jorgenson, 1967; Lucas, 1967, 1976; Treadway, 1969, 1971; Lucas and Prescott, 1971; Brainard and Tobin, 1968; Tobin, 1969). These theories all predict a negative relation between minimum wages and capital investment to the extent that the minimum wage affects production costs. Such a relation is also consistent with Aaronson (2001), Dube, Naidu, and Reich (2007), and Aaronson, French, and Mcdonald (2008), which all provide evidence that a significant portion of the costs attributable to minimum wage are passed on to customers via higher prices. If there is any elasticity in demand, this behavior will trigger a scale effect whereby product market size shrinks, reducing optimal capital investment.

The above arguments, which we refer to as the *Scale Hypothesis*, relate most directly to capital investment for production. Expanding the types and purposes of investment motivates the (non-mutually exclusive) *Substitution Hypothesis*, which predicts a positive relation between minimum wage increases and investment. Since firms can substitute capital for labor (see e.g., Arrow, Chenery, Minhas, and Solow, 1961), firms may respond to minimum wage increases by increasing investment, with the intention of substituting away from the now more expensive labor inputs in the long run. Stigler (1946) articulates this idea, arguing that the minimum wage may lead to increased investment if it (1) makes previously suboptimal production techniques optimal, or (2) shocks managers into adopting new technologies. This type of long-run substitution is broadly consistent with the evidence in the minimum wage literature. In a meta-analysis of 23 academic studies, Card and Krueger (2015) argue that there is little evidence that minimum wage increases have an immediate effect on employment, while Meer and West (2015) and Sorkin

[7] See Internet Appendix Table A1 for a complete list of federal minimum wage changes.

(2015) document a long-run reduction in the employment of minimum wage workers following minimum wage increases.

To formalize these two non-mutually exclusive hypotheses, consider a firm in a perfectly competitive market that produces a single good $y$ with two inputs (capital $K$ and labor $L$). The firm maximizes

$$\pi(K,L) = pf(K,L) - rK - wL \tag{1}$$

where $p$ is the output price, $r$ is the rental price of capital, and $w$ is the hourly wage. Assume that the firm's production function is increasing and concave, so that $f_K, f_L > 0$ and $f_{KK}, f_{LL} < 0$, where $f_x = \partial f/\partial x$ and $f_{xy} = \partial^2 f/(\partial x\,\partial y)$.

Since the production function is strictly concave, the firm maximizes profit by choosing levels of capital and labor such that the marginal product of each input equals its marginal cost. That is, the firm chooses $K^*$ and $L^*$ to satisfy

$$pf_K = r \tag{2}$$

$$pf_L = w \tag{2'}$$

To generate predictions regarding the effect of wage changes on investment we take the total derivative of Eq. (2) with respect to $w$ and solve for $\partial K^*/\partial w$.

$$\frac{\partial K^*}{\partial w} = -\frac{\partial L^*}{\partial w}\,\frac{f_{KL}}{f_{KK}} \tag{3}$$

Since diminishing returns to capital and downward sloping labor demand make both $f_{KK}$ and $\partial L^*/\partial w$ negative, the sign of $\partial K^*/\partial w$ depends on the sign of the cross-partial derivative $f_{KL}$.[8] If $f_{KL}$ is positive (i.e., capital and labor are gross complements), then $\partial K^*/\partial w < 0$ and the *Scale Hypothesis* dominates the *Substitution Hypothesis*. Conversely, if $f_{KL}$ is negative (i.e., capital and labor are gross substitutes) then $\partial K^*/\partial w > 0$ and the *Substitution Hypothesis* dominates. Thus, the effect of wage changes on corporate investment depends on whether the investment is complimentary or substitutable with labor.

This stylized model suggests that the effect of minimum wage on investment is an empirical question, the answer to which depends on both the sensitivity of a firm's wage bill to minimum wage changes and the type of investment under consideration.[9] Figure 2 illustrates these

[8] Under our assumptions, Young's theorem shows that the cross-partial derivatives are equal, $f_{LK} = f_{KL}$.

[9] In the Internet Appendix, we show that these conclusions hold in more complex settings, such as when firms can adjust prices in response to changes in minimum wage or simultaneously invest in two different types of capital.

empirical predictions separately for the *Scale* and *Substitution Hypotheses*. Under either hypothesis, investments that are complementary with low-wage labor will be more negatively (or less positively) affected by minimum wage increases, compared to investments that substitute for low-wage labor. Both hypotheses also predict that any effect of minimum wage changes on investment will be more muted for firms that are less exposed to minimum wage employees (i.e. when $\partial L^*/\partial w$ is smaller in magnitude).

## 3. Identification

The active political debate surrounding minimum wages has spurred a significant body of academic research attempting to understand the effects of wage floors. In this section, we describe the empirical challenges to identifying the impact of minimum wage changes. We then propose an identification strategy to address these challenges.

### 3.1. Identification challenges

Although variation in the timing of state minimum wage changes seems to present an attractive setting to estimate the economic effects of minimum wage, the analysis is complicated because states raise minimum wages at non-random times. For instance, during our 1987 to 2013 sample period state-level minimum wage changes have a highly significant correlation of -0.30 with a state's lagged unemployment rate, suggesting that minimum wage hikes are more common when economic conditions are favorable. Additionally, Allegratto, Dube, Reich, and Zipperer (2013) show that states that increase minimum wages differ from other states in their business cycle severity, level of inequality, and composition of the labor force. Since firms may factor state-level economic conditions into their investment decision, regressions of corporate investment on state-level minimum wage changes are difficult to interpret. Table A2 of the Internet Appendix illustrates this idea using a sample of Compustat firms. In the absence of control variables, there is a highly significant positive relation between corporate investment and recent minimum wage increases, however the relation becomes statistically insignificant after the inclusion of firm and year fixed effects and turns negative (and insignificant) after controlling for firm- and state-level characteristics.

One way to overcome the fact that local economic conditions contribute to state-level minimum wage changes is to use regional controls. In a seminal paper, Card and Krueger (1994) study the effects of an increase in New Jersey's minimum wage on fast-food restaurants along the New Jersey-Pennsylvania border. Since firms on either side of the state border face similar

economic conditions, the effect of minimum wage can be identified. This approach has been widely adopted and expanded to more general settings (see, e.g. Dube, Lester and Reich, 2010; Allegretto, Dube and Reich, 2011; Magruder, 2013). However, it is difficult to apply this technique to the study of corporate decisions because firms do not concentrate their business activities along state borders.

Consequently, we introduce a novel strategy to identify the effect of minimum wage changes on corporate investment. We exploit the fact that since 1987 there have been some states with minimum wages above the federal minimum wage (i.e., unbound states) and others with minimum wages equal to the federal minimum wage (i.e., bound states). Internet Appendix Table A3 provides a detailed breakdown of the annual percentage change in minimum wages for bound and unbound states for each year since 1980. Bound states' minimum wage increases by approximately 11% during the 7 years that the federal minimum wage increases and 0% in other years. On average, these discrete jumps in the minimum wage are matched by unbound states within 2 to 3 years.[10] Thus, a federal minimum wage increase represents a shock to the relative wages paid in bound versus unbound states, with the largest effect being in the year of the federal minimum wage increase.

One way to use this variation in exposure to federal minimum wage changes to identify the effect of minimum wage changes on corporate investment would be to estimate a difference-in-differences analysis that compares the investment of firms in bound and unbound states surrounding federal minimum wage changes.[11] By taking the decision to raise minimum wages out of the control of the state, this procedure begins to break the endogenous link between minimum wage changes and state economic conditions. However, this approach can only identify the causal effect of minimum wage changes to the extent that there are no uncontrolled for differences in how the economies of bound and unbound states correlate with federal minimum wage increases. The geographical distribution of bound and unbound states, presented in Figure 3, casts doubt on this possibility. Although many important states, such California, Florida, Ohio, and New York, change bound status during our sample period and cover the entire political

[10] The minimum wage policies in unbound states vary considerably. Some unbound states index their minimum wage to inflation, others pre-schedule minimum wage rate increases years in advance, and others rarely adjust their minimum wage.

[11] Clemens and Wither (2016) use this idea to identify the effect of minimum wage changes on employee outcomes surrounding the 2007-2009 federal minimum wage change.

spectrum, the economies and political views of many bound states are highly correlated. In particular, bound states are concentrated in the U.S. heartland, while states around the coasts and great lakes are more likely to be unbound.

The geographical concentration of bound states raises the possibility that the relative economic conditions of bound and unbound states vary over time, perhaps in a manner that correlates with federal minimum wage increases. We descriptively examine this possibility in Figure 4 by plotting the (firm-weighted) average unemployment rate in bound and unbound states in event time leading up to the three federal minimum wage changes during our sample period. The figure shows that unemployment rate trends are approximately parallel several years before federal minimum wage hikes, but right around the time of the minimum wage increase unbound states experience a relative increase in unemployment. Indeed, unbound states go from having an approximately 10% lower unemployment rate two years before the hike to having a higher unemployment rate in the year of the hike.

Because a difference-in-differences strategy cannot account for changing relative economic conditions that occur around the implementation of higher minimum wages, Figure 4 makes it clear that we cannot use this strategy to identify the causal effect of minimum wages on corporate investment.

### 3.2. Identification strategy

The discussion in Section 2 suggests that this identification challenge can be overcome by exploiting within-state heterogeneity in firms' reliance on minimum wage labor. Specifically, Figure 2 indicates that the effect of minimum wage changes on investment will be larger in magnitude when minimum wage labor is a more important factor in production. This motivates non-labor-intensive firms as a within-state control sample of firms that are subject to the same local economic conditions, but are less sensitive to minimum wage increases.

We integrate these two control groups discussed above—firms in unbound states and non-labor-intensive firms—into two triple differencing frameworks to identify the effect of minimum wage changes on corporate investment. Both approaches use a within state-year control sample of non-labor-intensive firms. An important benefit to the triple differencing design, relative to a difference-in-differences design, is that we can directly control for state-level economic conditions surrounding federal minimum wage increases using state × year fixed effects. Equation 4 formalizes our first triple differencing specification.

$$\begin{aligned}\text{Inv}_{\text{it}} = \beta\left(Bound_{ijt\text{-}1} \times \Delta Min\ Wage_{it} \times Sensitive_{it}\right) + \gamma_1\left(Bound_{ijt\text{-}1} \times \Delta Min\ Wage_{it}\right) \\ + \gamma_2\left(Bound_{ijt\text{-}1} \times Sensitive_{it}\right) + \gamma_3(\Delta Min\ Wage_{it} \times Sensitive_{it}) + \gamma_4 Bound_{ijt\text{-}1} \\ + \gamma_5 Sensitive_{it} + \gamma_5 \Delta Min\ Wage_{it} + \boldsymbol{X}_{it-1}\boldsymbol{\Lambda} + \alpha_i + \tau_{jt} + \epsilon_{it} \qquad (4)\end{aligned}$$

where $\text{Inv}_{\text{it}}$ is the investment of firm *i* at time *t*, scaled by lagged total assets. $Bound_{it\text{-}1}$ measures a firm's exposure to states that are bound (i.e., have a state minimum wage less than or equal to the federal minimum wage) as of the end of the firms' prior fiscal year. $\Delta Min\ Wage_{it}$ is the percentage change in the nominal federal minimum wage over the firm's prior fiscal year, and $Sensitive_{it}$ indicates that firm *i* is in a minimum wage sensitive industry in year *t*. See Section 4.1. for more detail on our empirical measures for $Sensitive_{it}$ and $Bound_{it\text{-}1}$.

Here, the coefficient on the triple interaction term, β, represents the differential effect of minimum wages on minimum wage sensitive firms compared to non-labor-intensive firms across bound and unbound states. State × year fixed effects absorb any unobserved economic changes during a state-year, while firm fixed effects control for time invariant firm characteristics.[12]

Equation 4 uses all 26 years of our sample period. In our second triple difference specification, which we use primarily as a robustness analysis, we employ an event study approach that restricts the sample to the three years before and two years after each of the three federal minimum wage changes during our sample period. Aside from differences in sample construction (which we discuss in detail in Section 4), the main difference between the full sample and event study frameworks is that in our event study analysis we replace $\Delta Min\ Wage_{it}$ with $Post_{it}$, where $Post_{it}$ equals zero for the three years before the federal minimum wage increase and one for the two years of the federal minimum wage increase. We also add five indicators to control for the event year, denoted $\lambda_e$.[13] Specifically, we estimate Equation 5 below.

$$\begin{aligned}\text{Inv}_{\text{it}} = \beta\left(Bound_{ijt\text{-}1} \times Post_{it} \times Sensitive_{it}\right) + \gamma_1\left(Bound_{ijt\text{-}1} \times Post_{it}\right) \\ + \gamma_2\left(Bound_{ijt\text{-}1} \times Sensitive_{it}\right) + \gamma_3(Post_{it} \times Sensitive_{it}) + \gamma_4 Bound_{ijt\text{-}1} \\ + \gamma_5 Sensitive_{it} + \gamma_5 Post_{it} + \boldsymbol{X}_{it-1}\boldsymbol{\Lambda} + \alpha_i + \tau_{jt} + \lambda_e + \epsilon_{it} \qquad (5)\end{aligned}$$

We do not expect the inclusion of firm-level control variables to meaningfully affect our estimate of β in either Equation 4 or 5 because β is the estimated response to an arguably

[12] Our Bound and Change in Min. Wage variables are measured as of each firm's fiscal year end, so including year x state fixed effects does not absorb the coefficient on Bound or the interaction of Bound x Δ Min Wage. Since these coefficients are identified off differences in fiscal years, it is not clear that they have any meaningful economic interpretation.

[13] Results are similar without these additional fixed effects, which are identified via differences in fiscal year end that create an imperfect mapping between years in calendar and event time (see Section 4 for more details).

exogenous change in minimum wage. Nevertheless, in most specifications we control for a vector of firm-level controls measured in year $t$-1, $\mathbf{X}_{it-1}$. For our baseline analysis, we restrict this vector to lagged market-to-book and cash flows, which existing literature highlights as two primary determinants of corporate investment. We find similar results also controlling for lagged employees, liabilities, tangibility, net income, cash, and the natural log of lagged total assets. We cluster standard errors at the state level. Since firms rarely change their headquarter state, this clustering deals with within firm correlation of errors, which Bertrand, Duflo, and Mullainathan (2004) argue is important in difference-in-differences estimation. This clustering also controls for any correlation in the error term that is attributable to any state or state-year economic shock. Results are similar clustering at the year or firm levels.

These triple differencing specifications isolate the effect of minimum wage on corporate investment by comparing changes in investment after increases in the minimum wage between minimum wage sensitive and non-labor-intensive firms across bound states (which are affected by federal minimum wage changes) and unbound states (which are not affected). Assuming that any differences between minimum wage sensitive and non-labor-intensive firms do not change differentially in bound versus unbound states, in a manner that is correlated with the timing of federal minimum wage changes, this triple differencing framework will identify the effect of minimum wage changes on the differential investment of minimum wage sensitive firms. This assumption is more intuitive than the assumption that firms in bound and unbound states evolve similarly surrounding federal minimum wage passages, which underlies the difference-in-differences estimation. In subsequent sections we discuss the plausibility of this assumption in more detail. In Section 4, we present descriptive statistics on the characteristics of minimum wage sensitive and non-labor-intensive firms partitioned by their state's bound status. In Section 5.2, we examine the two groups' investment trends leading up to federal minimum wage changes and show that our results are results are robust to various adjustments in our definitions of minimum wage sensitive and non-labor-intensive firms. Finally, in Section 6.3.2 we document robustness to matched samples in which our treatment and control firms are similar along observable dimensions.

## 4. Sample description and empirical measures

We employ a sample of (non-financial and non-utility) Compustat firms from 1987 to 2012 to examine how the investment of public firms responds to the three sets of federal minimum wage

changes that have occurred since 1987.[14] Our main analyses uses the entire 1987 through 2012 panel (subject to the sample construction discussion in the remainder of this section), but we replicate this analysis using an event study sample that retains only observations during the three years before and two years after each of the three federal minimum wage changes during our sample period.[15] The event study sample is restricted to firms-years representing firms that exist for at least 4 of the 5 event years in an event window.

In the remainder of this section we discuss the sample and variable construction used to estimate Equations 4 and 5. The main dependent variable that we use throughout the analysis is total investment, measured as the sum of capital, R&D, and M&A expenditures scaled by lagged total assets. Over the full sample, the average (median) firm invests at a rate of 20.0% (10.1%) of their total assets each year. Capital expenditures are the most common form of investment, closely followed by R&D. Less than 20% of investment is in the forms of M&A expenses. In Section 6, we decompose this measure into its three components to separately examine the effect of minimum wage changes on the various types of investments.

### 4.1. Defining treatment and control samples

When estimating Equations 4 and 5, treated firms are those that are (1) in minimum wage sensitive industries, and (2) in bound states, which have state-level minimum wage rates that are bound by the federal minimum wage rate. Control firms are those in industries that are less exposed to minimum wage labor and/or in unbound states. Here, we discuss the empirical measures and sample restrictions that we use to define our treatment and control samples.

#### 4.1.1. Identifying minimum wage sensitive and non-labor-intensive firms

We restrict the sample to minimum wage sensitive firms and non-labor-intensive firms. We define minimum wage sensitive firms as those in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). For these firms $Sensitive_{it}$ equals one. This definition is motivated by the fact that, according to the 2015 Current Population Survey,

[14] We begin our sample in 1987 because our identification strategy requires cross-sectional variation in state-level minimum wages, which first occurs with regularity in 1987. Since 1987 is 3 years before the first federal minimum wage change in our sample occurs, we balance our sample by ending in 2012, which is 3 years after the completion of the most recent federal minimum wage change.

[15] Event year 0 is defined as the first fiscal year end following a federal minimum wage increase in a given event window. Event year 0's for the first event in our sample period occur in fiscal years ending in either 1990 or 1991. Event year 0's occurs in either 1996 or 1997 (2007 or 2008) for the second (third) event. All other event years are defined relative to event year 0.

over 70% of minimum wage workers are employed in Leisure and Hospitality and Retail Trade; no other industry employs more than 10% of minimum wage workers.

Because other firms may be affected by minimum wage changes to the extent that they rely on low-wage labor, we use only the firms that we estimate to be the least labor-intensive as control firms (i.e., we drop labor-intensive firms that are not in minimum wage sensitive industries from our main analyses). After inflation adjusting total assets, we define a non-labor-intensive firm as one in a Fama-French 49 industry-year with a median employee-to-assets ratio that is below the median of all industry-years in our sample period. Table A4 in the Internet Appendix lists the top and bottom 10 Fama-French industries based on the percent of years an industry is labor-intensive. Intuitively, industries that have been traditionally associated with minimum wage, such as retail and restaurants, make up a large proportion of the firms that we define as labor-intensive. As we discuss in Section 5, we conduct a variety of robustness analyses to ensure that these specific definitions of minimum wage sensitive and non-labor-intensive firms do not materially affect our inferences.

Figure 5 indicates that minimum wage sensitive and non-labor-intensive firms have similar intertemporal investment patterns. The correlation between the two timeseries is approximately 0.45 over the full sample, 0.6 from 1988 onward, and 0.88 since 1995.[16] Importantly, our results are robust to eliminating the early years of our sample when the correlation in investment was not as strong. This evidence suggests that non-labor-intensive firms are a reasonable benchmark from which to identify the effect of minimum wage changes on the investment of labor-intensive firms—their investment is generally influenced by similar economic forces, but is less sensitive to minimum wage changes.

#### 4.1.2. Measuring exposure to bound states

We use two strategies to measure a firm's exposure to bound states. Our first is to define $Bound_{it\text{-}1}$ as an indicator that is equal to one if at time *t* firm *i* is headquartered in a state that has a state minimum wage less than or equal to the federal minimum wage at the end of the firms' prior fiscal year.[17] We refer to this as our HQ-based Bound measure. This definition of bound status is only appropriate to the extent that a firm's employees disproportionately reside in the state

[16] We find qualitatively similar results beginning our sample in 1987, 1988, or 1995.
[17] We correct for headquarter changes over time using the header data of EDGAR 10-K/Q filings. This data begins in 1994. To adjust for changes that occur prior to this time, we use the corrections compiled by Heider and Ljungqvist (2013).

of their headquarters. To mitigate measurement error in this proxy for exposure to bound states, we partition the sample based on a firm's size relative to their home state and retain only observations in the bottom three quartiles of total assets relative to headquarter state population. Results are qualitatively similar retaining only the bottom two quartiles according to this relative size measure.

Our second way of identifying a firm's exposure to bound states augments the above bound indicator with the geographical dispersion measure used in Garcia and Norli (2012). We refer to this measure as our 10-K-based Bound measure, which equals the percentage of state names mentioned in SEC filings that are bound states as of the filing date. This provides a continuous measure of exposure to minimum wage changes, assuming that firms primarily discuss states where they have employee operations. The continuous nature of this measures makes it appealing for both small and large firms. Thus, we retain the entire spectrum of firm sizes when using this alternate bound measure. A limitation to the measure is that to maintain a consistent sample, we must extrapolate the Garcia and Norli (2012) sample to our sample period and then replace missing observations with our Bound indicator.[18]

### 4.2. Descriptive statistics

Table 1 summarizes the characteristics of the firms in our two main samples—the full sample (Panel A) and the event study sample (Panel B)—both restricted to firms in the bottom three quartiles of total assets to headquarter state population. Each cell presents the mean (top) and median (bottom) for the main variables used throughout our analyses. We partition the statistics by minimum wage sensitivity and the firm's headquarter states' bound status. We winsorize all variables at the 1% and 99% levels.

Panel A shows that 22% (or 1,708) of the minimum wage sensitive firm years are in unbound states, compared to 37% of non-labor-intensive firm-years. This percentage breakdown is very similar in the event study sample in Panel B, which contains approximately 35% of the firm-year observations as the full sample.

In general, after conditioning on minimum wage sensitivity, firms in bound and unbound states exhibit qualitatively similar levels of investment, cash flows, market-to-book, and total assets. Panel A shows that the average minimum wage sensitive firm headquartered in bound

[18] Results are robust to adjusting the extrapolation method or dropping the approximately 15% of our sample for which the firm never appears in the Garcia and Norli (2012) dataset.

(unbound) states invests at a rate of 12% (14%) of lagged total assets per year. These statistics are even more comparable at the median and using the event study sample in Panel B. The investment of non-labor-intensive firms in bound and unbound states is also very similar. This similarity is especially pronounced in the event study sample in which the average non-labor-intensive firm in unbound states invests at a rate of 22% of lagged assets, compared to a 20% rate for firms headquartered in bound states.

Not only is the investment of firms similar across bound and unbound states, the determinants of investment are as well. In the event study sample, median cash flows in bound and unbound states differ by less than two percent of total assets in both the minimum wage sensitive and non-labor-intensive samples. The market-to-book ratios of minimum wage sensitive firms in bound and unbound states are virtually identical. Perhaps the biggest difference is with respect to market-to-book ratios of non-labor-intensive firms, which are approximately 15% higher in unbound compared to bound states. Overall, these descriptive statistics support the use of non-labor-intensive firms as a control group that is subject to similar state-level economic conditions, but whose investment policy is likely to be less sensitive to minimum wage changes. In Section 6.3.2, we show that our results are robust to matching procedures that make treatment and control firms even more similar along these dimensions.

## 5. Main Results: Minimum Wages and Corporate Investment

In Section 2, we motivate two non-mutually exclusive hypotheses regarding the effect of minimum wage changes on investment. The *Scale Hypothesis* predicts that investment will decline as a firm's wage bill rises, while the *Substitution Hypothesis* predicts the opposite. Here, we use a triple differencing specification to provide evidence on the predominant channel through which minimum wage changes affect corporate investment. As discussed in Section 3, we identify the effect of minimum wages on investment by comparing how the relative investment of minimum wage sensitive and non-labor-intensive firms changes following federal minimum wage increases in bound states compared to unbound states.

We begin with a comprehensive measure of corporate investment that includes capital, M&A, and R&D expenditures and report the results in Table 2. In Columns 1 and 2 we employ our HQ-based bound measure, which defines a firm-year as bound if the state-level minimum wage in the firm's headquarter state is at or below the federal minimum wage at the beginning of the firm's fiscal year. This measure is only appropriate to the extent that a firm's employees

disproportionately reside in the state of their headquarters. Thus, when using this HQ-based measure we restrict the sample to the bottom three quartiles of total assets relative to headquarter state population. In Column 3 we employ a second measure of firm-level exposure to states bound by the federal minimum wage by augmenting our bound indicator with the geographical dispersion measure used in Garcia and Norli (2012). As we discuss in Section 4, our 10-K-based bound measure equals the percentage of state names mentioned in SEC filings that are bound states as of the filing date. Because this continuous measure of exposure is applicable to all firm sizes, we do not restrict the sample to small firms in Column 3.

The significantly negative coefficients on the Bound x Δ Min. Wage x Sensitive triple interaction in Columns 1 through 3 of Table 2 suggest that minimum wage changes are followed by reduced investment for minimum wage sensitive firms. This evidence is consistent with the *Scale Hypothesis* being the predominant channel through which minimum wage changes affect corporate investment.

Comparing the coefficient from our baseline specification in Column 2 to the sample-wide average investment of 0.20 suggests that a 10% increase in minimum wages is predicted to reduce the investment of firms in the most minimum wage sensitive industries by approximately 14%. However, this estimate may overstate the decline in production capacity for retail and restaurant firms. For these firms, one of the major forms of investment is property, which can be leased instead of bought.[19] In Table 3, we examine the extent to which firms substitute leases for investment by estimating the change in future operating lease commitments following minimum wage increases.[20] We find that minimum wage sensitive firms in bound states increase their operating leases relative to control firms following minimum wage hikes; comparing the coefficients in Table 2 and Table 3 suggests that approximately 29% of the investment decline is substituted for by operating leases. Consequently, our finding that minimum wage sensitive firms respond to a 10% minimum wage increase by reducing investment by 14% does not necessarily mean that these firms are delaying or cancelling 14% of their projects. Rather, they appear to be delaying or cancelling approximately 10% of investment projects and financing another 4% with leases instead of capital investments.

[19] Sale-leasebacks are also a common tactic employed by restaurant and retail firms when faced with financial difficulties. Sears is one recent example.

[20] We capitalize future lease commitments by discounting these commitments at the 10-year Treasury bond yield, following the procedure in Rauh and Sufi (2011).

To further clarify the magnitude of the investment decline that we observe in minimum wage sensitive industries, we present a back of the envelope estimate of the dollar change in wage expenses and investment for the median restaurant in our sample, which has 2,800 employees, annual investments of $10.1 million, and net income of $1.4 million. In the last year of our sample (2012), the BLS estimates that 22% of food service workers earned less than the minimum wage. Assuming that these employees work full-time, a $0.73 increase in the minimum wage (i.e., 10% increase from current levels) wipes out about 70% of the net income of the firm. The actual cost shock might be smaller if the restaurant is able to pass on some of the costs through higher prices or if the employees work fewer hours. On the other hand, the shock might be larger if there are workers paid above the current but below the new minimum wage or to the extent that increases in the minimum wage affect the broader wage scale. [21] Our estimates imply that the restaurant responds to this $935,000 cost shock by cutting investment by about $1 million. For perspective, the entrepreneurial magazine Inc. estimates that the cost of opening a new restaurant location is between $450-525,000, so the numbers are consistent with the median restaurant reacting to higher minimum wages by purchasing two fewer locations.

### 5.1. Decomposing capital, M&A, and R&D expenditures

In Table 4 we decompose total investment into its components (capital, M&A, and R&D expenditures) to examine the type of investments that are most sensitive to minimum wage changes. Panel A of Table 4 replicates the main analysis using capital expenditures scaled by lagged total assets as the dependent variable. Minimum wage sensitive and non-labor-intensive firms spend 10.5% and 6.6% of their lagged total assets on capital expenditures, respectively. The coefficients on the triple interaction are significantly negative, with magnitudes between 55% and 77% the size of those in Table 2. This suggests that the majority of the investment reduction post-minimum wage shock is in the form of capital expenditures. In contrast, Panel B of Table 4 indicates no significant relation between minimum wage changes and R&D expenditures. One caveat to this null result is that firms in minimum wage sensitive industries conduct very little R&D (0.3% of total assets per year compared to 10.7% for the non-labor-intensive control sample).

In Panels C and D of Table 4 we examine the relation between minimum wage changes and M&A expenditures. Panel C measures M&A expenditures based on the Compustat data used

[21] When Seattle passed a higher city minimum wage, approximately 36% of restaurant workers were earning less than the new minimum (see Jardim et al, 2017).

to construct the total investment measure that we use in Table 2. According to this measure, both minimum wage sensitive and non-labor-intensive firms spend between 2% and 3% of their lagged total assets on M&As each year. In Panel D we construct an M&A expenditure variable from Thomson's SDC database, which equals the total dollar value of M&A transactions reported in the SDC database, scaled by beginning of period total assets. On average, firms spend 2.2 percent of their lagged assets on M&As reported in the SDC database, which is approximately 70% of the total M&A expenditures reported in Compustat. Using either measure, we find a negative (and in most specifications statistically significant) relation between minimum wage increases and M&A expenditure in minimum wage sensitive industries.

This breakdown of investment into its components yields little evidence for the *Substitution Hypothesis*—minimum wage sensitive firms do not increase any type of investment. In contrast, the evidence that firms reduce capital and M&A expenditures following increases in the minimum wage is consistent with the *Scale Hypothesis*. Interpreted in the context of our conceptual framework, these results also suggest that for minimum wage sensitive firms, capital expenditures are the subset of investment that is most complementary to low-wage labor (since our framework predicts that the largest investment reductions occur when the investment complements low-wage labor). Although it is difficult to predict *ex ante* which investments complement or substitute for low-wage labor, it does seem reasonable to expect that typical capital expenditures in the restaurant and retail industries, such as opening new establishments, result in higher demand for low-wage labor. In this sense, these results provide an intuitive check on the plausibility of the *Scale Hypothesis*.

### 5.2. Robustness of main result

Table 5 presents a variety of tests demonstrating the robustness of our main results to adjustments in (1) the control variables used, (2) our definition of minimum wage sensitive industries, (3) the control sample used, and (4) the geographical concentration of treatment and control firms.

The similarity of the coefficient estimates in Columns 1 and 2 of Table 2 suggests that our specific choice of firm-level controls has little effect on the estimated relation between arguably exogenous minimum wage changes and corporate investment. Column 1 of Table 5 provides additional evidence of this as augmenting the specification in Column 2 of Table 2 with controls for lagged total assets, employees-to-assets, total liabilities-to-assets, property, plant and

equipment-to-assets, cash-to-assets, and net income-to-assets does not qualitatively affect our findings.

In Columns 2 through 5 we conduct analyses to ensure that the choices we make when defining our treatment and control samples do not materially affect our inferences. Since approximately 58% of the minimum wage sensitive firms in our sample are in retail industries (compared to 22% and 19% in the restaurant and entertainment industries, respectively), Columns 2 and 3 present our results separately defining minimum wage sensitivity as retail and the combination of restaurants and entertainment. The estimated effect of minimum wage is statistically indistinguishable between the two subsamples, and very similar to the full sample estimate. Columns 4 and 5 conduct similar robustness tests with respect to our control sample of non-labor-intensive firms. In Column 4, we define non-labor-intensive firms as those in Fama-French 49 industries with below median employees-to-assets ratios pooled over our sample period (in contrast to our industry-year definition used in our primary analysis). In Column 5, we construct a firm-specific measure for labor intensity, defining non-labor-intensive firm-years as those with employee-to-asset ratios below the pooled sample median. In both cases we obtain estimated effects of minimum wage changes that are similar to those in Table 2. In section 6.3.2., we show that the results are also robust to using a matched-sample control group. Finally, Column 6 shows that our results are similar after excluding the approximately 26% of firm-years that are headquartered in states that do not change their bound status throughout our sample period. This specification effectively eliminates the U.S. heartland from our sample, and alleviates concerns that differences in the political economy drive our results.

In Table 6 we replicate our main results using an event study framework, which we summarize in Equation 5. Here, the sample is restricted to the three years before and the two years after the three federal minimum wage changes during our sample period, and the coefficient of interest is the triple interaction Bound x Post x Sensitive. The significantly negative coefficient of on this triple interaction, which ranges from -0.046 to -0.053 across the three specifications, suggests that minimum wage sensitive firms reduce their investment relative to non-labor-intensive firms more in bound states than in unbound states following federal minimum wage changes.

An important benefit to the event study framework is that we can more directly examine the plausibility of the parallel trends assumption underlying our triple differencing estimation

strategy. Specifically, the triple differencing framework requires that there are no uncontrolled for factors that affect the relative investment of minimum wage sensitive and non-labor-intensive firms that differentially change in bound versus unbound states in a manner that is correlated with the timing of federal minimum wage changes. Figure 6 descriptively examines whether the investment of firms in bound and unbound evolves differently surrounding federal minimum wage increases. Each line represents firms of a given labor intensity and is derived by plotting the $Bound_{ite} \times E\ Year$ coefficients (i.e., the βs) from Equation 6 below. We estimate Equation 6 using a sample of firm-years from three years before until two years after each federal minimum wage change.[22]

$$Inv_{it} = \beta_1 (Bound_{it} \times E\ Year_{-3}) + \beta_2 (Bound_{it} \times E\ Year_{-2}) + \beta_3 (Bound_{it} \times E\ Year_{-1}) + \beta_4 (Bound_{it} \times E\ Year_1) + \beta_5 (Bound_{it} \times E\ Year_2) + \mathbf{X}_{it-1}\mathbf{\Lambda} + \mathbf{S}_{it-1}\mathbf{\Omega} + \alpha_i + \tau_t + \epsilon_{it} \quad (6)$$

where $Inv_{it}$ is firm *i*'s investment at time *t*. $\mathbf{X}_{it-1}$ includes the firm's lagged market-to-book ratio and lagged cash flows as well as five event year fixed effects. Because we estimate the equation separately for minimum wage sensitive and non-labor-intensive firms we cannot include state x year fixed effects. Thus, we include a vector $\mathbf{S}_{it-1}$ to control for recent changes in state-level population, gross state product, average wages, and unemployment.

Figure 6 shows that the pattern of relative investment in bound and unbound states is similar for minimum wage sensitive firms and non-labor-intensive firms leading up to federal minimum wage changes—the relative investment in bound states drops between years -3 and -2 and then increases between years -2 and -1. This is consistent with the identifying assumption underlying our triple difference analysis. The fact that the relative investment in bound and unbound states is not constant leading up to the federal minimum wage passage suggests that the assumptions underlying a simpler difference-in-differences strategy comparing the investment of firms in bound and unbound states are unlikely to hold. The right half of Figure 6 also clearly shows that the investment of minimum wage sensitive firms declines in bound states following minimum wage increases. Compared to firms in the same industries in unbound states, the investment of minimum wage sensitive firms in bound states drops by approximately 1.5% of

[22] Longer windows are not possible because the first set of federal minimum wage changes ends in 1991 and the second begins in 1996.

lagged assets. In contrast, the relative investment of non-labor-intensive firms in bound states increases by approximately 1% of total assets relative to similar firms in unbound states.

Another benefit to the event study framework is that we can replicate the analysis excluding any given federal minimum wage increase to examine the extent to which any one of the three events in our sample period drives our results. Across the three columns of Table A5 of the Internet Appendix we exclude each of the three federal minimum wage increase events during our sample period. The estimated coefficients on the triple interaction of interest are statistically significant in all three columns, with t-statistics ranging from -1.96 to -3.93. Moreover, the point estimates across the three columns are similar in magnitude, ranging from -0.036 to -0.044. This suggests that no single federal minimum wage increase is disproportionately driving our results, and in particular, confirms that the results are not driven by the fact that the most recent change overlapped with the 2007-2009 financial crisis.

The evidence in this section suggests that minimum wage increases have a statistically significant negative effect on the investment of minimum wage sensitive firms, which is consistent with the *Scale Hypothesis* being the predominant channel through which minimum wage changes affect corporate investment. Precisely identifying the magnitude of the effect is challenging because unbound states might adjust their minimum wages in response to federal minimum wage increases, non-labor-intensive firms could be impacted by minimum wage changes, and firms in bound states might adjust their behavior in anticipation of future federal minimum wage changes. These same limitations to the analysis make it difficult to extend the analysis to future years. Subject to these caveats, we estimate that a 10% increase in the minimum wage results in the total investment of public firms in minimum wage sensitive industries declining by approximately 10% in the year following minimum wage hikes.

## 6. Additional Analyses

In this section we conduct three sets of analyses to provide additional evidence on the plausibility of the *Scale Hypothesis* as the driver of the negative relation between minimum wage increases and the investment of minimum wage sensitive firms. We also discuss the plausibility of other explanations for our collection of results.

### 6.1. Minimum wage changes and county-level establishment growth

One key prediction of the *Scale Hypothesis* is that firms react to minimum wage increases by cutting investment in capital that complements low-wage labor. Because firms can invest in so

many different types of projects, some of which complement and some of which substitute for labor, it is difficult to examine this prediction using the broad measures of investment we study in the previous section. Instead, we use industry-level establishment data to directly test this prediction. Because a firm can't open up a new store or restaurant without hiring new employees, establishment growth clearly complements low-wage labor. As a result, the *Scale Hypothesis* predicts that higher minimum wages will lead to lower establishment growth.

We collect county-industry-level establishment and average wage data from the Quarterly Census of Employment and Wages (QCEW). Because the data do not begin until 1990, we restrict this analysis to establishment growth surrounding the last two federal minimum wage increases during our sample period, and begin the sample in 1992, which is the earliest year for which we can control for the lagged dependent variable. We define minimum wage sensitive industries as retail (NAICS 44), arts and entertainment (NAICS 71), and accommodations and food services (NAICS 72). We define our non-labor-intensive control sample as the mining (NAICS 21), construction (NAICS 23), manufacturing (NAICS 31), and wholesale (NAICS 42) industries. Other industries, which are generally service industries that employ relatively few minimum wage workers, are excluded. We further restrict the sample to county-industries that have at least 100 employees in every year during our sample period.

We define establishment (average wage) growth at the county-industry-year level as the change in the number of establishments (average wage) during the year scaled by the beginning of year number of establishments (average wage). One important benefit to this analysis is that it captures changes in activity within a specific county, irrespective of whether or not a firm operates across state lines—as a result, there is no measurement error in the exposure of the establishment to the change in the minimum wage. Another difference between this and our previous analyses is that this analysis is not restricted to public firms.

Using this county-industry-establishment data, we replicate our main triple difference specification. We include county x industry, industry x year, and county x year fixed effects, along with controls for state economic conditions. In Panel A of Table 7, we first confirm that increases in the federal minimum wage actually do represent a cost shock to minimum-wage sensitive firms in bound states. Columns 1 and 2 of Panel A show that, regardless of whether or not we include control variables, average wage growth is significantly higher for minimum wage sensitive

industries in bound states following increases in the minimum wage rate. Panel B shows that, consistent with the *Scale Hypothesis*, this cost shock leads to a reduction in establishment growth.

The estimations in columns 1 and 2 of Table 7 use the same structure as our main results. However, since this establishment data is measured at a more detailed geographic level, it is possible to significantly improve our estimation strategy. In columns 3 and 4, we limit the sample of industry-county-years to observations that are located on the border of a bound and unbound state. Because we generally expect local economic conditions to be similar on either side of the state border, this approach further alleviates concerns that omitted variables bias the results.

After limiting the sample to counties located along the borders of bound and unbound states, we estimate an even stronger effect of minimum wage on establishment growth. The negative coefficient of -0.06 in column 4 of Panel B implies that a 10% increase in the minimum wage leads sensitive industries in bound states to decrease their establishment growth rate by 60 basis points relative to non-labor-intensive industries. The robust negative effect of minimum wage on establishment growth suggests that the input cost shock leads minimum wage sensitive industries to scale down production.

It is interesting to note that in both Panel A and Panel B, the estimated coefficients are roughly similar whether we use the entire state or limit the sample to border counties. This suggests that our earlier results that rely on state-level exposure to minimum wage are not likely to be systematically biased, which is reassuring since it is not possible to disaggregate investment for public firms.

### 6.2. Minimum wage changes and firm scale

The *Scale Hypothesis* predicts not only that firms react to minimum wage increases by cutting investment, but also by scaling down their business operations. To test this, we use our main triple difference specification to examine the effect of minimum wage on firm size.

Table 8 replicates our main results with the percentage change in total assets as the dependent variable. Across all three columns, the coefficient on the Bound x $\Delta$ Min. Wage x Sensitive triple interaction is significantly negative. In our baseline specification in Column 2, the coefficient estimate is -0.271, suggesting that a 10% increase in minimum wages results in minimum wage sensitive firms reducing their total asset growth by approximately 2.7 percentage points. Notably, this is almost exactly the same magnitude as the investment decline that we

estimate in Column 2 of Table 2, suggesting that the investment decline we observe is accompanied by a reduction in firm size of similar magnitude.

### 6.3. Effect of minimum wage on other labor-intensive firms

The evidence presented thus far suggests that the primary channel through which minimum wages affect firm investment in the year following wage hikes is through the *Scale Hypothesis*. This hypothesis also predicts that the negative relation between minimum wage increases and investment will be larger the more reliant firms are on minimum wage labor (see Figure 2). To test this prediction and examine the extent to which other labor-intensive industries are impacted by minimum wage changes, we replicate our analyses replacing minimum wage sensitive firms with the sample of other labor-intensive firms, which we exclude from our previous analyses. We define labor-intensive firms as those in a Fama-French industry-year with above median employees to assets that are not in the restaurant, retail, or entertainment industries. These firms employ many fewer minimum wage workers than the firms in our minimum wage sensitive industries; as a result, if the *Scale Hypothesis* drives our results, we expect to find a smaller effect of minimum wage on investment.

Although this set of labor-intensive firms is less exposed to minimum wage changes than minimum wage sensitive firms, the extent to which minimum wage changes affect these industries is an empirical question. The models of Grossman (1983) and Akerlof and Yellon (1990) suggest that minimum wage increases may also affect the cost of non-minimum wage labor. Specifically, the authors show that this type of spillover can occur if higher minimum wages either (1) create more demand for skilled labor, since the alternative has become more expensive, or (2) reduce the incentive for skilled employees to exert effort.

Panel A of Table 9 offers weak support for the idea that minimum wage changes affect the investment of labor-intensive firms outside of the most minimum wage sensitive industries. Here, the Bound X Δ Min. Wage X Labor triple interaction compares the relative investment of labor-intensive and non-labor-intensive firms in bound and unbound states following federal minimum wage changes. The magnitude of the coefficients are less than half the size of those estimated for minimum wage sensitive firms, and are only marginally statistically significant, with t-statistics ranging from -1.38 to -1.81 across the three columns. Panels B and C tell a similar story using capital expenditures and percentage change in total assets as dependent variables, although the results are even less statistically significant, with t-statistics ranging from -0.91 to -1.56 across the

six columns. Although lack of statistical power limits the inferences that can be drawn from this analysis, these findings are generally consistent with the predictions of the *Scale Hypothesis*. Future research is needed to more precisely identify the extent to which minimum wage changes affect labor-intensive firms, beyond those that are most reliant on minimum wage labor.

### 6.4. Alternative Explanations

In this section, we examine the extent to which alternative explanations can explain the relation between minimum wage and corporate investment. Under the assumption that any differences between minimum wage sensitive and non-labor-intensive firms in the incentives to invest in bound versus unbound states do not change around the passage of increases in the federal minimum wage, the empirical strategy we use in this paper identifies the causal effect of minimum wage on corporate investment. If this assumption is violated, alternative explanations may exist.

#### 6.4.1. Lobbying

We first consider the extent to which firm lobbying might introduce differences between sensitive and non-labor-intensive firms in bound and unbound states that vary with federal minimum wage changes. Firms spend a significant amount of money lobbying against minimum wage increases; there are two ways that this lobbying effort could impact our identification. First, a state's bound status might be determined by state-level lobbying. We find no evidence that the probability of a state switching its bound status is a function of firm-level characteristics, even if these characteristics are partitioned by minimum wage sensitivity (untabulated). This suggests that the success of state-level lobbying against minimum wage is not correlated with firm conditions, which means that state-level lobbying is unlikely to impact our estimates of the effect of minimum wage on corporate policy.

To the extent that lobbying confounds our estimates, it must be related to federal-level lobbying. Specifically, it must be that the effectiveness of federal-level lobbying is correlated with differences in the investment policies of firms in bound and unbound states. Moreover, these differences must be unique to minimum wage sensitive firms, since we control for state-level economic conditions with state x year fixed effects. We believe that this complicated lobbying story is unlikely for at least four reasons. First, most of the federal-level lobbying is done by trade organizations that represent firms across large geographic areas, making it less likely that their lobbying efforts vary with the relative characteristics of firms in bound and unbound states. Second, laws to increase the federal minimum wage have been proposed in every single Congress

during our sample period. This suggests that the impetus for the law change does not vary with economic conditions, let alone differential economic conditions in bound versus unbound states. Third, anecdotally federal minimum wage increases have been enacted in a bi-partisan way with support across both bound and unbound states.[23] This support from politicians in both bound and unbound states reduces the possibility that lobbying efforts from one type of state are the driving force behind minimum wage changes. Finally, descriptive evidence does not support the most likely remaining story, which is that when minimum wage sensitive firms in bound states are in poor condition (i.e., when investment is likely to be low) they have less money to lobby against minimum wage increases. In contrast, we find that on average sensitive firms in bound states invest at a somewhat higher rate than sensitive firms in unbound states prior to federal minimum wage increases. Taken together, this evidence makes it unlikely that lobbying is a primary driver of our results, even though it might be an important factor in minimum wage changes.

#### 6.4.2. Correlated Differences

The evidence presented in this paper suggests that non-labor-intensive firms are a reasonable control group for minimum wage sensitive firms: their investment behavior is strongly positively correlated over time (Figure 5), the trends in investment are identical prior to federal minimum wage increases (Figure 6), and both investment and the primary determinants of investment are similar for non-labor-intensive firms in bound and unbound states (Table 1). However, it is also true that sensitive firms differ from non-labor-intensive firms in the level of investment, cash flow, market-to-book, and asset size (Table 1). These differences raise the possibility that the incentives for sensitive and non-labor-intensive firms to invest in bound vs. unbound states might differentially change in a manner that is correlated with federal minimum wage increases. We know of no compelling explanation for why this would be the case, but to help alleviate this concern, we re-examine our main result using two separate matching procedures to minimize the observable differences in the primary determinants of investment.

[23] For example, when debating the most recent federal minimum wage change in 2007, Representative Charles Rangel noted, "This is a bi-partisan bill providing critical momentum for the bi-partisan effort to raise the minimum wage." Consistent with this, the bill was sponsored by Representative Jim McCrery (R-LA) and Representative George Miller (D-CA). California was an unbound state, but Louisiana was a bound state. Several other representatives from partially bound states (states with minimum wage rates higher than the then current minimum wage, but lower than the newly proposed wage) also played key roles in the legislation. The bill passed the house by a vote of 360 to 45, suggesting that this was indeed a bi-partisan effort supported by representative from all states.

For the first set of matches, we match each minimum wage sensitive firm to a non-labor-intensive control firm. We require the matches to be in the same year and same state-type (bound or unbound), and then select the single nearest neighbor (with replacement) based on the Mahalanobis distance of lagged cash flow, market-to-book, and the natural logarithm of total assets. We report the characteristics of the matched sample in Panel A of Table 10. Conditional on bound status, the minimum wage sensitive and non-labor-intensive control firms have identical cash flows, market-to-book, and firm size. Consistent with these characteristics being among the primary drivers of investment, the two sets of firms also have comparable levels of current investment.

Though these firms are very similar, there are still some differences between bound and unbound states. For example, bound states have smaller firms with lower market-to-book ratios. We address this using a separate matching procedure, where we match each treated firm (i.e., minimum wage sensitive firm in a bound state) to one control firm in each of the three control groups (sensitive firms in unbound states and non-labor-intensive firms in bound and unbound states). We match on the same characteristics described above, and report the sample characteristics in Panel B of Table 10. For this sample, the observable characteristics are similar across all four categories.

We use these two sets of matches to replicate our main triple difference analysis on total investment. The results are reported in Panel C. We find a significantly negative relation between increases in minimum wages and firm investment using both sets of matches. The results hold whether or not we include control variables, and the magnitudes are approximately the same as our full sample estimates reported in Table 2. The similarity between our treatment and control firms in these matched sample analyses mitigates the possibility that the negative relation between minimum wage hikes and the investment of minimum wage sensitive firms is due to differences between treatment and control firms that happen to correlate with the timing of federal minimum wage increases.

## 7. Conclusion

The minimum wage is one of the most frequently revised socio-economic policies in the United States. In January of 2018, 18 states increased their minimum wages. Although an enormous amount of research has been devoted to understanding the labor market effects of minimum wages, almost no work has been done on how minimum wage rates affect first order

corporate decisions. We fill this void by providing evidence that minimum wage changes do affect the policies of large public corporations.

Building on existing theory and a stylized model, we motivate two non-mutually exclusive hypotheses regarding the effect of minimum wage increases on corporate investment. The *Scale Hypothesis* predicts a negative relation between minimum wage increases and investment since higher input costs lead to smaller market size, while the *Substitution Hypothesis* predicts that firms will increase investment in response to higher minimum wage as they attempt to substitute away from labor inputs.

To determine which of these hypotheses dominates, we introduce a novel empirical strategy to identify the effect of minimum wage changes on corporate investment. Our findings consistently suggest that the *Scale Hypothesis* is the predominant channel through which minimum wage changes affect corporate investment. Not only does the investment of minimum wage sensitive firms (i.e., those in the retail, restaurant, and entertainment industries) significantly decline relative to non-labor-intensive firms following minimum wage increases, but consistent with the predictions of the *Scale Hypothesis* asset and establishment growth declines as well. The majority of this investment decline is in the form of capital investments, although M&A expenditures significantly decrease as well. We find little effect of minimum wage changes on industries other than those heavily reliant on minimum wage labor.

Existing policy discussions revolve around raising the minimum wage to $15 per hour. Currently, around 42% of U.S. workers make less than this, which implies that the effects that we document in this paper could affect a substantial number of firms. Consequently, our paper suggests that policy makers should carefully consider the effect of minimum wages not only on employees, but also on firms. Our empirical framework is well-suited to identify the short-run effects of minimum wage increases on corporate policy, however future research is needed to conclusively identify longer-run effects.

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## Appendix A: Variable Definitions

This Appendix provides definitions and sources for the variables used in our paper. Panel A defines the dependent variables used throughout the analysis, while Panel B defines the explanatory variables. In our empirical analysis, all explanatory variables, except for the annual minimum wage change, are measured one year prior to the end date over with the dependent variable is computed.

### Panel A: Dependent Variables

| Variable Name | Definition (Sources) |
|---|---|
| Total Investment | The sum of annual capital expenditure (CAPX), mergers and acquisitions expenses (AQC), and research and development expenses (XRD) scaled by beginning-of-period total assets (AT). (Compustat) |
| Change in Operating Leases | Annual change in the capitalized value of operating leases scaled by beginning of period total assets. Specifically, we use the inflation adjusted annual change in capitalized operating leases scaled by beginning-of-period assets, where leases are capitalized following Rauh and Sufi (2011) and are discounted at the 10-year Treasury rate. |
| CAPEX | Annual capital expenditure (CAPX) scaled by beginning-of-period total assets (AT). (Compustat) |
| M&A | Annual mergers and acquisitions expenses (AQC) scaled by beginning-of-period total assets (AT). (Compustat) |
| R&D | Annual research and development expenses (XRD) scaled by beginning-of-period total assets (AT). (Compustat) |
| All SDC M&A | The total dollar value of M&As in Thomson's SDC M&A database in a fiscal year scaled by beginning of year total assets. Excludes M&As labeled as spinoffs, recapitalizations, self-tender or exchange offers, repurchases, privatizations, acquisitions of remaining interest, and leveraged buyouts. (SDC, Compustat) |
| Ln (Assets) | The natural logarithm of end-of-period total assets (AT). (Compustat) |
| Establishment Growth | Establishment growth is measured at the state-industry-year level and is defined as the change in the number of establishments during the year scaled by the beginning of year number of establishments. (Data as used in Meer and West (2015), which they obtain from the Bureau of Labor Statistics) |
| Employment Growth | Employment growth is measured at the state-industry-year level and is defined as the change in the number of employees during the year scaled by the beginning of year number of employees. (Data as used in Meer and West (2015), which they obtain from the Bureau of Labor Statistics) |

**Panel B: Explanatory Variables**

| Variable Name | Definition (Sources) |
|---|---|
| Δ Min. Wage | Annual percentage in the nominal federal minimum wage for the year ending at the beginning of the calendar quarter before fiscal year end. (U.S. Department of Labor) |
| HQ-based Bound | An indicator for a firm year that begins with the state minimum wage being equal to or less than the federal minimum wage. (U.S. Department of Labor) |
| 10-K-based Bound | The percentage of state mentions in 10-K filings that are of states with minimum wage less than or equal to the federal minimum wage, according to the dataset used in Garcia and Norli (2012) that runs from 1995 through 2008. To maintain a consistent sample and because the lack of electronic SEC filings prevents us from computing this measure prior to 1995, firm-years prior to 1995 (after 2008) are extrapolated from the earliest (latest) observation in the dataset. If a firm does not appear in Garcia and Norli (2012)'s dataset then Alt. Bound equals Bound. (U.S. Department of Labor, Garcia and Norli, 2012) |
| Sensitive | An indicator for a firm that is in a minimum wage sensitive industry (FF 49 industries 7, 43, and 44). Note that non-sensitive firms are defined as labor-intense firms not in a sensitive industry. (Current Population Survey) |
| MtB | The value of debt (DLTT+DLC) plus the market value of equity (\|PRCC_F\|*CSHO), divided by total assets (AT). (Compustat) |
| Cash Flow | Income Before Extraordinary Items (IB) minus Depreciation and Amortization (DP) all scaled by beginning of period total assets (AT). (Compustat) |
| Employees | Employees (EMP) divided by total assets (AT). (Compustat) |
| Total Liabilities | Total liabilities (LT) divided by total assets (AT). (Compustat) |
| Tangibility | Net property, plant, and equipment (PPENT) divided by total assets (AT). (Compustat) |
| Ln(Assets) | The natural log of one plus total assets (AT) in 1983 $ millions. (Compustat) |
| Profitability | Operating income before depreciation (OIBDP) divided by total assets (AT). (Compustat) |
| Cash | Cash and equivalents (CHE) divided by cash total assets (AT). (Compustat) |

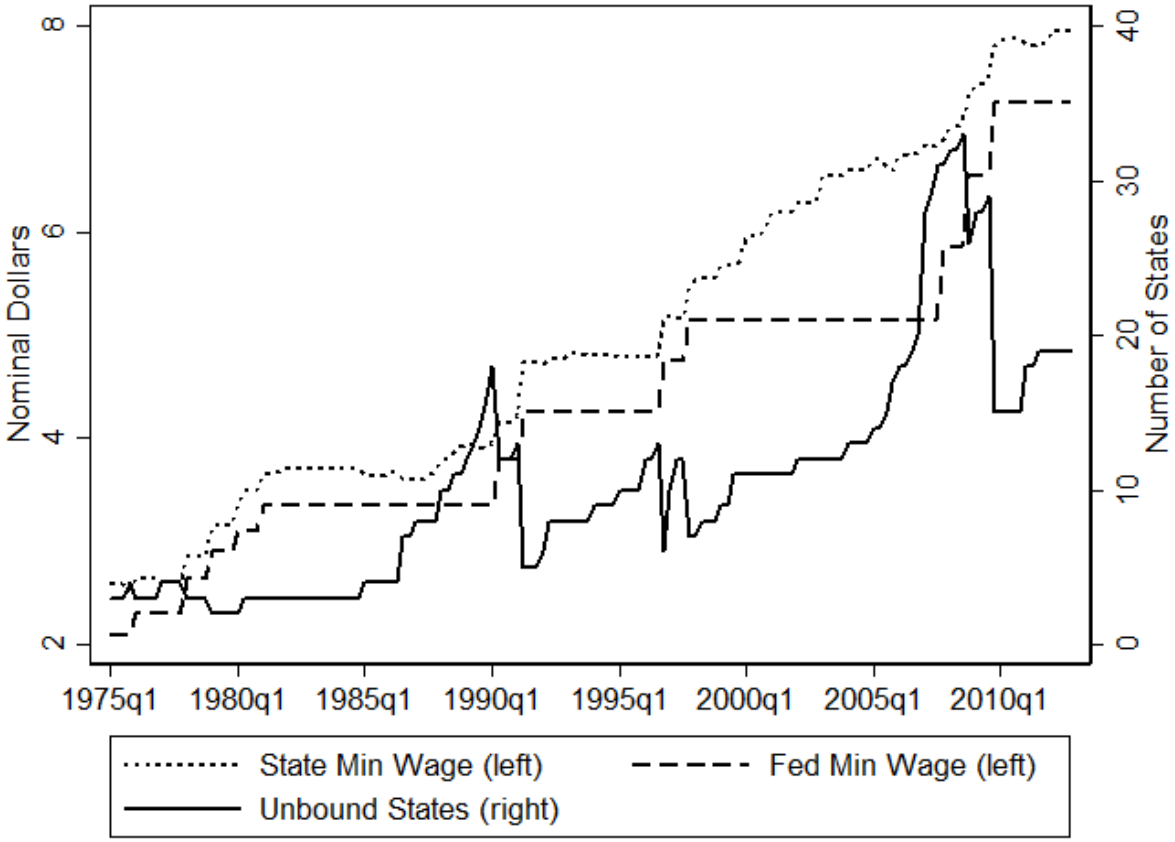


**Figure 1. Minimum Wage Changes Over Time.** This chart shows the quarterly evolution of minimum wages in the United States from 1975 to 2012. The dotted line plots the average nominal state-level minimum wage for the subset of states that have a minimum wage higher than the federal minimum wage. The dashed line shows the nominal federal minimum wage. The solid line (right axis) shows the number of states that have a state minimum wage higher than the federal minimum wage. Source: U.S. Department of Labor.

Panel A: Scale Hypothesis

| | | Firm's Minimum Wage Exposure | |
|---|---|---|---|
| | | **Low** | **High** |
| **Type of Investment** | **Labor Comp.** | -- | --- |
| | **Labor Subs.** | - | -- |

Panel B: Substitution Hypothesis

| | | Firm's Minimum Wage Exposure | |
|---|---|---|---|
| | | **Low** | **High** |
| **Type of Investment** | **Labor Comp.** | + | ++ |
| | **Labor Subs.** | ++ | +++ |

**Figure 2. Empirical Predictions.** This Figure presents empirical predictions for the two non-mutually exclusive hypotheses regarding the effect of minimum wage on corporate investment. Panel A describes the predictions of the *Scale Hypothesis*, while Panel B does the same for the *Substitution Hypothesis*. Each panel is split into four quadrants, based on whether a firm has high or low sensitivity to minimum wage workers and whether the investment is a substitute or complement with low-wage labor. The magnitudes entered into each quadrant are defined relative to the other quadrants within each panel (i.e., +++ > ++, but the relation between |+| and |-| is unknown).

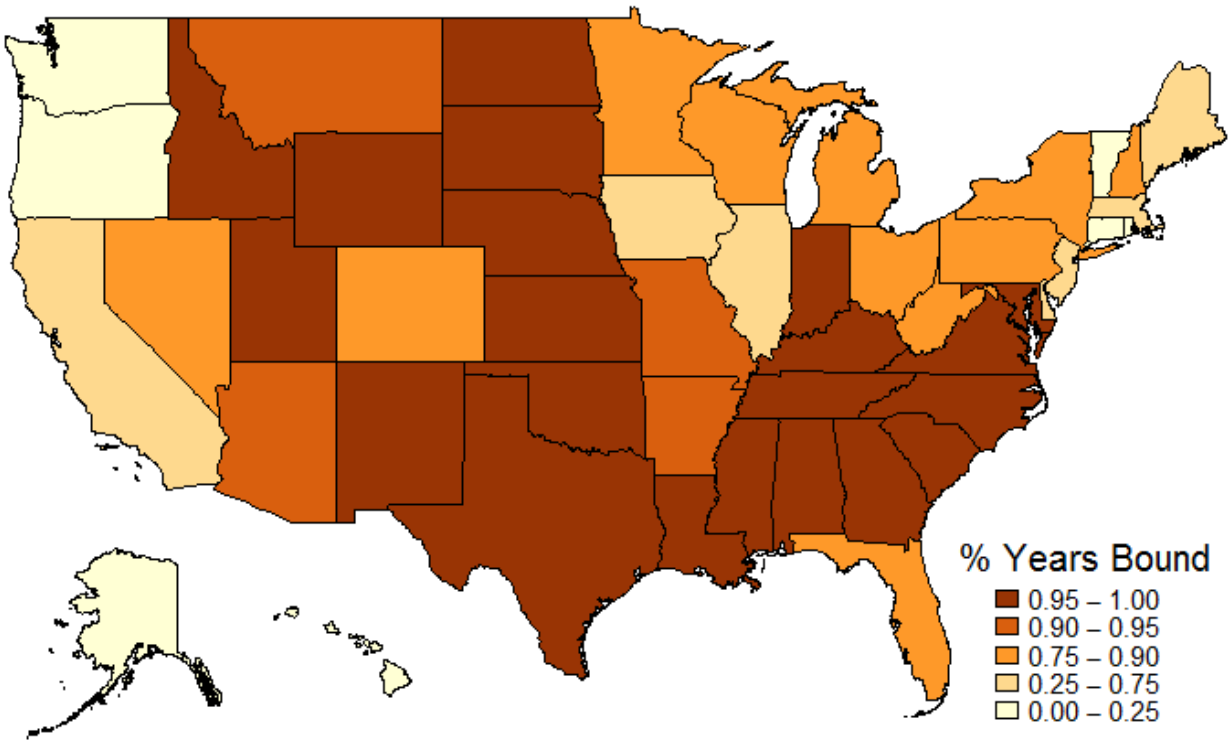


**Figure 3. Bound Vs. Unbound States.** For each state, this figure shows the percent of quarters from 1987 to 2012 for which the state is bound by the federal minimum wage; i.e. the state-level minimum wage is less than or equal to the federal minimum wage or the state has no state minimum wage law. Source: U.S. Department of Labor.

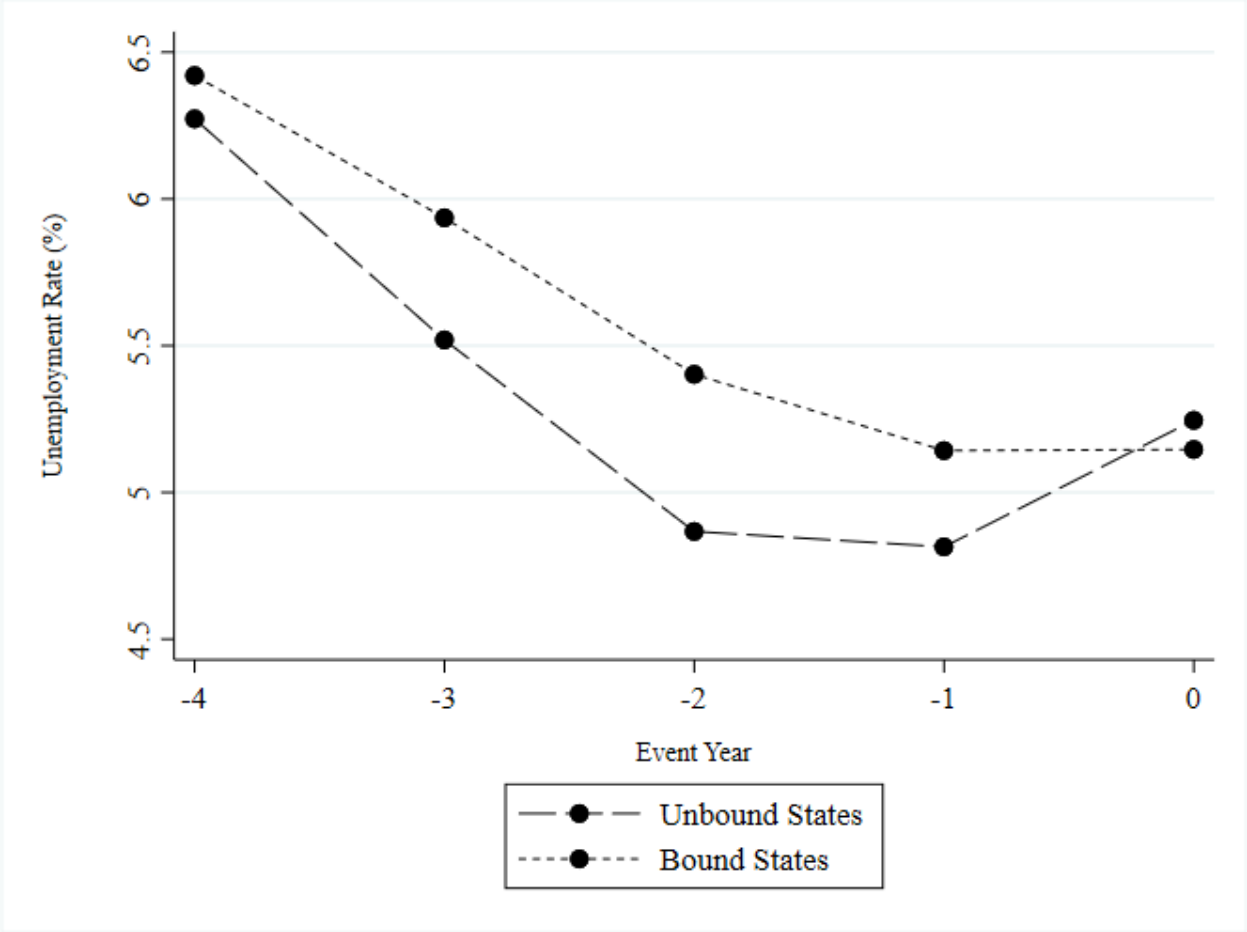


**Figure 4. Unemployment Rates in Bound and Unbound States surrounding Minimum Wage Increases.** This figure plots the average unemployment rates in bound and unbound states in event time surrounding federal minimum wage increases. The averages are weighted by the number of observations in each state-year in our event study sample containing 17,150 firm-year observations pooled across the five-year event windows containing firm-years in the three years before and two years after each of the three federal minimum wage changes during the sample period.

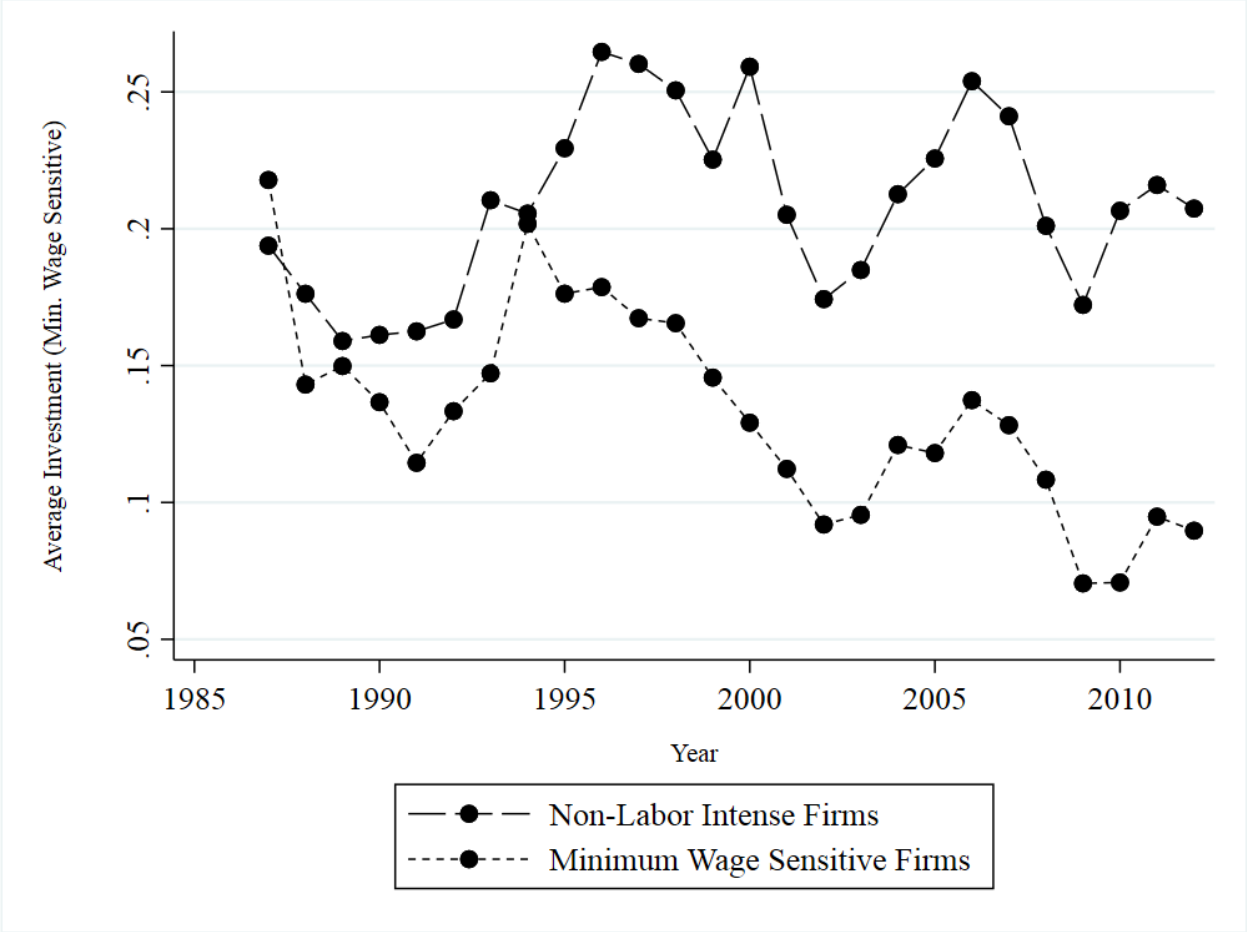


**Figure 5. Investment of Minimum Wage Sensitive and Non-Labor-Intensive Firms over Time.** This figure plots the average investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets, for the minimum wage sensitive and non-labor-intensive firms used in our main test sample, which is restricted to firm-years in the bottom three quartiles of total assets to state population. **M**inimum wage sensitive firms are defined as those in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Non-labor-intensive firm-years are those in Fama-French 49 industry-years with below median employees-to-assets ratios.

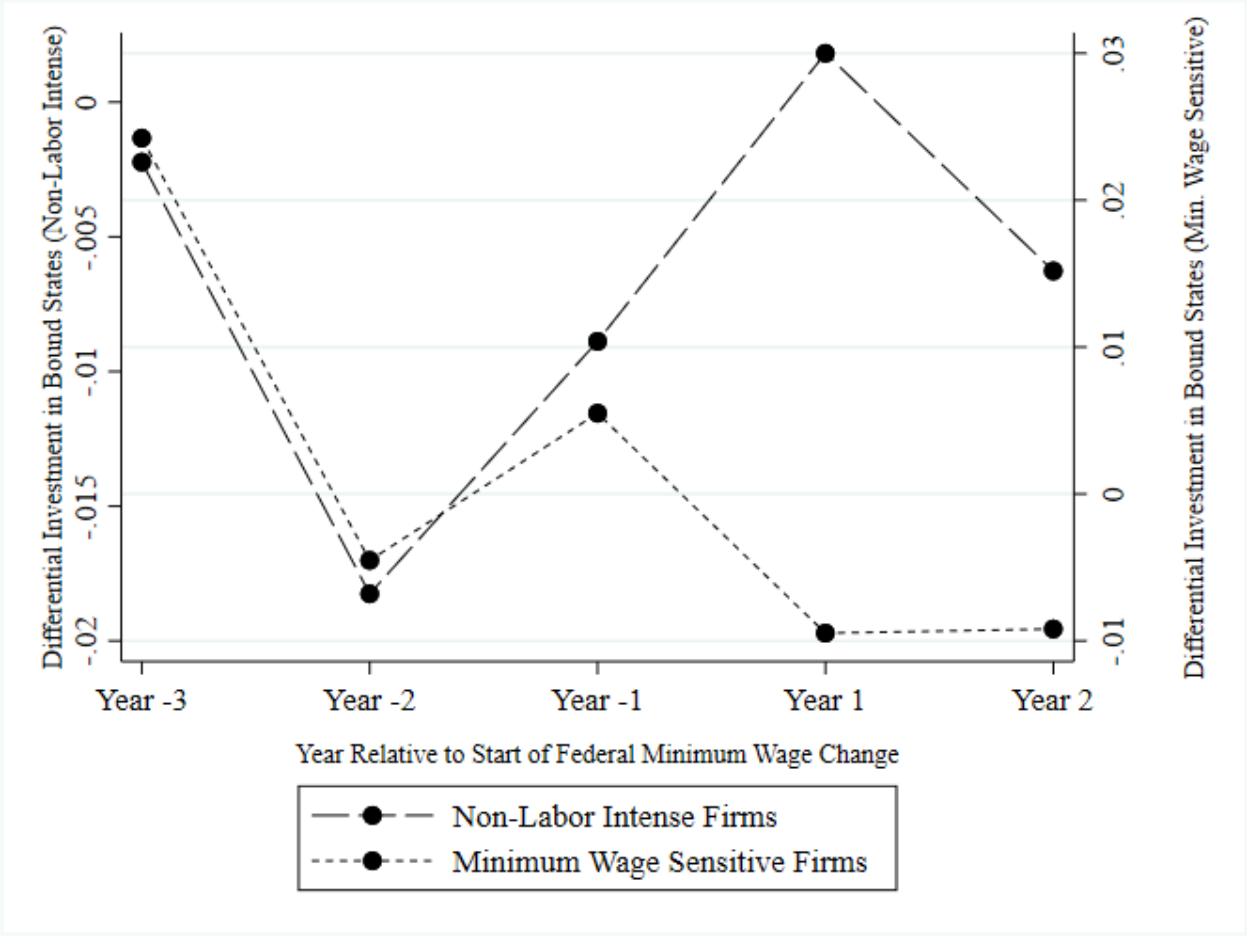


**Figure 6. Trends in minimum wage sensitive and non-labor-intensive investment surrounding federal minimum wage changes.** This figure plots the coefficients on $Bound_i$ x Event Year after estimating Equation 5 separately for minimum wage sensitive and non-labor-intensive firms. Each point can therefore be interpreted as the differential investment of firms in bound states, relative to that in unbound states. The sample is restricted to observations that are within three years before or two years after each of the three federal minimum wage increases (i.e., our event sample, see Section 4 for more details). Each of the three events consists of consecutive federal minimum wage increases. Thus, federal minimum wages increase between year -1 and year 1 (there is no year 0) and between year 1 and year 2.

## Table 1: Descriptive statistics, partitioned by bound and minimum wage sensitivity

This table presents the mean and median for the main firm-level characteristics used in our regression analyses, partitioned by minimum wage sensitivity and bound status. Panel A contains firm-years between 1987 and 2012. Panel B contains firm years that occur within three years before or two years after the three federal minimum wage changes during our sample period. Both panels restrict the sample to firms in the bottom three quartiles of total assets to state population. Each cell presents the mean on top and the median below. Columns 1 and 2 present averages for minimum wage sensitive firms in unbound and bound states, respectively. Columns 3 and 4 present the same statistics for non-labor-intensive firms. States are defined as bound if a firm-year is headquartered in a state with state-level minimum wage that is less than or equal to the federal minimum wage. We classify firms as minimum wage sensitive if they are in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Non-labor-intensive firms are those in Fama French 49 industry-years with below median employee-to-assets ratios. Definitions for the variables shown in this table are found in Appendix A.

### Panel A: Full sample

| | Min. Wage Sens. | | Non-Labor-Intensive | |
|---|---|---|---|---|
| | Unbound | Bound | Unbound | Bound |
| | (1) | (2) | (3) | (4) |
| Current Investment | 0.12 | 0.14 | 0.23 | 0.20 |
| | 0.07 | 0.08 | 0.15 | 0.11 |
| Lag Cash Flow | -0.14 | -0.09 | -0.29 | -0.24 |
| | -0.04 | -0.02 | -0.09 | -0.06 |
| Lag MtB | 1.54 | 1.49 | 2.54 | 2.20 |
| | 1.04 | 1.01 | 1.59 | 1.30 |
| Lag Ln(Assets) | 3.99 | 3.79 | 3.55 | 3.36 |
| | 4.18 | 3.94 | 3.60 | 3.40 |
| Observations | 1,708 | 6,094 | 14,750 | 24,414 |

### Panel B: Event study sample

| | Min. Wage Sens. | | Non-Labor-Intensive | |
|---|---|---|---|---|
| | Unbound | Bound | Unbound | Bound |
| | (1) | (2) | (3) | (4) |
| Current Investment | 0.12 | 0.14 | 0.22 | 0.20 |
| | 0.08 | 0.08 | 0.14 | 0.11 |
| Lag Cash Flow | -0.07 | -0.05 | -0.20 | -0.15 |
| | -0.03 | -0.02 | -0.05 | -0.03 |
| Lag MtB | 1.53 | 1.47 | 2.39 | 2.11 |
| | 1.09 | 1.06 | 1.66 | 1.37 |
| Lag Ln(Assets) | 4.17 | 3.96 | 3.59 | 3.52 |
| | 4.37 | 4.12 | 3.62 | 3.54 |
| Observations | 723 | 2,562 | 5,616 | 8,249 |

## Table 2: Total investment and exposure to minimum wage changes

This table presents OLS estimates. In Panel A the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The sample contains firm-years between 1987 and 2012 and we measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | -0.318*** | -0.280*** | -0.270** |
| | (-2.86) | (-2.96) | (-2.44) |
| Bound X Sensitive | 0.025** | 0.029*** | 0.040*** |
| | (2.22) | (3.15) | (4.53) |
| Bound X Δ Min. Wage | 0.129* | 0.131** | 0.106 |
| | (1.97) | (2.06) | (1.63) |
| Δ Min. Wage X Sensitive | 0.074 | 0.062 | 0.122 |
| | (0.99) | (0.97) | (1.64) |
| Lag Market-to-book | | 0.032*** | 0.032*** |
| | | (22.80) | (22.99) |
| Lag Cashflow | | -0.013** | -0.011** |
| | | (-2.62) | (-2.11) |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.367 | 0.416 | 0.399 |
| Observations | 46,966 | 46,966 | 62,985 |

## Table 3: Change in Operating Leases and Exposure to Minimum Wage Changes

This table presents OLS estimates where the dependent variable is the annual change in the capitalized value of operating leases scaled by beginning of period total assets. Specifically, we use the inflation adjusted annual change in capitalized operating leases scaled by beginning-of-period assets, where leases are capitalized following Rauh and Sufi (2011) and are discounted at the 10-year Treasury rate. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The sample contains firm-years between 1987 and 2012 and we measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | 0.078** | 0.082** | 0.128** |
| | (2.26) | (2.28) | (2.52) |
| Bound X Sensitive | -0.006 | -0.006 | -0.005 |
| | (-1.07) | (-0.98) | (-0.62) |
| Bound X Δ Min. Wage | -0.003 | -0.002 | -0.030* |
| | (-0.21) | (-0.16) | (-1.74) |
| Δ Min. Wage X Sensitive | -0.170*** | -0.172*** | -0.182*** |
| | (-6.80) | (-6.61) | (-3.88) |
| Lag Market-to-book | | 0.003*** | 0.003*** |
| | | (12.37) | (14.75) |
| Lag Cashflow | | 0.001 | 0.001 |
| | | (0.51) | (1.10) |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Event Year Fixed Effects | NO | NO | NO |
| Adj. R-squared | 0.111 | 0.117 | 0.112 |
| Observations | 46,966 | 46,966 | 62,985 |

## Table 4: Capital, R&D, and M&A expenditures and exposure to minimum wage changes

This table presents OLS estimates. In Panel A the dependent variable is capital expenditures scaled by beginning of period total assets. In Panel B the dependent variable is R&D expenditures scaled by beginning of period total assets. In Panel C (D) the dependent variable is M&A expenditures measured using Compustat (Thomson's One) data scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The sample contains firm-years between 1987 and 2012 and we measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

### Panel A: Capital expenditures

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | -0.179*** | -0.166*** | -0.208*** |
| | (-4.39) | (-4.53) | (-3.79) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.452 | 0.474 | 0.487 |
| Observations | 46,966 | 46,966 | 62,985 |

### Panel B: R&D Expenditures

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | 0.006 | 0.020 | 0.010 |
| | (0.12) | (0.47) | (0.26) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.717 | 0.741 | 0.750 |
| Observations | 46,966 | 46,966 | 62,985 |

**Panel C: Compustat M&A expenditures**

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | -0.075** | -0.069* | -0.039 |
| | (-2.12) | (-1.90) | (-1.15) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.129 | 0.132 | 0.109 |
| Observations | 46,966 | 46,966 | 62,985 |

**Panel D: Thomson's One M&A expenditures**

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Δ Min. Wage X Sensitive | -0.113*** | -0.107** | -0.112*** |
| | (-2.71) | (-2.43) | (-3.42) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.096 | 0.102 | 0.093 |
| Observations | 46,966 | 46,966 | 62,985 |

## Table 5: Robustness of main result

This table conducts several robustness analyses on Column 2 of Table 2. All estimates are from OLS regressions where the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Column 1 expands the set of firm characteristics that we control for to include lagged logged total assets, lagged cash-to-assets, lagged net income-to-assets, lagged total liabilities-to-assets, and lagged employees-to-assets. Column 2 retains only minimum wage sensitive firms in the retail industry (i.e., Fama-French industry 43). Column 3 retains only all other minimum wage sensitive firms (i.e., Fama-French industries 7 and 44). Column 4 changes the definition of non-labor firms to include a fixed set of industries over time (i.e., the Fama-French 49 industries with below median employee-to-assets ratios over our entire sample period are considered non-labor-intensive). Column 5 changes the definition of non-labor firms to include firm-years with above median employee-to-assets ratios (as opposed to our main measure, which is Fama-French 49 industry-years with above median employees-to-assets ratios). Finally, Column 6 drops all firm-years headquartered in states that never change their bound status over our sample period. The sample contains firm-years between 1987 and 2012 and we measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects and controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | Expanded Controls | Sensitive: Retail | Sensitive: Non-Retail | Fixed Ind. Controls | Firm-Level Controls | Bound Changers |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Bound X Δ Min. Wage X Sensitive | -0.365*** | -0.313*** | -0.280** | -0.321*** | -0.302*** | -0.228** |
| | (-3.66) | (-3.31) | (-2.27) | (-3.56) | (-2.77) | (-2.57) |
| Bound X Sensitive | 0.033*** | 0.021*** | 0.038** | 0.033*** | 0.024** | 0.029*** |
| | (3.45) | (3.67) | (2.34) | (3.89) | (2.19) | (3.07) |
| Bound X Δ Min. Wage | 0.153** | 0.133* | 0.133** | 0.191** | 0.118 | 0.100 |
| | (2.41) | (1.93) | (2.01) | (2.55) | (1.41) | (1.35) |
| Δ Min. Wage X Sensitive | 0.134* | 0.043 | 0.100 | 0.095 | 0.037 | 0.047 |
| | (1.78) | (0.89) | (0.95) | (1.63) | (0.60) | (0.71) |
| Lag Market-to-book | 0.027*** | 0.032*** | 0.032*** | 0.033*** | 0.029*** | 0.032*** |
| | (18.73) | (23.72) | (21.25) | (22.00) | (18.17) | (46.66) |
| Lag Cashflow | 0.001 | -0.016*** | -0.014*** | -0.013** | -0.008 | -0.017*** |
| | (0.16) | (-3.18) | (-2.94) | (-2.64) | (-1.59) | (-2.87) |
| Additional Firm Controls | YES | NO | NO | NO | NO | NO |
| Firm Fixed Effects | YES | YES | YES | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES | YES | YES | YES |
| Adj. R-squared | 0.445 | 0.426 | 0.418 | 0.417 | 0.398 | 0.452 |
| Observations | 46,966 | 43,469 | 42,054 | 41,936 | 33,205 | 34,551 |

## Table 6: Total investment and exposure to minimum wage changes, event study sample

This table presents OLS estimates where the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The analyses use an event study sample that is restricted to observation that occur between three years before and two years after a federal minimum wage change. Here, we measure minimum wage changes using a Post indicator that equals one for the two years after the federal minimum wage change and 0 for the three years prior. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Post X Sensitive | -0.047*** | -0.046*** | -0.053*** |
| | (-3.91) | (-4.05) | (-3.18) |
| Bound X Sensitive | 0.028 | 0.036** | 0.046** |
| | (1.63) | (2.40) | (2.68) |
| Bound X Post | 0.023** | 0.028*** | 0.023** |
| | (2.17) | (3.69) | (2.60) |
| Post X Sensitive | -0.002 | 0.006 | 0.019* |
| | (-0.31) | (0.75) | (1.70) |
| Lag Market-to-book | | 0.039*** | 0.039*** |
| | | (16.69) | (17.61) |
| Lag Cashflow | | 0.006 | 0.011 |
| | | (0.56) | (0.98) |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Event Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.416 | 0.463 | 0.440 |
| Observations | 17,150 | 17,150 | 23,625 |

## Table 7: Minimum Wage Sensitivity and County-Industry Establishment Growth

This table presents OLS estimates where the dependent variable is the average wage (Panel A) or establishment (Panel B) growth rate in a given county-industry-year. Minimum wage sensitive industries are defined as firms in the restaurant, retail, and entertainment industries (i.e., two-digit NAICS classifications 44, 71, and 72), while the control group of non-labor industries is defined as the remaining non-service sector industries (NAICS 21, 23, 31, 42). The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive industry. Bound is an indicator for a state-year with minimum wage less than or equal to the federal minimum wage, and Δ Min. Wage is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which growth rates are measured. In columns 1-2, we include all treatment and control industry-counties within the state, while in columns 3-4 we limit the sample to industry-counties that are located along the border of a bound and unbound state. All columns include county × industry, industry × year, and county × year fixed effects. T-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

**Panel A: Average Wage Growth**

| | All Counties | | Border Counties | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Bound X Δ Min. Wage X Sensitive | 0.056*** | 0.052*** | 0.047** | 0.046** |
| | (4.15) | (3.19) | (2.28) | (2.20) |
| State Economic Controls | NO | YES | NO | YES |
| County × Industry Fixed Effects | YES | YES | YES | YES |
| County × Year Fixed Effects | YES | YES | YES | YES |
| Industry × Year Fixed Effects | YES | YES | YES | YES |
| Adj. R-squared | 0.052 | 0.084 | 0.054 | 0.083 |
| Observations | 264,747 | 263,459 | 61,597 | 61,407 |

**Panel B: Establishment Growth**

| | All Counties | | Border Counties | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Bound X Δ Min. Wage X Sensitive | -0.053* | -0.046* | -0.072** | -0.061** |
| | (-1.89) | (-1.83) | (-2.61) | (-2.29) |
| State Economic Controls | NO | YES | NO | YES |
| County × Industry Fixed Effects | YES | YES | YES | YES |
| County × Year Fixed Effects | YES | YES | YES | YES |
| Industry × Year Fixed Effects | YES | YES | YES | YES |
| Adj. R-squared | 0.080 | 0.098 | 0.104 | 0.121 |
| Observations | 264,747 | 263,459 | 61,597 | 61,407 |

## Table 8: Firm size and exposure to minimum wage changes

This table presents OLS estimates where the dependent variable is the percentage change in total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The sample contains firm-years between 1987 and 2012 and we measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (4) |
| Bound X Δ Min. Wage X Sensitive | -0.363*** | -0.271** | -0.432** |
| | (-3.24) | (-2.22) | (-2.27) |
| Bound X Sensitive | 0.018 | 0.023 | 0.061*** |
| | (1.15) | (1.63) | (3.76) |
| Bound X Δ Min. Wage | 0.269*** | 0.291*** | 0.228** |
| | (3.29) | (3.10) | (2.15) |
| Δ Min. Wage X Sensitive | 0.010 | -0.025 | 0.281** |
| | (0.12) | (-0.32) | (2.11) |
| Lag Market-to-book | | 0.067*** | 0.067*** |
| | | (47.35) | (49.39) |
| Lag Cashflow | | 0.050*** | 0.054*** |
| | | (6.03) | (7.01) |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.110 | 0.206 | 0.231 |
| Observations | 46,966 | 46,966 | 62,985 |

## Table 9: Effect of minimum wage changes on other labor-intensive industries?

This table presents OLS estimates. In Panel A the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. In Panel B the dependent variable is capital expenditures scaled by beginning of period total assets. In Panel C the dependent variable is percentage change in total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a labor-intensive firm-year, defined as one in a Fama-French industry year with above-median employees-to-assets that is not in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). The control sample is all non-labor-intensive firms defined as those in a Fama-French 49 industry year with below-median employees-to-assets. Columns 1 and 2 restrict the sample to firms in the bottom three quartiles of total assets to state population and use a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. In Column 3 we use firms of all sizes and an alternate bound measure, based on the geographical dispersion measure in Garcia and Norli (2012), which counts the percentage of state mentions in a firm's 10-K filings that refer to a bound state. The sample contains firm-years between 1987 and 2012 and measure minimum wage changes with Δ Min. Wage, which is the annual percentage change in federal minimum wage ending one quarter before the end of the fiscal year over which investment is measured. All columns include firm and state-year fixed effects, while Columns 2 and 3 also include controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

### Panel A: Total investment

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (4) |
| Bound X Δ Min. Wage X Labor | -0.139* | -0.134* | -0.131 |
| | (-1.81) | (-1.79) | (-1.38) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.350 | 0.399 | 0.378 |
| Observations | 69,586 | 69,585 | 93,134 |

### Panel B: Capital expenditures

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (4) |
| Bound X Δ Min. Wage X Labor | -0.055 | -0.053 | -0.041 |
| | (-1.47) | (-1.44) | (-0.91) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.429 | 0.451 | 0.469 |
| Observations | 69,586 | 69,585 | 93,134 |

**Panel C: Change in total assets**

| | HQ-based Bound | | 10-K-based Bound |
|---|---|---|---|
| | (1) | (2) | (4) |
| Bound X Δ Min. Wage X Labor | -0.129 | -0.112 | -0.179 |
| | (-1.56) | (-1.28) | (-1.37) |
| Lagged Firm Controls | NO | YES | YES |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.109 | 0.199 | 0.223 |
| Observations | 69,586 | 69,585 | 93,134 |

## Table 10: Matched Analysis

This table replicates our main triple difference analysis using a matched sample, with total investment as the dependent variable. States are defined as bound if a firm-year is headquartered in a state with state-level minimum wage that is less than or equal to the federal minimum wage. We classify firms as minimum wage sensitive if they are in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). Non-labor-intensive firms are those in Fama French 49 industry-years with below median employee-to-assets ratios. Panel A presents the mean and median (in parenthesis) for the main firm-level characteristics used in our regression analyses, partitioned by minimum wage sensitivity and bound status. In this sample, we match each minimum wage sensitive firm to a single non-labor-intensive control group in the same year and in the same state type (i.e., bound or unbound). We match with replacement to the nearest neighbor based on the Mahalanobis distance of lagged cash flow, market-to-book, and assets. Panel B reports sample characteristics for a separate sample where we match each treated firm (minimum wage sensitive firm in a bound state) to a control firm in each category, based on the same set of characteristics as in Panel A. Panel C shows the results of an OLS regression where the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

### Panel A: Matching sensitive to non-labor-intensive firms

| | Min. Wage Sens. | | Non-Labor-Intensive | |
|---|---|---|---|---|
| | Unbound | Bound | Unbound | Bound |
| | (1) | (2) | (3) | (4) |
| Current Investment | 0.12 | 0.15 | 0.17 | 0.16 |
| | (0.07) | (0.08) | (0.11) | (0.09) |
| Lag Cash Flow | -0.14 | -0.09 | -0.13 | -0.09 |
| | (-0.04) | (-0.02) | (-0.04) | (-0.02) |
| Lag MtB | 1.56 | 1.49 | 1.56 | 1.49 |
| | (1.04) | (1.02) | (1.04) | (1.02) |
| Lag Ln(Assets) | 3.97 | 3.80 | 3.95 | 3.79 |
| | (4.15) | (3.95) | (4.14) | (3.95) |
| Observations | 1,746 | 6,084 | 1,746 | 6,084 |

### Panel B: Matching treated to control firms

| | Min. Wage Sens. | | Non-Labor-Intensive | |
|---|---|---|---|---|
| | Unbound | Bound | Unbound | Bound |
| | (1) | (2) | (3) | (4) |
| Current Investment | 0.13 | 0.15 | 0.16 | 0.16 |
| | (0.08) | (0.08) | (0.11) | (0.09) |
| Lag Cash Flow | -0.07 | -0.09 | -0.08 | -0.09 |
| | (-0.03) | (-0.02) | (-0.02) | (-0.02) |
| Lag MtB | 1.34 | 1.49 | 1.47 | 1.49 |
| | (0.98) | (1.02) | (1.05) | (1.02) |
| Lag Ln(Assets) | 3.84 | 3.80 | 3.79 | 3.79 |
| | (4.07) | (3.95) | (3.98) | (3.96) |
| Observations | 6,084 | 6,084 | 6,084 | 6,084 |

**Panel C: Effect of Minimum Wage on Total Investment**

| | Matching sensitive to non-labor-intense (Panel A) | | Matching treated to all control firms (Panel B) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Bound X Δ Min. Wage X Sensitive | -0.292** | -0.288** | -0.309** | -0.351*** |
| | (-2.23) | (-2.54) | (-2.68) | (-2.88) |
| Bound X Sensitive | 0.014 | 0.021 | 0.016 | 0.017 |
| | (1.27) | (1.54) | (1.26) | (1.38) |
| Bound X Δ Min. Wage | 0.135 | 0.140 | 0.220 | 0.242* |
| | (0.58) | (0.61) | (1.57) | (1.72) |
| Δ Min. Wage X Sensitive | -0.041 | 0.001 | -0.001 | 0.078 |
| | (-0.50) | (0.01) | (-0.01) | (0.67) |
| Lag Market-to-book | | 0.039*** | | 0.039*** |
| | | (11.41) | | (10.15) |
| Lag Cashflow | | 0.028 | | 0.032** |
| | | (1.26) | | (2.44) |
| Firm Fixed Effects | YES | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES | YES |
| Adj. R-squared | 0.302 | 0.338 | 0.459 | 0.484 |
| Observations | 14,196 | 14,196 | 22,928 | 22,928 |

# Internet Appendix to
# Minimum Wage and Corporate Policy

Matthew Gustafson and Jason Kotter

## 1. Extensions to Conceptual framework

The stylized model in Section 2 of the paper suggests that the effect of minimum wage on investment is an empirical question, the answer to which depends on both the sensitivity of a firm's wage bill to minimum wage changes and the type of investment under consideration. Here, we show that these conclusions hold in two settings that are more complex. First, we allow firms to pass on some of the costs of minimum wage in the form of higher prices. Second, we derive the conditions under which a firm that simultaneously invests in two different types of investment changes its investment mix in response to wage increases.

When firms can adjust prices after a shock to minimum wage, price is a decreasing function of output. The total derivative of the first order condition becomes:

$$\frac{\partial K^*}{\partial w} = -\frac{\partial L^*}{\partial w} \times \frac{\left(pf_{KL} + f_K \frac{\partial p}{\partial Q} f_L\right)}{\left(pf_{KK} + f_K \frac{\partial p}{\partial Q} f_K\right)} \quad \text{(IA 1)}$$

As in the main paper, diminishing returns to capital and downward sloping labor demand make both $f_{KK}$ and $\partial L^*/\partial w$ negative, and $f_K$ and $f_L$ are both positive because they are normal inputs in the production process. As long as the demand curve for the product is not upward sloping, $\partial p/\partial Q \leq 0$, the denominator of Eq (IA 1) will be negative. Consequently, the sign of $\frac{\partial K^*}{\partial w}$ is determined by the numerator of Eq. (IA 1).

If $f_{KL}$ is negative (i.e., capital and labor are gross substitutes) then the numerator is negative and the same result that we obtain in the main paper holds: the *Substitution Hypothesis* dominates and an increase in wages leads to an increase in investment. In contrast, if capital and labor are gross complements ($f_{KL} > 0$), then the relation between capital investment and wages is indeterminate: an increase in wages can lead investment to increase, decrease, or stay the same.

While we cannot determine the sign in general, we gain insight by examining the conditions when investment increases or decreases. If $pf_{KL} < -f_K \frac{\partial p}{\partial Q} f_L$, then $\partial K^*/\partial w > 0$ and the *Substitution Hypothesis* dominates even if capital complements labor. This will be more likely if capital and labor are only weakly complementary or if product demand is very inelastic. In contrast, the *Scale Hypothesis* dominates if capital and labor are especially complementary or product market demand is sufficiently elastic. This discussion illustrates that both the *Scale* and

*Substitutions Hypotheses* remain possible even after we allow firms to pass on some of the costs of minimum wage in the form of higher prices.

Next, we consider the case where a firm simultaneously invests in two types of capital: capital that is complementary to minimum wage labor and capital that substitutes for minimum wage labor. To do this, we assume a nested constant elasticity of substitution (CES) production function. The CES production function is a generalized function that includes Cobb-Douglas as a special case and the nested structure allows the elasticities of substitution to both vary and be asymmetric across the three inputs (Sato, 1967).

Formally, consider a firm that produces output *y* such that

$$y = \left(\alpha(\gamma L^{\nu} + (1-\gamma)K^{\nu})^{\rho\backslash\nu} + (1-\alpha)R^{\rho}\right)^{1\backslash\rho} \quad \text{with } 0 < \{\alpha, \gamma\} < 1; \{\rho, \nu\} \leq 1 \qquad \text{(IA 2)}$$

where K is production capital, L is labor, and R is technology capital. We are interested in the response of investment in K and R to an increase in the cost of labor, which is reflected in the elasticity of substitution, defined as the percentage change in demand for that investment-type for a percentage change increase in the wage. If this elasticity is greater than one, then the inputs are gross substitutes and an increase in minimum wage leads to higher levels of investment. In contrast, if the elasticity is less than one, the inputs are gross complements and an increase in minimum wage causes a reduction in investment.

Given Eq. (IA 2), the elasticity of substitution between capital and labor is $\sigma_{LK} = 1/(1-\nu)$. Empirical evidence suggests that $\sigma_{LK} < 1$, or that capital and labor are gross complements. Similarly, define the elasticity of substitution between the combined capital/labor input and technology as $\sigma_{\{L,K\}R} = 1/(1-\rho)$. We assume that capital is more labor-complementary than technology, so that $\sigma_{LK} < \sigma_{\{L,K\}R}$. This corresponds with the idea underlying our framework in Section 2.3 that some investments are more labor-complementary, while other investments are more likely to substitute for labor.

$\sigma_{LK}$ and $\sigma_{\{L,K\}R}$ are both Hicks-McFadden elasticities (upon which the CES model is built), which do not allow the firm to substitute across all inputs. This is an important limitation, since an increase in wages might lead firms to substitute out of labor into or out of both types of investment simultaneously. Consequently, we need an elasticity measure that allows the firm to respond to increases in wages by potentially adjusting labor, capital, and technology. The Morishima (1967)

elasticity is a generalization of the Hicks-McFadden elasticity that allows for this simultaneous substitution between all of the inputs of production. An additional benefit of the Morishima measure is that it allows for asymmetric elasticities between any given pair of inputs, which makes it particularly suited to describe nested CES production functions.

Anderson and Moroney (1993) derive the Morishima elasticities for a generalized nested production function. Applying their derivation to the nested CES model described in Eq. (1), we find that:

$$M_{LK} = \sigma_{LK} \tag{IA 3}$$

$$M_{LR} = \gamma\sigma_{\{L,K\}R} + (1-\gamma)\sigma_{LK} \tag{IA 4}$$

where $M_{ij}$ is the Morishima elasticity between goods $i$ and $j$ for a percentage change in the price of good $i$. Recall that $\gamma \in (0,1)$ and that we have assumed that capital is more complementary to labor than technology, so that $\sigma_{LK} < \sigma_{\{L,K\}R}$. Consequently, Eq. (IA 4) is a convex combination and so $M_{LK} < M_{LR}$ which means that an increase in wages leads firms to cut investment in capital relative to investment in technology. This is analogous to the results presented in Section 2; the model predicts that the largest cuts investment are for capital-types that are most complementary to labor.

To further interpret Eq. (IA 4), it is necessary to make one additional assumption. Consistent with our discussion in Section 2, assume that technology and the combined output of labor and capital are gross substitutes, $\sigma_{\{L,K\}R} > 1$. Given this, Eq. (IA 4) shows that an increase in wages can lead firms to increase investments in technology ($M_{LR} > 1$), decrease investments ($M_{LR} < 1$), or hold technology investments constant ($M_{LR} = 1$). Investment in technology is more likely to increase when technology is a better substitute for the labor/capital input and when labor is a more important input in production ($\gamma$ is bigger). Conversely, investment in technology is more likely to fall when labor and capital are more strongly complimentary and when capital is a more important input in production.

This result stands in contrast to the general framework presented in the paper where a minimum wage increase always causes investment in labor-substitutable capital to rise, and is a good illustration of the importance of allowing the firm to simultaneously choose investment in all inputs. As the price of labor rises, the firm does tend to substitute technology for labor, particularly when labor is an important part of production. However, at the same time, the increase in wages increases the relative price of capital (since it is complementary to labor), which causes the firm

to reduce capital investment. This reduction in capital makes it harder to substitute technology for labor, since the technology now needs to replace the outputs of both labor and capital. This reduces the incentives to invest in technology. Combined, the net effect on technology investment is ambiguous. Nevertheless, this more complex model supports the idea that the effect of minimum wage on corporate investment is an empirical question, the answer to which depends (at least in part) on how reliant a firm is on minimum wage labor and the type of investment under consideration.

**References:**

Anderson, R. K., and Moroney, J. R. (1993). Morishima elasticities of substitution with nested production functions. *Economics Letters*, 42, 159–166.

Morishima, M. (1967). A few suggestions on the theory of elasticity. *Keizai Hyoron* (*Economic Review*), 16, 144-150.

Sato, K. (1967). A two-level constant-elasticity-of-substitution production function. *The Review of Economic Studies*, 34, 201-218.

## Table A1: Federal Minimum Wage Changes

This table shows the evolution of nominal federal minimum wages over time. The law enacted date is from Whittaker, W.G. (2007). Minimum Wage in the 110th Congress. *CRS Report for Congress*, Order Code RL33754.; the effective dates are gathered from the Department of Labor.

| Public Law Enacted | Effective Date | Minimum Wage |
|---|---|---|
| 6/25/1938 | 10/24/1938 | $0.25 |
| | 10/24/1939 | $0.30 |
| | 10/24/1945 | $0.40 |
| 10/26/1949 | 1/25/1950 | $0.75 |
| 8/12/1955 | 3/1/1956 | $1.00 |
| 5/5/1961 | 9/3/1961 | $1.15 |
| | 9/3/1963 | $1.25 |
| 9/23/1966 | 2/1/1967 | $1.40 |
| | 2/1/1968 | $1.60 |
| 4/8/1974 | 5/1/1974 | $2.00 |
| | 1/1/1975 | $2.10 |
| | 1/1/1976 | $2.30 |
| 11/1/1977 | 1/1/1978 | $2.65 |
| | 1/1/1979 | $2.95 |
| | 1/1/1980 | $3.10 |
| | 1/1/1981 | $3.35 |
| 11/17/1989 | 4/1/1990 | $3.80 |
| | 4/1/1991 | $4.25 |
| 8/20/1996 | 10/1/1996 | $4.75 |
| | 9/1/1997 | $5.15 |
| 5/25/2007 | 7/24/2007 | $5.85 |
| | 7/24/2008 | $6.55 |
| | 7/24/2009 | $7.25 |

## Table A2: Regressing Investment on State-level Minimum Wage Changes

This table presents ordinary least squares estimates, regressing a firm's annual total investment on recent changes in their headquarter state's minimum wage. Total investment is defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. Δ State Minimum Wage is obtained from the U.S. Department of Labor and is the annual percentage in the nominal federal minimum wage for the year ending at the beginning of the calendar quarter before fiscal year end. Column 2 includes year and firm fixed effects, while Column 3 further adds controls for firm characteristics (Employees, Liabilities, Tangibility, Ln(Assets), Profitability, MtB, and Cash) and state economic conditions (population, change in population, unemployment, change in unemployment, state-level average wage, change in state-level average wage). Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | Total Investment (1) | Total Investment (2) | Total Investment (3) |
|---|---|---|---|
| Δ State Minimum Wage | 0.079*** | 0.009 | -0.012 |
| | (3.69) | (0.78) | (-1.01) |
| Firm Controls | NO | NO | YES |
| State-level Controls | NO | NO | YES |
| Firm Fixed Effects | NO | YES | YES |
| Year Fixed Effects | NO | YES | YES |
| Adj. R-squared | 0.000 | 0.002 | 0.081 |
| Observations | 106,340 | 106,340 | 106,340 |

## Table A3: Minimum Wage Changes by Year

This table shows the average annual percentage change (weighted by firms in our regression sample) in the effective minimum wage for bound and unbound states from 1980 to 2012. For bound states, the effective minimum wage is the federal minimum wage, while for unbound states, the effective minimum wage is the state minimum wage.

| Year | Unbound States | Bound States | Year | Unbound States | Bound States |
|---|---|---|---|---|---|
| 1980 | 0.072 | 0.069 | 1997 | 0.047 | 0.095 |
| 1981 | 0.078 | 0.081 | 1998 | 0.053 | 0.027 |
| 1982 | 0.001 | 0.000 | 1999 | 0.013 | 0.000 |
| 1983 | 0.000 | 0.000 | 2000 | 0.096 | 0.000 |
| 1984 | 0.000 | 0.000 | 2001 | 0.029 | 0.000 |
| 1985 | 0.000 | 0.000 | 2002 | 0.054 | 0.000 |
| 1986 | 0.001 | 0.000 | 2003 | 0.006 | 0.000 |
| 1987 | 0.049 | 0.000 | 2004 | 0.006 | 0.000 |
| 1988 | 0.063 | 0.000 | 2005 | 0.024 | 0.000 |
| 1989 | 0.024 | 0.000 | 2006 | 0.042 | 0.000 |
| 1990 | 0.016 | 0.113 | 2007 | 0.077 | 0.097 |
| 1991 | 0.020 | 0.120 | 2008 | 0.038 | 0.124 |
| 1992 | 0.002 | 0.013 | 2009 | 0.022 | 0.110 |
| 1993 | 0.001 | 0.000 | 2010 | 0.008 | 0.020 |
| 1994 | -0.000 | 0.000 | 2011 | 0.005 | 0.000 |
| 1995 | 0.000 | 0.000 | 2012 | 0.014 | 0.000 |
| 1996 | 0.021 | 0.072 | | | |

## Table A4: Labor Intensity by Industry

This table presents the top 10 and bottom 10 Fama French 49 industries by labor intensity for our sample. For each industry year, we calculate the median employees-to-assets ratio. We then calculate the median over all industry-years in our sample; firms are classified as labor-intense if their employees-to-assets ratio is greater than this sample median. For each industry, we show the number of firm-years that are classified as labor and non-labor in our sample.

| Fama French 49 Industry | Non-Labor | Labor | Total | % Labor |
|---|---|---|---|---|
| **Top 10 Labor-intense Industries:** | | | | |
| Retail | - | 6,533 | 6,533 | 100% |
| Restaurants, Hotels, Motels | - | 2,537 | 2,537 | 100% |
| Healthcare | - | 2,529 | 2,529 | 100% |
| Personal Services | - | 1,432 | 1,432 | 100% |
| Apparel | 50 | 1,663 | 1,713 | 97% |
| Automobiles and Trucks | 114 | 1,694 | 1,808 | 94% |
| Textiles | 47 | 674 | 721 | 93% |
| Fabricated Products | 32 | 446 | 478 | 93% |
| Business Services | 575 | 5,908 | 6,483 | 91% |
| Rubber and Plastic Products | 169 | 1,038 | 1,207 | 86% |
| | | | | |
| **Bottom 10 Labor-intense Industries:** | | | | |
| Pharmaceutical Products | 7,160 | - | 7,160 | 0% |
| Petroleum and Natural Gas | 5,117 | - | 5,117 | 0% |
| Communication | 3,652 | - | 3,652 | 0% |
| Chemicals | 2,351 | - | 2,351 | 0% |
| Construction | 1,452 | - | 1,452 | 0% |
| Precious Metals | 547 | - | 547 | 0% |
| Non-Metallic and Industrial Metal Mining | 446 | - | 446 | 0% |
| Beer & Liquor | 352 | - | 352 | 0% |
| Coal | 239 | - | 239 | 0% |
| Candy & Soda | 227 | 11 | 238 | 5% |

## Table A5: Robustness of event study analysis

This table conducts several robustness analyses on the event study analysis in Column 2 of Table 6. Specifically, each column replicates the result after dropping one of the three federal minimum wage changes that occur during our sample period to ensure that no specific event drives our results. All estimates are from OLS regressions where the dependent variable is total investment, defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period total assets. The explanatory variable of interest is the triple interaction between a bound state, a federal minimum wage change, and a minimum wage sensitive firm, defined as in the restaurant, retail, or entertainment industries (i.e., Fama-French 49 industries 7, 43, and 44). The sample of firms is restricted to those in the bottom three quartiles of total assets to state population and uses a headquarter-based bound measure, which is an indicator for a firm headquartered in a state-year with minimum wage equal to the federal minimum wage. The analyses use an event study sample that is restricted to observation that occur between three years before and two years after a federal minimum wage change. Here, we measure minimum wage changes using a Post indicator that equals one for the two years after the federal minimum wage change and 0 for the three years prior. All columns include firm and state-year fixed effects as well as controls for lagged market-to-book ratio and cash flows. Appendix A defines all control variables, t-statistics based on standard errors that are clustered by state are reported in parentheses below the coefficients, and *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

| | Event 1 Dropped | Event 2 Dropped | Event 3 Dropped |
|---|---|---|---|
| | (1) | (2) | (3) |
| Bound X Post X Sensitive | -0.044*** | -0.036*** | -0.041* |
| | (-3.93) | (-2.95) | (-1.96) |
| Bound X Sensitive | 0.037*** | 0.039** | 0.021 |
| | (2.85) | (2.33) | (0.74) |
| Bound X Post | 0.030*** | 0.006 | 0.033*** |
| | (3.22) | (0.51) | (3.30) |
| Post X Sensitive | 0.008 | 0.010 | -0.003 |
| | (0.99) | (1.20) | (-0.16) |
| Lag Market-to-book | 0.039*** | 0.039*** | 0.043*** |
| | (15.77) | (15.36) | (12.73) |
| Lag Cashflow | 0.008 | 0.009 | 0.047*** |
| | (0.69) | (0.95) | (5.04) |
| Firm Fixed Effects | YES | YES | YES |
| State × Year Fixed Effects | YES | YES | YES |
| Event Year Fixed Effects | YES | YES | YES |
| Adj. R-squared | 0.485 | 0.493 | 0.437 |
| Observations | 14,052 | 11,836 | 8,334 |