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DuckKi Cho
Peking University

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Abstract

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Keywords: Downward wage rigidity, corporate investment, minimum wage laws, theory of second best
JEL Classification: D92, G31, J30, K31

Peking University HSBC Business School
University Town, Nanshan District
Shenzhen 518055, China

Downward Wage Rigidity, Corporate Investment, and Firm Value*

DUCKKI CHO†

ABSTRACT

Firms reduce investment when facing downward wage rigidity (DWR), the inability or unwillingness to adjust wages downward. I construct DWR measures and exploit staggered state-level changes in minimum wage laws as an exogenous variation in DWR to document this fact. Following a one standard deviation increase in the minimum wage, firms reduce their investment rate by 2.68 percentage points. This evidence highlights the unintended consequences of minimum wage policy on corporate investment. The investment cut cannot be explained by labor adjustment under capital-labor complementarities. Rather, I identify aggravation of debt overhang and increased operating leverage as mechanisms by which DWR impedes investment. Finally, this labor market friction enhances the firm value and production efficiency when firms are subject to other frictions causing overinvestment, which is consistent with the theory of second best.

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†Peking University HSBC Business School. E: duckki.cho@phbs.pku.edu.cn

Firms do not appear to fully adjust wages in response to labor market conditions, particularly when the marginal product of labor decreases. This is referred to as downward wage rigidity.[1] This friction converts a wage claim into a debt-like contract that requires firms to pay a fixed amount, which is presumably unrelated to worker productivity or market-equilibrium wages. The result is creation of an additional debt overhang (Myers, 1977) on top of a firm's actual amount of debt. Downward wage rigidity also increases a firm's operating leverage because wages do not fall by as much as output falls during bad times. The greater operating leverage prevents the firm using financial leverage, which in turn decreases its ability to finance investment. Hence downward wage rigidity can deter investment. Yet empirical evidence of the effect of labor market frictions on investment is scant, in part because these frictions are hard to measure and in part because identifying their causal effects is challenging.

This study addresses these challenges. Applying the method proposed by Lebow et al. (1995), I construct a firm-level, time-varying measure of downward wage rigidity using the Quarterly Workforce Indicators from the U.S. Census Bureau. The idea is to construct a *notional* (rigidity-free) distribution of wage growth and to investigate whether the empirical distribution is compressed from the left, relative to the notional one. The measure exhibits considerable cross-sectional and time-series variation and has sensible properties: the measure increases following a minimum wage increase, affirming its validity.

I first document that my measure of downward wage rigidity is negatively associated with investment. Within firms, a one standard deviation increase in downward wage rigidity is associated with a 1.7% decrease in the investment rate (i.e., capital expenditure/capital stock), relative to the median, after controlling for firm and year fixed effects and other firm-level determinants of investment. These results are robust to using three alternative measures and to the business cycle or inflation. To account for measurement errors in a

[1] Campbell and Kamlani (1997) review theories of wage rigidity and investigate potential sources of wage rigidity using a survey. More recently, Baqaee (2020) proposes a model in which asymmetric household expectations about the inflation rate generate downward wage rigidity. Empirical evidence for downward wage rigidity can be found, for example, in the work of Card and Hyslop (1997), Kahn (1997), Lebow et al. (2003), Daly et al. (2012), Barattieri et al. (2014), and Kurmann et al. (2016).

proxy for investment opportunities and my measure, I use the linear cumulant estimators of Erickson et al. (2014) and find robust and even stronger results.

Yet empirical identification is challenging not only because wage policy may be correlated with the demand for capital but also because it could be simultaneously determined with investment decisions. To develop causal inferences, I exploit staggered state-level changes in minimum wage laws as a source of exogenous variation in downward wage rigidity. An increase in the minimum wage creates a higher floor for wages, which makes them more downwardly rigid. The identification strategy assumes that changes in minimum wage laws are exogenous to individual firm outcomes. My empirical design takes several steps to make this identification strategy more convincing.

First, I exclude all the firms headquartered in the U.S. states that have indexed their minimum wage rates to inflation. This ensures that the potential impact of inflation on investment does not bias my estimates. Second, if state-level minimum wage legislation was motivated by unobservable, anticipated improvement in local investment opportunities, the identifying assumption may be violated. However, this will bias my tests against finding a negative relation between minimum wage increases and investment. Third, I exploit states that set their minimum wage rates based on the federal rate. To the extent that federal minimum wage policy is orthogonal to the state-level economic conditions, this enables us to isolate the effect of unobservable state-level macroeconomic shocks on corporate investment. Fourth, owing to staggered changes in minimum wage rates, firms can be in both the treatment and control groups at different times, which alleviates the potential problem of systematic differences between treatment and control firms. Finally, I show that my measure of downward wage rigidity indeed increases after a minimum wage increase. This ensures that minimum wage hike likely affects investment decisions only through affecting downward wage rigidity.

Armed with this identification strategy, I find that, after a one standard deviation increase in the minimum wage, firms reduce their investment rates by 2.68 percentage points, a 13.5% decrease, relative to the median investment rate. The negative effects are more pronounced for firms in industries that are most subject to the changes in minimum wage laws. These industries are identified by the percentage of hourly workers with earnings close to the prevailing minimum wage. Moreover, the negative effects are stronger for firms in states with stronger employment protection laws and for those with higher labor intensity or stickier product prices. These results lend further credence to my identification strategy. This large and statistically significant negative impact provides suggestive evidence that minimum wage increase could dampen the employment growth by stifling corporate investment.

After having established the effects of downward wage rigidity on investment, I explore the potential channels for these effects. First, under capital-labor complementarities, a firm would adjust its capital expenditures in response to labor adjustment that potentially results from downward wage rigidity. However, I show that, after controlling for potential labor adjustment, downward wage rigidity remains significant both statistically and economically. Therefore the investment cut cannot be explained by this channel. Second, downward wage rigidity converts a wage claim into a debt-like contract that requires firms to pay a fixed amount of wages, which exacerbates the debt overhang problem. As indirect evidence, I find that downward wage rigidity increases a firm's default risk for a given amount of actual debt. Moreover, the investment cuts are concentrated in a condition where bankruptcy or financial distress is more likely to occur, consistent with the theoretical work by Myers (1977). Third, downward wage rigidity also increases a firm's operating leverage: a one standard deviation increase in it is associated with a 5% increase in operating leverage, measured by the sensitivity of changes in earnings to changes in sales.[2] The heightened operating leverage prevents a firm from using financial leverage, which decreases its ability to finance investment.[3]

With the negative impact and underlying mechanisms identified, I turn to an examina-

[2] A similar argument is made by Simintzi et al. (2015), who focus on employment protection laws that impose restrictions on firing and hiring.

[3] Schoefer (2015) examines the role of the interaction between wage rigidity and financing constraints in explaining hiring fluctuations in the U.S. labor market.

tion of the value consequences. Consider a typical optimization problem in which a firm maximizes shareholder value. Imposing an additional binding friction reduces the firm's choice sets and seems to unconditionally lower the value function. The theory of second best (Viner, 1950; Lipsey and Lancaster, 1956) suggests that this may not always be true, however. The newly added friction (e.g., downward wage rigidity) may partially counteract the effect of other frictions on investment (e.g., overinvestment), improving production efficiency.

I examine this theoretical prediction by focusing on market value and total factor productivity (TFP) for firms that are identified by the literature as over- or underinvesting. For underinvesting firms, as measured by Hennessy (2004), downward wage rigidity is *negatively* associated with firm value and production efficiency, which implies that this additional friction is inefficient. A one standard deviation increase in downward wage rigidity is related to a 5.7 percentage point *decrease* in Tobin's q and a 1.60% *drop* in TFP over a year for the firms in the top quintile of debt overhang measure. These findings are consistent with those of Bell and Machin (2018). However, I find that downward wage rigidity is *positively* associated with firm value when firms are likely to overinvest; this circumstance is proxied in the literature by firms that have overly confident CEOs (Malmendier and Tate, 2005; Campbell et al., 2011) or CEOs who are in the later years of their tenure (Pan et al., 2016). A one standard deviation increase in downward wage rigidity is associated with a 3.8 percentage point *increase* in Tobin's q for the overly confident group. Consistent with the firm value results, a one standard deviation increase in downward wage rigidity is followed by a 0.65% *increase* in TFP over a year. Taken together, these results suggest that labor market friction may curb overinvestment problems that are due to managerial overconfidence or agency problems, consistent with the theory of second best.

The main contributions of this study are threefold. First, this study builds on the literature that investigates the impact of frictions on a firm's real activities. Previous research has documented that capital market frictions can have a large and perhaps causal impact on both capital investment and employment.[4] While the link between labor market frictions

[4]See, e.g., Fazzari et al. (1988), Hennessy and Whited (2007), Almeida and Campello (2007), and Chava

and employment has long been investigated in economics, much less is known about the role of these in determining capital investment, the subject of this paper. A few exceptions are the work of Gustafson and Kotter (2017) and Geng et al. (forthcoming). Like this article, Gustafson and Kotter (2017) document a negative effect of minimum wage increase on investment for the public U.S. firms whereas Geng et al. (forthcoming) find the opposite effect for the private Chinese manufacturing firms. Both studies interpret their findings that the income effect (i.e., an increase in cost of production) dominates the capital-labor substitution effect, or vice versa.[5] While this article uses minimum wage laws as an identification tool, it focuses on a specific labor market friction governing all incumbent workers' wages by constructing the measures of downward wage rigidity. More importantly, I find little evidence that the capital-labor complementarity (or substitutability) explains the observed investment cut. Instead, I identify unique channels that are based on financing: exacerbation of debt overhang and increased operating leverage.

Second, this article documents new evidence for the positive role of labor market friction in the context of corporate investment. Acemoglu and Pischke (1999) propose a theory in which labor market frictions that distort a wage structure encourage firms to enhance the productivity of low-skilled workers through worker training. Similarly, Acharya et al. (2014) provide evidence that employment protection laws stimulate (rather than impede) corporate innovation by mitigating holdup problems. This article complements the literature by pointing out the countervailing effect of downward wage rigidity on firm overinvestment, which could improve firm value and production efficiency.[6] These results call for a richer theory on the interaction effects between labor and other frictions in the firm.

Third, this article has policy implications for minimum wage laws, which are a source of political contention, especially during presidential election years with the recent movement

and Roberts (2008) for the impact on investment and Chodorow-Reich (2013), Giroud and Mueller (2017), Barrot and Nanda (2016), and Benmelech et al. (2011) for the effect on employment.

[5]Geng et al. (forthcoming) attribute these different findings across two countries to a lower level of technological penetration for Chinese firms than U.S. firms.

[6]Hau et al. (2020) also document accelerated total factor productivity growth in response to minimum wage hikes using Chinese manufacturing firms.

of fight for $15-dollar in large U.S. cities.[7] Legislators focus mainly on the potential impact of the minimum wage on income inequality or unemployment of low-skilled workers. My findings point out an overlooked but important effect of minimum wages on employment through forgone corporate investment: investment cuts may shift the labor demand curve to the left, which further reduces employment over and above any decline due to the increased wages.[8] Hence, regulators and proponents of minimum wage laws should be aware of the unintended consequences of minimum wage policies on the workforce through the investment cut.[9]

1 Measuring Downward Wage Rigidity

I use the Quarterly Workforce Indicators (QWI) from the U.S. Census Bureau, which are available online for public use. These are based on the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program, which links works to their employers. The data contain a great deal of information on the U.S. labor market, even though only *aggregated* microdata are publicly available. In the next section, I describe the QWI in more detail. Using the aggregated microdata and the method described in Section 1.2, I construct firm-level downward wage rigidity measures.

1.1 Data

The QWI provide a rich set of local labor market statistics at the *aggregate* level by four-digit NAICS industry, employee demographics (age, gender, education, and race/ethnicity), employer age and size, and geography (state and county). The data are drawn from a wide range of sources, including administrative records on employment, Social Security data, federal tax records, and other census and survey sources: for example, Unemployment Insurance

[7]CNBC News reported on Nov. 18, 2015, for example; "One of the clearest distinctions to come out of the presidential debates so far has been around the minimum wage ... Democratic candidates' support for, and the Republican candidates' opposition to, raising the federal minimum wage."

[8]This idea is illustrated in Figure 4.

[9]"New Jersey Governor Chris Christie vetoed a bill backed by Democratic lawmakers that would have increased the state's minimum hourly wage to $15 by 2012. ... The proposed increase, he said, 'would trigger an escalation of wages that will make doing business in New Jersey unaffordable.'" (N.J.'s Christie Vetoes Minimum-Wage Bill, *Wall Street Journal*, Aug. 30, 2016)

Earnings Data (UI), Quarterly Census of Employment and Wages (QCEW), Business Dynamics Statistics (BDS), and demographic sources.[10] The main variables I use to construct the firm-level measures of downward wage rigidity are worker flows and average quarterly earnings of full-quarter employment.[11]

The source of the QWI is unique job-level data (not firm- or person-level data) from the LEHD program, which covers over 95% of U.S. private sector jobs. The data are collected through a unique federal-state data sharing collaboration, the Local Employment Dynamics (LED) partnership. The partner states submit quarterly data from administrative record systems, which are less subject to measurement errors caused by self-reporting than other survey-based data. Total wages reported by the Unemployment Insurance Earnings Data include gross wages and salaries, bonuses, stock options, tips and other gratuities, and the value of meals and lodging, where supplied. Hence the earnings data from the QWI essentially capture the total labor costs to firms. The QWI are produced quarterly, and the earliest time series begin in 1990. Because the availability of QWI data is limited before 1994, my sample period begins in 1994. The National QWI are also available from 1993.[12]

1.2 Definitions

The literature proposes various methods for quantifying the extent of downward wage rigidity. These methods share one basic idea: first, construct a notional (rigidity-free and menu-costs-free) distribution of wage growth and then examine whether the empirical wage-growth distribution is compressed from the left, relative to the notional distribution. Using the approach of Lebow et al. (1995) as a baseline method, I first construct three dimensional measures at firm-size, industry, and state level. Then I define a firm-level measure by projecting firm characteristics onto these three dimensional measures.

[10]Details on each data source can be found at `http://lehd.ces.census.gov/data/`.

[11]Pissarides (2009) points out that wages for new workers are more procyclical than those for incumbents. Therefore I focus on downward wage rigidity of job stayers. For more empirical evidence that wage rigidity is more severe for incumbent workers, see Table II and III of Pissarides (2009) and references therein.

[12]Since I use the wage growth rate year-over-year to construct the downward wage rigidity measures, my sample starts from 1994.

Specifically, the first step is to calculate nominal wage growth rates year-over-year using *quarterly* earnings. Many studies use *hourly* pay rates to examine the extent of downward wage rigidity. However, Kurmann et al. (2016) point out that firms may reduce the labor costs of incumbent workers by reducing the number of hours worked (the intensive margin) rather than by lowering hourly wages. Therefore changes in quarterly earnings provide a more accurate measure of the flexibility of total labor costs. In this regard, hourly wages matter little in corporate investment decisions. On top of adjusting the intensive margin, firms may reduce the number of workers (the extensive margin) when they face higher unit labor costs. Therefore I examine whether the relation between downward wage rigidity and investment can be explained by labor adjustment in Section 3.1.

As pointed out by the U.S. Census Bureau, all items, including average quarterly earnings for full-quarter employment, may contain an elevated level of noise for confidentiality protection. Hence I treat average quarterly earnings at quarter t as a missing observation if it lies outside the interval between 50% and 500% of the time-series mean of average quarterly earnings. That is, I remove earnings data that decrease by more than half or increase more than fivefold over one quarter.[13] Also note that the observational unit is a change in the quarterly earnings *in a group*. Hence the measure based on the aggregated microdata will be affected by the compositional effect as a result of wage differences between newly hired and departing workers. The direction of this effect on estimates of downward wage rigidity is unclear a priori. However, as empirically shown by Lebow et al. (2003), the estimates using aggregated job-level data are lower than those using individual-level data (see also Barattieri et al., 2014). Therefore it is more likely that using aggregated earnings data biases the measures toward zero, which leads to an underestimation of the true effects.

Using the distribution of nominal wage growth rates for each firm-size (five groups) and year-quarter pair, I calculate the firm-size-level downward wage rigidity. In doing so, I exploit a rich set of cross-sectional data on wage growth at state × NAICS 4 digit × employee gender

[13] Using different criteria for removing outliers yields the same number of firm-year observations and the main results remain unchanged.

× employee age level:[14]

$$DWR_{fs,t} = \int_{2 \cdot med_{fs,t}}^{\infty} f_{fs,t}(x)dx - \int_{-\infty}^{0} f_{fs,t}(x)dx, \tag{1}$$

where $f_{fs,t}$ and $med_{fs,t}$ refer to an empirical probability density function of log wage growth and a median of the same distribution for a given firm-size group (fs) at year-quarter (t), respectively. Figure 1 illustrates the intuition of this measure. The measure essentially compares the cumulative frequency of wage growth above twice the median with that below zero wage growth. Hence it measures missing mass left-of-zero wage growth.[15] Since the observational unit is a group of employees, I use number-of-employees weighted medians.

[Insert Figure 1 here.]

Similarly, for each industry and year-quarter pair, I calculate the NAICS four-digit-level measure using cross-sectional data on wage growth at state × firm size × employee gender × employee age level:[16]

$$DWR_{ind,t} = \int_{2 \cdot med_{ind,t}}^{\infty} f_{ind,t}(x)dx - \int_{-\infty}^{0} f_{ind,t}(x)dx, \tag{2}$$

where $f_{ind,t}$ and $med_{ind,t}$ refer to an empirical probability density function of log wage growth and a median of the same distribution for a given industry (ind) at year-quarter (t).

Last, using cross-sectional data on wage growth at the NAICS four-digit × firm size × employee gender × employee age level, I construct the following state-level measure for each

[14] Note that the maximum possible number of observations in this cross-sectional distribution is 51 (states) × 313 (NAICS four-digit industries) × 2 (employee genders) × 8 (employee age groups) = 255,408 for a given firm size and year-quarter.

[15] My measures may be subject to potential asymmetry of the underlying notional distribution. However, since I exploit within-firm variation in these measures when estimating the effect of downward wage rigidity on investment, the potential asymmetry would have little impact on the estimation provided that it is stable over time. This idea is consistent with that of Kurmann et al. (2016), who argue that an asymmetry measure itself does not necessarily indicate downward wage rigidity but that the *difference* in this measure across otherwise similar firms is a more valid measure.

[16] The maximum possible number of observations in this cross-sectional distribution is 51 (states) × 5 (firm sizes) × 2 (employee genders) × 8 (employee age groups) = 4,080 for a given industry and year-quarter.

year-quarter:[17]

$$DWR_{st,t} = \int_{2 \cdot med_{st,t}}^{\infty} f_{st,t}(x)dx - \int_{-\infty}^{0} f_{st,t}(x)dx, \tag{3}$$

where $f_{st,t}$ and $med_{st,t}$ refer to an empirical probability density function of log wage growth and a median of the same distribution for a given state (st) at year-quarter (t).

Then I define the firm-level measure as an average of these three-dimensional (firm size, industry, and headquarters state) measures as follows:[18]

$$DWR_{i,t} = \frac{1}{3}\left[DWR_{fs=fs_i,t} + \frac{\sum_{ind_j} Sales_{i,ind_j,t} \cdot DWR_{ind=ind_j,t}}{\sum_{ind_j} Sales_{i,ind_j,t}} + DWR_{st=st_i,t}\right], \tag{4}$$

where fs_i indicates firm i's firm size group as of t, ind_j denotes each industry segment j of firm i, $Sales_{i,ind_j,t}$ is the sales amount of industry segment j in firm i at t, and st_i refers to the state where firm i's headquarters is located. Information about firms' headquarters in the Compustat database reflects only the most recent location, not previous locations. However, as pointed out in the literature, locations rarely change, and even when they do, the new and old locations are usually not far apart.[19] Moreover, this measurement error will bias estimates of the downward wage rigidity effect on investment toward zero, which leads to an underestimation of the true effect. If a firm operates in more than one industry, I use the value-weighted average of industry-level measures across the business segments in which the firm operates. I use segment sales from the Compustat Segment files as weights.

[17]The maximum possible number of observations in this cross-sectional distribution at quarter t is 313 (NAICS four-digit industries) × 5 (firm sizes) × 2 (employee genders) × 8 (employee age groups) = 25,040 for a given state and year-quarter.

[18]The information about the number of employees by industry segment and sales by geographic segment is also available in the Compustat Segment files. However, many firm-year observations have missing values in these variables. Moreover, the method used by a firm to organize its geographic segments is inconsistent and varies across firms: some firms report state-level geographic segments, whereas others use regional geographic segments. As a robustness check, I construct a subsample of single-segment firms and find qualitatively similar results.

[19]I confirm this in my sample using historical headquarters data from Bill McDonald's website `http://www3.nd.edu/~mcdonald/10-K_Headers/10-K_Headers.html`.

1.3 Descriptive Statistics

Table 1 presents summary statistics for 69,661 firm-year observations from 1994 to 2014 Q3. Panel A provides descriptive statistics for the firm-level measures of downward wage rigidity. The sample mean of DWR is 1.08%, which implies that, on average, empirical wage growth distribution is compressed from the left by 1.08%, relative to the notional distribution. In the absence of downward wage rigidity (i.e., $DWR = 0\%$), the expected aggregate wage change, conditional on negative wage growth, amounts to \$6.13 billion as of 2013. This amount decreases by \$0.71 billion, owing to the average level of friction ($DWR = 1.08\%$), which corresponds to 11.58%, relative to \$6.13 billion.[20] Alternatively, 11.58% of all jobs that should have experienced wage decreases in the absence of downward wage rigidity will not face wage reductions under the average level of downward wage rigidity.

[Insert Table 1 here.]

Note that various factors lead to variation in downward wage rigidity across firms and over time. Changes in provisions of the major labor laws play a critical role. For example, as shown in this paper, wages become more downwardly rigid after an increase in state-level minimum wage rates. A number of non-legislative factors also lead to changes in firm-level downward wage rigidity. A firm's unionization rates or capacity to pay wages, which varies over time, affects the degree of downward wage rigidity. Consistent with this notion, downward wage rigidity measures vary considerably: for example, the mean of DWR is 1.08%, and the standard deviation is 1.61%. This sizable cross-sectional and time-series variation

[20]

$$\Big[N \times \int_{-\infty}^{0} f(x;\mu,\sigma)dx\Big] \times w \times \Big(exp\Big[\int_{-\infty}^{0} xf(x;\mu,\sigma|x<0)dx\Big] - 1\Big) = -\$6.13\ billion$$

$$\$6.13\ billion \times \frac{\overline{DWR}}{\int_{-\infty}^{0} f(x;\mu,\sigma)dx} = \$0.71\ billion,$$

where N refers to the total number of jobs, w is average annual earnings per job, $f(x;\mu,\sigma)$ represents a probability density function of normal distribution with mean of μ and standard deviation of σ where x is log wage growth, and $\overline{DWR}$ refers to the sample mean of DWR measure. For simplicity, I assume that a notional distribution of log wage growth is normally distributed and downward wage rigidity compresses the empirical distribution proportionally. I calculate the sample moments ($\mu = 3.41\%$, $\sigma = 2.59\%$) of notional distribution using the National Quarterly Workforce Indicators (NQWI) from 1994 to 2014. According to the NQWI, the total number of jobs is 100,075,410, and average annual earnings per job is \$53,832 as of 2013.

in measures of downward wage rigidity allows for a powerful test.

Panel B of Table 1 shows sample mean of main variables for low and high downward wage rigidity groups. I define *Low* (*High*) *DWR* as firm-year observations with a below-(above-)median DWR for each year. Column (3) reports mean differences in variables between *Low DWR* and *High DWR* groups. Standard errors of mean differences that are robust to heteroskedasticity and clustered by firm are reported in parentheses. Investment rates for firm i in year t ($Investment_{i,t}$) are defined as capital expenditures ($I_{i,t}$) normalized by the beginning-of-the-year capital stock ($K_{i,t-1}$) in which capital stock is measured as property, plant, and equipment. The sample mean of investment rates is lower for *High DWR* (26.88%) than for *Low DWR* (27.06%). *Cash Flow* is calculated as earnings before extraordinary items plus depreciation ($CF_{i,t}$), normalized by the beginning-of-the-year capital stock: $Cash\ Flow_{i,t} = \frac{CF_{i,t}}{K_{i,t-1}}$. *Tobin's q* is a proxy for investment opportunities, which is measured as the ratio of market value of assets to book value of assets where market value of assets is defined as total assets plus market equity minus book equity. *High DWR* group exhibits higher *Cash Flow* and *Tobin's q* than *Low DWR* group. The detailed definition of each variable is provided in Appendix A.

2 Downward Wage Rigidity and Corporate Investment

2.1 Sample Construction

I consider a sample of firms listed by Compustat at any point between 1994 and 2014. Following a similar sample selection approach used by Almeida et al. (2010), I eliminate observations from financial institutions (SIC codes 6000–6999). In addition, I discard firm-years that display asset or sales growth exceeding 100% to eliminate firms that exhibit large jumps in business fundamentals in terms of size and sales, because these jumps are usually associated with major corporate events, such as mergers and acquisitions or reorganizations. I also remove very small firms for which capital is less than \$10 million, because linear investment models may not be appropriate for those firms, as discussed by Gilchrist and

Himmelberg (1995). Finally, I eliminate firm-years that have negative *Tobin's q*. All dollar valued variables are converted into December 2014 constant dollars using the consumer price index for all urban consumers (CPI-U).

2.2 Downward Wage Rigidity Measure and Corporate Investment

A standard investment regression used by Fazzari et al. (1988) provides the empirical framework for researchers to investigate the effect of financing frictions on investment. Even though the interpretation of cash flow coefficient in this regression is controversial, there seems to be a consensus that financial frictions causally affect investment and that these effects are non-trivial (e.g., Hennessy and Whited, 2007; Chava and Roberts, 2008).[21]

If one further takes labor market frictions into account, a natural extension of the standard investment regression would be to augment it with a measure of labor market friction. I begin by estimating the effect of downward wage rigidity on investment using the following specification:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 Tobin's\ q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} + \epsilon_{i,t}, \tag{5}$$

where i and t index firms and years; $\frac{I_{i,t}}{K_{i,t-1}}$ is investment rate; α_i is a set of firm fixed effects, which absorb time-invariant unobservable firm characteristics and α_t is a set of year fixed effects, which absorb time-varying macroeconomic shocks faced by all firms; $Tobin's\ q_{i,t-1}$ indicates a proxy for investment opportunities; $\frac{CF_{i,t}}{K_{i,t-1}}$ refers to cash flow; and $DWR_{i,t}$ is the measure of downward wage rigidity defined in Section 1. I cluster standard errors by firm to allow for correlation of the residuals over time within a firm. I predict β_3 to be negative.

Panel A of Table 2 displays baseline results that use the DWR measure. In column (1), I also include dummy variable ($\mathbb{1}_{DWR>0}$) indicating the existence of downward wage rigidity, because firms with and without downward wage rigidity may behave differently.

[21] See Fazzari et al. (1988), Kaplan and Zingales (1997), Fazzari et al. (2000), and Alti (2003), among others, for the debate on the interpretation of cash flow coefficient in the literature.

In all specifications, I find a negative association between investment and downward wage rigidity, which is significantly different from 0 at the 1% level of significance. Since I exploit a time variation in my measure within a firm, the interpretation is that firms invest less when they exhibit a high level of downward wage rigidity. With the full set of controls in column (1), a one standard deviation (1.61%) increase in my measure of downward wage rigidity implies a 0.32 (0.0161×0.1958) percentage point decrease in the investment rate (i.e., capital expenditure/capital stock). Changing the measure of downward wage rigidity from the 10th percentile (0.00%) of the distribution to the 90th percentile (2.83%) would decrease the investment rate by 0.55 percentage points, which is sizable compared to the median investment rate of 19.21%.

[Insert Panel A of Table 2 here.]

2.3 Minimum Wage Laws across U.S. States and Corporate Investment: Exogenous Variation in Downward Wage Rigidity

Empirical identification of the effect of downward wage rigidity on investment is challenging not only because wage policy may be correlated with demand for capital but also because it would be determined simultaneously with investment decisions. To overcome these challenges and establish a causal inference, I exploit staggered state-level changes in minimum wage rates as a source of exogenous variation in downward wage rigidity.

The basic idea is that an increase in the minimum wage rates puts a higher floor on wages, which makes wages more downwardly rigid. This effect is not necessarily circumscribed to minimum wage workers. According to the *fair wage-effort hypothesis* by Akerlof and Yellen (1990), workers' effort depends on the ratio of their actual wage to their fair wage. Therefore a firm is under pressure, potentially to a lesser extent, not to reduce wage of non-minimum wage workers when the minimum wage rates increase.[22] The identification strategy assumes that changes in minimum wage laws are exogenous to individual firm outcomes. This section discusses (i) institutional details on minimum wage laws in the United States, (ii)

[22]A similar argument and corresponding theoretical and empirical evidence can be found in Engbom and Moser (2017)

identification strategy, and (iii) estimation procedures and results.

2.3.1 Institutional Details

The federal minimum wage provisions for employees in the U.S. are contained in the Fair Labor Standards Act (FLSA). Employers whose annual sales are at least $500,000 or who engage in interstate commerce are subject to the Act. The Act establishes overtime pay, recordkeeping, and youth employment standards for workers in the private sector as well as in federal, state, and local governments. It was enacted in 1938 and has been amended many times since, mainly to increase the federal minimum wage. As of July 2009, more than 143 million workers in more than 9.8 million workplaces are protected by the FLSA, which is enforced by the Wage and Hour Division of the Department of Labor.

In addition, many states have their own minimum wage laws. Some states index their minimum wage rates to inflation, increase the rates in legislatively scheduled increments, set the rates at the federal rate, or use the mix of these three methods. Therefore the state minimum wage rates may differ from those set by the federal statutes. Under Section 18 of the FLSA, when an employee is subject to both the federal and state minimum wage laws, the employee is entitled to the higher of the two standards.

2.3.2 Identification Strategy

My identification strategy for testing a causal link between downward wage rigidity and investment assumes that changes in the federal- and state-level minimum wage laws are exogenous to individual firm outcomes. As outlined in Section 2.3.1, each state uses its own adjustment mechanisms for minimum wage rates. Some states index their minimum wage rates to inflation to maintain the real value of the rates over time. If inflation triggers a minimum wage increase, the identifying assumption may be violated because of the potential impact of inflation on investment. In general, inflation has two conflicting effects on corporate investment (Hochman and Palmon, 1983): depreciation effect and interest effect. On the one hand, the real tax benefit of depreciation decreases with inflation because depreciation allowances are based on historical costs, rather than on current nominal values. On the other hand, the real tax benefit of interest deductions increases with inflation because firms deduct interest expenses at nominal interest rates, rather than at real rates. Therefore it remains an empirical question whether inflation increases or decreases corporate investment. Feldstein (1982) empirically finds that inflation is negatively associated with firm investment under the structure of U.S. tax rules. In line with this empirical finding, Chen and Boness (1975) show that the risk-standardized cost of capital will be overstated (understated), leading to underinvestment (overinvestment), if inflation (deflation) is expected. Therefore, I exclude all the firms headquartered in the 15 U.S. states that have indexed their minimum wage rates to some measures of inflation.[23]

Another adjustment mechanism that some states employ is to specify future minimum wage rates in legislation. If such legislation was motivated by unobservable, anticipated improvement in local investment opportunities, the identifying assumption may be violated. If the unobservable component of expected investment opportunity is positively related to future changes in minimum wage rates, my tests are likely to find a positive (not negative) relation between minimum wage increases and capital expenditures.

The last adjustment mechanism is to set minimum wage rates based on the federal rate. The Congress either specifies a single rate in the enacting legislation or sets rates in advance. Therefore, from the identification perspective, states that use this mechanism are similar to those that specify their rates in state legislation. Moreover, a change in federal minimum wage law can largely be regarded as exogenous to the state-level macroeconomic conditions that may affect individual firm outcomes. This enables us to isolate the effect of unobservable state-level macroeconomic shocks on corporate investment to the extent that federal minimum wage policy is orthogonal to the state-level economic conditions.

Furthermore, the federal and state minimum wage rates change at various times in various increments. Figure 2 depicts the time-series of minimum hourly wage rates for California,

[23]Alaska, Arizona, Colorado, Florida, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, Ohio, Oregon, South Dakota, Washington, and Vermont. I obtain qualitatively similar results when including those 15 states in my sample.

Connecticut, and Illinois as an example. The timing of minimum wage changes varies across states, and the increments also differ across states and within a state. The figure shows that changes in states' minimum wage laws do not necessarily happen at the same time. I exploit this staggered nature of changes in minimum wage rates to estimate the causal relation between downward wage rigidity and corporate investment. Since minimum wage increases are staggered, it is possible for firms to be in both the treatment (i.e., minimum wage increases) and control groups at different times, which alleviates the potential problem of systematic differences between treatment and control firms.

[Insert Figure 2 here.]

To confirm that my measure of downward wage rigidity indeed grows after the minimum wage increases, I estimate the following regression of downward wage rigidity measure on a corresponding minimum wage:

$$\begin{aligned} DWR_{i,s,t} = \alpha_i + \alpha_t + \beta_1 w_{i,s,t-1} + \beta_2 \mathbb{1}_{i \in \{Ind\ Most\ s.t.\ Min\ Wage\}} \\ + \beta_3 w_{i,s,t-1} \times \mathbb{1}_{i \in \{Ind\ Most\ s.t.\ Min\ Wage\}} + \epsilon_{i,s,t}, \end{aligned} \tag{6}$$

where i, s, and t index firms, states, and years; $w_{i,s,t-1}$ is minimum wage at time $t-1$ in state s where firm i's headquarters is located; and $\mathbb{1}_{i \in \{Ind\ Most\ s.t.\ Min\ Wage\}}$ is an indicator variable set to one if firm i belongs to industries that are most subject to minimum wages. These industries are defined as those with an above-median percentage of hourly workers with earnings at or below the prevailing federal minimum wage as of 2015. Minimum-wage worker data comes from the Labor Force Statistics from the Current Population Survey by the BLS.

[Insert Panels B and C of Table 2 here.]

Panel B of Table 2 presents the estimation results of Equation (6). In column (1), the estimated coefficient on the minimum wage variable is positive and statistically significant at the 5% level. This implies that DWR grows after an increase in the minimum wage, which also proves the validity of my measure. If the increase in DWR is indeed driven by a higher floor on wages, this effect should be more pronounced for firms with a higher percentage of minimum wage workers. In column (2), the estimated coefficient on the interaction term

($w_{i,s,t-1} \times \mathbb{1}_{i \in \{Ind\ Most\ s.t.\ Min\ Wage\}}$) is positive and statistically significant.[24] These results indicate that the measure grows after an increase in the minimum wage, and this effect is stronger for firms in the industries that are most subject to minimum wage increases. Panel C of Table 2 lists industries that are most prone to minimum wage increases. Coupled with the key identifying assumption discussed in this section, the results in Panel B support my identification strategy in that minimum wage increases likely affect investment decisions only through affecting downward wage rigidity.

2.3.3 Estimation

I estimate the reduced-form effect of minimum wage laws on corporate investment using the following regression:[25]

$$\frac{I_{i,s,t}}{K_{i,s,t-1}} = \alpha_i + \alpha_t + \beta_1 Tobin's\ q_{i,s,t-1} + \beta_2 \frac{CF_{i,s,t}}{K_{i,s,t-1}} + \beta_3 w_{i,s,t-1} + \beta_4 X_{s,t-1} + \epsilon_{i,s,t}, \quad (7)$$

where $w_{i,s,t-1}$ is minimum wage at time $t-1$ in state s where firm i's headquarters is located. I also control for state-level variables, $X_{s,t-1}$, including real GDP growth rates, log of population, and unemployment rates. The definitions and sources of all variables are provided in Appendix A. I cluster standard errors at the state-level, instead of the firm-level.[26] Given that the minimum wage laws vary by state, potential time-series correlations in unobserved factors that affect different firms in the same state may lead to inconsistent estimates of standard errors. Hence this method accounts for cross-firm correlations of error terms within a state, which is more general than firm-level clustering. I predict β_3 to be negative.

[Insert Panel D of Table 2 here.]

Column (1) in Panel D of Table 2 reports the estimates for the coefficients in Equation

[24] Including state-level variables (real GDP growth rates, log of population, and unemployment rates) in the equation does not alter the results.

[25] Instrumenting the downward wage rigidity measure using changes in minimum wage laws, I run a two-stage least squares (2SLS) regression and obtain a significant negative coefficient on the predicted value from the first-stage regression. I report both results based on the measure and minimum wage laws because each method has its own advantages, and they are complements: the measure is constructed from comprehensive public microdata, which covers all levels of employees but is subject to endogeneity, whereas the minimum wage laws provide a cleaner identification but mainly capture a changes in downward wage rigidity for minimum wage workers.

[26] Clustering standard errors by firm yields smaller standard errors.

(7). When a state's minimum wage increases, firms headquartered in that state reduce their investment rates. The magnitudes of the regression coefficients indicate that the effect is economically large. Following a one standard deviation increase in minimum wage, firms reduce their investment rates by 268 basis points, which corresponds to a 13.5% decrease, relative to the median investment rate.

A potential decrease in employment due to minimum wage increases might drive a reduction in capital expenditures if capital and labor are complements. However, according to the survey results by the Initiative on Global Markets, there seems to be no consensus among economic experts regarding whether minimum wage increases have a negative effect on the employment rate: 26% of the experts believe it does, 38% are uncertain, and 24% disagree. (See also Card and Krueger, 1994, 1995; Dube et al., 2010; Neumark and Wascher, 2000; Neumark et al., 2014; Meer and West, 2016) Moreover, Aaronson et al. (2018) document that continuing restaurants barely change their employment following minimum wage hikes and that industry-level composition gradually shifts towards more capital-intensive restaurants. Nonetheless, I examine the labor adjustment channel in Section 3.1.

2.3.4 Placebo Test

In this section, I perform a placebo test to check whether a *pseudo* minimum wage increase affects investment. Specifically, I repeat the estimation of Equation (7) using a pseudo minimum wage variable. To construct the pseudo minimum wage variable ($w^{Pseudo}_{i,s,t-1}$), I randomly assign firm i to a particular state s. In the process of this random assignment, I maintain the distribution of the number of firms in each state. The timing of the state-level minimum wage changes also remains identical. I define $w^{Pseudo}_{i,s,t-1}$ as the minimum wage at time $t-1$ in state s where firm i's hypothetical headquarters is located. All other control variables are based on the firm's characteristics as well as the firm's assigned state. I repeat this exercise 1,000 times and save the coefficients on $w^{Pseudo}_{i,s,t-1}$ to gauge the likelihood of obtaining a significant coefficient, absent true shocks to a firm's downward wage rigidity.

[Insert Panel E of Table 2 here.]

[Insert Figure 3 here.]

Panel E of Table 2 reports the empirical distribution of the estimated coefficients on $w^{Pseudo}_{i,s,t-1}$ based on the random sample. The mean and median of the distribution are close to zero. This suggests that, in this random sample, minimum wage changes do not have any significant impact on corporate investment. The original estimate in column (1) of Panel D (-0.0226) falls below the 1% threshold of this distribution (-0.0112). I plot the empirical distribution of the coefficient on $w^{Pseudo}_{i,s,t-1}$ in Figure 3. The green line shows kernel density. The vertical red line indicates the actual β_3 obtained from the regression based on the actual data (column (1) of Panel D in Table 2). Therefore the negative effect of a minimum wage increase on investment is not likely to be obtained by chance.

2.4 Does Labor Market Friction Drive Investment Cuts?

In this section, I conduct four conditional analyses to confirm that labor market friction drives the investment cuts. The results in this section lend further credence to my identification strategy that uses minimum wage laws.

2.4.1 Fraction of Minimum Wage Workers

I estimate differential effects across firms that are *least* and *most* subject to the minimum wage changes. I expect upward pressure on downward wage rigidity, due to minimum wage increases, to be more pronounced for firms with a higher fraction of workers with earnings close to the prevailing minimum wage. I use worker characteristics data from the Labor Force Statistics in the Current Population Survey by the Bureau of Labor Statistics. Industries that are most (least) subject to minimum wage rates are defined as those with above-(below-)median percentage of hourly workers with earnings at or below the prevailing federal minimum wage rates as of 2015. As listed in Panel C of Table 2, *Food services and drinking places* and *Accommodation* are the industries that have the highest fractions.[27] In column (2) of Panel D, Table 2, I interact the minimum wage variable with the indicator variable for industries that are most subject to minimum wage policies. The estimated coef-

[27]In fact, a report from Moody's Investors Service points out that minimum wage increases could erode profit margins in the U.S. restaurant industry. *The Wall Street Journal*, "Minimum Wage Increases Likely to Hit Restaurant Profits, Moody's Says," June 11, 2015.

ficient on the interaction term is negative and significant. This result is consistent with the idea that the negative effects are more pronounced for firms in the industries that heavily rely on minimum wage workers.

2.4.2 Employment Protection Legislation

Some states have higher levels of employment protection laws than other states. Firms with higher firing costs, due to employment protection laws, are less likely to adjust their workforce when they face downward wage rigidity. Therefore the negative effect of downward wage rigidity on investment would be more acute for firms that are headquartered in states with high levels of employment protection. I construct the *Wrongful Discharge Law Score* variable by counting the number of exceptions each state recognizes as of 1994 among the three common law exceptions to the traditional employment at-will rule: good faith, implied contract, and public policy exceptions. I use data from Serfling (2016), and the score variable ranges from 0 to 3. I define states with a high (low) level of employment protection as those with a score of 2 or 3 (0 or 1). I then construct an indicator variable, $\mathbb{1}_{s \in \{States\ with\ High\ EPL\}}$, set to one if state s has a high level of employment protection legislation. Column (3) of Panel D in Table 2 presents the estimation results. The negative estimated coefficient on the interaction term (-0.0123) indicates that the effect is stronger for firms in states with higher levels of employment protection.[28]

2.4.3 Labor Intensity

Labor-intensive firms are more susceptible to labor market friction. I examine whether the magnitudes of the negative effect of downward wage rigidity are different in the least and the most labor-intensive firms. I define labor intensity as a ratio of labor costs to sales, as do Gorodnichenko and Weber (2016).[29] I then construct an indicator variable, $\mathbb{1}_{i \in \{Labor\ Intensive\ Ind\}}$, set to one if firm i belongs to labor intensive industries. The detailed definition of this variable is provided in Appendix A. Column (4) in Panel D of Table 2

[28] The indicator variable, $\mathbb{1}_{s \in \{States\ with\ High\ EPL\}}$, is absorbed by the firm fixed effects because it has no time-variation within a state during my sample period.

[29] Defining labor intensity as a ratio of the total number of employees to sales (DeWenter and Malatesta, 2001) yields qualitatively similar results.

reports the estimation results. The negative estimated coefficient on the interaction term (-0.0158) indicates that the effect of downward wage rigidity on investment is stronger for labor-intensive firms. These findings ensure that the investment cut is indeed driven by the labor market friction.

2.4.4 Product Price Stickiness

Flexible-price firms can pass a greater portion of the burden of labor costs to customers: raising the price of products to compensate for higher input costs. Therefore the negative effect should be more acute for firms with inflexible prices than for those with flexible prices. To measure price stickiness at the *industry* level, I use the inverse of the volatility of producer price index (PPI) growth. This measure is motivated by Favilukis and Lin (2016), who use the inverse of the volatility of wage growth as a proxy for wage rigidity. To construct this measure, I use monthly PPI data by NAICS five-digit industries from the BLS. I define $\mathbb{1}_{i \in \{Sticky\ Price\ Ind\}}$ as an indicator variable set to one if firm i belongs to industries with sticky product prices. Sticky price industries are defined as those with an above-median product price stickiness. In column (5) of Panel D, Table 2, I find that the negative effect is stronger for firms with stickier prices than for those with more flexible prices.

2.5 Robustness Tests

2.5.1 Alternative Measures of Downward Wage Rigidity

To check the robustness of the main results in Panel A of Table 2, I construct three alternative measures used by Kurmann et al. (2016), which are similar to those used by Card and Hyslop (1997). For each firm-size and year-quarter pair, I calculate firm-size-level downward wage rigidity measures (γ, η, and ζ) using a rich set of cross-sectional data on wage growth at state × NAICS four-digit × employee gender × employee age level as follows:

$$\begin{aligned}
\gamma_{d,t} &= \int_{2\cdot med_{d,t}+0.005}^{\infty} f_{d,t}(x)dx - \int_{-\infty}^{-0.005} f_{d,t}(x)dx \\
\eta_{d,t} &= \int_{-0.005}^{0.005} f_{d,t}(x)dx - \int_{2\cdot med_{d,t}-0.005}^{2\cdot med_{d,t}+0.005} f_{d,t}(x)dx \\
\zeta_{d,t} &= \left[0.5 - \int_{-\infty}^{0.005} f_{d,t}(x)dx\right] - \left[\int_{-\infty}^{2\cdot med_{d,t}-0.005} f_{d,t}(x)dx - 0.5\right],
\end{aligned} \tag{8}$$

where $d \in \{fs\ (firm\ size),\ ind\ (industry),\ st\ (state)\}$; $f_{d,t}$ and $med_{d,t}$ refer to an empirical probability density function of the log wage growth and a median of the same distribution for a given dimension (d) at year-quarter (t), respectively. Intuitively, γ compares the cumulative frequency of the log wage growth above twice the median and that below zero wage growth. Hence it measures missing mass left-of-zero wage growth, whereas η measures a spike at zero and ζ measures excess mass right of zero (see Figure 1). Since the observational unit is a group of employees, I use number-of-employees weighted medians.

To construct a firm-level measure, I first calculate the value-weighted average of the industry-level downward wage rigidity measures across the business segments in which the firm operates. I use segment sales from the Compustat Segment files as weights. Then I define the firm-level measure as an average of three-dimensional (firm-size, industry, and headquarters state) measures as follows:

$$\gamma_{i,t} = \frac{1}{3}\left[\gamma_{fs=fs_i,t} + \frac{\sum_{ind_j} Sales_{i,ind_j,t} \cdot \gamma_{ind=ind_j,t}}{\sum_{ind_j} Sales_{i,ind_j,t}} + \gamma_{st=st_i,t}\right], \tag{9}$$

where fs_i indicates firm i's firm size group as of t, ind_j denotes each industry segment of firm i, $Sales_{i,ind_j,t}$ is sales amount of industry segment j in firm i at t, and st_i refers to the state where firm i's headquarters is located. The firm-level $\eta_{i,t}$ and $\zeta_{i,t}$ are similarly defined.

[Insert Panel A of Table 3 here.]

Panel A of Table 3 reestimates the baseline specification in Equation (5) using these three alternative measures of downward wage rigidity. In all specifications, I confirm a strong negative association between downward wage rigidity and investment.

2.5.2 Measurement Errors in Tobin's q and Downward Wage Rigidity Measure

The empirical proxies for marginal q (or investment opportunities) and downward wage rigidity are likely to contain measurement errors which may produce biased coefficients in investment regressions. To overcome this problem, Erickson et al. (2014) develop minimum distance estimators for a classical errors-in-variables model with multiple mismeasured and multiple perfectly measured regressors on panel data. The underlying estimating equations are linear in the third- and higher-order polynomial functions of moments (cumulants) of the joint distribution of the observable variables. Using Erickson et al. (2014)'s high-order cumulant estimators, I assess the robustness of the relation between downward wage rigidity and corporate investment when the proxies for investment opportunities and downward wage rigidity are subject to measurement errors.

[Insert Panel B of Table 3 here.]

In column (1), Panel B of Table 3, I report the baseline fixed effect OLS estimators from column (2) of Panel A in Table 2 for easy comparison across estimates. Columns (2)-(4) display the higher-order cumulant estimators for the fourth, fifth, and sixth cumulants. Consistent with findings in Erickson et al. (2014), the estimated coefficients on *Tobin's q* (*Cash Flow*) based on the cumulant estimation are larger (smaller) than those from the fixed effect OLS estimation. The estimated coefficients on DWR remain significant for all orders of cumulants, and the magnitude of the coefficients becomes even larger once I take measurement errors into consideration. For example, in column (2), a one standard deviation (1.61%) increase in my measure of downward wage rigidity implies a 1.04 (0.0161×0.6473) percentage point decrease in the investment rate (i.e., capital expenditure/capital stock). This corresponds to a 5.4% decrease in the investment rate relative to the sample median. Overall, these results ensure that the relation between labor market friction and investment is unlikely to be driven by mismeasured *Tobin's q* or downward wage rigidity.

2.5.3 The Effects of the Business Cycle and Inflation

One concern related to the baseline results is that the measures used here may simply proxy for an economic downturn, which leads to lower corporate investment. If the measures capture the macroeconomic conditions of the U.S. economy, the year fixed effects will absorb this possibility.[30] More importantly, Kurmann et al. (2016) document that, during the recent financial crisis, downward wage rigidity *decreased* and wage growth distribution became more symmetric. Consistent with this finding, the cross-sectional average of my measure decreases during NBER business cycle troughs. Therefore a relation between downward wage rigidity and economic conditions, if any, is positive, which is likely to bias my tests against finding a negative relation.

The impact of inflation on both downward wage rigidity and corporate investment could raise another concern: that inflation may drive the negative relation between them. Card and Hyslop (1997) document that downward nominal wage rigidity becomes weaker during a period of high inflation because firms are able to set their workers' wages more flexibly when inflation is anticipated. Therefore, if inflation stimulates corporate investment, the negative effects reported in this paper could be driven by inflation. However, as discussed earlier, the literature has documented that the inflation is negatively associated with U.S. firms' investment. Therefore it is unlikely that the investment cuts are driven by inflation.

3 Mechanisms

I explore potential channels that might explain the observed effects of downward wage rigidity on corporate investment: (i) labor adjustment with capital-labor complementarities, (ii) debt overhang, and (iii) operating leverage. The labor adjustment with capital-labor complementarities channel allows for the possibility that a firm reduces capital expenditures to adjust its capital in response to labor adjustment that arises from facing downward wage rigidity. The latter two channels rely on the argument that downward wage rigidity converts a wage claim into a debt-like contract. This debt-like contract requires firms to pay a fixed amount even though the marginal productivity of labor falls below the current (or market equilibrium) wage. As a result, downward wage rigidity exacerbates the debt overhang problem and increases operating leverage. The operating leverage channel is motivated by

[30]The main results are robust to the inclusion of industry by year fixed effects.

the literature on the crowding-out effect of operating leverage. Specifically, downward wage rigidity increases a firm's operating leverage, which will prevent the firm from using financial leverage when it needs to finance its investment. This in turn decreases the ability to finance new investment and thus decreases capital expenditures. Notice that these channels are not mutually exclusive or exhaustive. I provide tests for each channel.

3.1 Labor Adjustment with Capital-Labor Complementarities

A firm usually manages cash flow shortfalls by dismissing current employees (Ofek, 1993; John et al., 1992; Kang and Shivdasani, 1997). In such cases, the firm would reduce its capital expenditures in response to labor adjustments under capital-labor complementarities. Therefore I control for a potential labor adjustment by including the net hiring rates in the baseline investment regression:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 Tobin's\ q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} + \beta_4 NHR_{i,t} + \epsilon_{i,t}, \tag{10}$$

where $NHR_{i,t}$ refers to firm i's *net* hiring rate at t, which is given by $NHR_{i,t} = H_{i,t}/[0.5 \times (N_{i,t-1} + N_{i,t})]$ in which $N_{i,t}$ is the number of employees and net hiring, $H_{i,t}$, is the change in the number of employees from year $t-1$ to year t, $H_{i,t} = N_{i,t} - N_{i,t-1}$.

[Insert Table 4 here.]

In Panel A of Table 4, consistent with the view of capital-labor complementarities, the estimated coefficients on net hiring rates are strongly positively associated with capital expenditures. If labor adjustment with capital-labor complementarities drives the reduction in investment, the net hiring rates should soak up most variations in investment rates, which could render the coefficient on downward wage rigidity insignificant. However, the coefficients on downward wage rigidity remain statistically significant at the 1% level, and the magnitudes are similar to those in Panel A of Table 2 in all specifications. Even though capital and labor seem to be, on average, complements, the investment cut cannot be fully explained by this channel. Some firms may substitute capital for labor due to higher labor costs that result from downward wage rigidity, which predicts an increase in investment. I do not directly test this possibility, due to lack of precise firm-level measure of elasticity of substitutions (Hamermesh, 1996). However, the strong negative impacts of downward wage rigidity on capital investment documented in this study imply that potential substitutability cannot dominate other two channels that lead to an investment cut: exacerbation of debt overhang and increased operating leverage. In addition, it is less likely for firms to change their capital to labor ratio in the short run, thereby substituting away from labor.

I also examine whether including hiring ($HR_{i,t}$) and separation rates ($SR_{i,t}$) in the investment regression affect the baseline results. Using the number of employees variable from Compustat does not allow me to calculate hiring rates and separation rates separately. Therefore I calculate $H(S)R_{i,t}$ using the QWI data from the U.S. Census Bureau. Hiring (separation) rate is defined as a ratio of hirings (separations) to the average employment: $2 \times HirAEnd\ (SepBeg)_t\ /\ (Emp_t + EmpEnd_t)$, where $HirAEnd\ (SepBeg)_t$ indicates the number of workers who started a new job in a given quarter (whose job in the previous quarter continued and ended in the given quarter) and Emp_t ($EmpEnd_t$) is a total number of jobs on the first (last) day of the reference quarter. Hiring (separation) rate data are available at the aggregate level. Therefore, using a similar method of constructing downward wage rigidity measures, I first calculate median hiring (separation) rates for three dimensions: firm size, four-digit NAICS industry, and state. Then I average these three hiring (separation) rates associated with a firm to obtain firm-level hiring (separation) rates. I use segment-sales weighted industry level hiring (separation) rates for the industry dimension.

Similar to Panel A of Table 4, Panel B presents a strong negative effects of downward wage rigidity on corporate investment after controlling for labor adjustment. Hiring rates from the U.S. Census data are positively related to corporate investment, while separation rates have no significant association with capital expenditures, except in column (3).[31] Taken together, I conclude that the investment cut cannot be fully explained by labor adjustment due to downward wage rigidity under capital-labor complementarities.

[31] A positive association between capital expenditures and layoffs might be due to a high correlation between hiring and separation rates, about 0.88 in my sample.

3.2 Debt Overhang Channel

An ideal approach to testing the debt overhang channel would be to gauge the *effective* amount of debt that includes a debt-like contract (e.g., a wage claim in the presence of downward wage rigidity). However, it is challenging to estimate the amount. Instead, I conduct two tests by examining the future likelihood of default and differential effects across financial strength.

3.2.1 Debt-Like Feature of Wage Contract: Predicting Likelihood of Default

If downward wage rigidity converts a wage claim into a debt-like contract, it will increase a firm's default risk for a given amount of *actual* debt on the financial statement. To assess the relation between downward wage rigidity and default frequency, I run a fixed effect regression of future defaults on downward wage rigidity. Using the UCLA-LoPucki Bankruptcy Research Database, I construct a default indicator that equals one if a firm defaults within the next five years, and zero otherwise. I include controls, following Hovakimian et al. (2012).

[Insert Panel A of Table 5 here.]

Column (1) in Panel A of Table 5 shows the result for estimating the fixed effect logistic regression of the default indicator on downward wage rigidity, which is estimated using a conditional logistic specification. The positive coefficient on DWR indicates that firms that exhibit strong downward rigidity of wages are more likely to default after controlling for leverage. Columns (2) and (3) use linear probability models with industry and firm fixed effects, respectively. The estimated coefficients on DWR remain positive and statistically significant. These findings are consistent with those of D'Acunto et al. (2018), who document that firms with inflexible output prices are more likely to default.

3.2.2 Really Debt Overhang? Acting Like All-Equity Firms: Financial Strength

Motivated by the theoretical work by Myers (1977), I investigate whether the negative effect of downward wage rigidity is mitigated by financial strength. Specifically, if the firm has enough money to pay its outstanding debt in all states of the economy, it will not turn down any positive net present value project in spite of the existence of debt holders. Therefore it essentially acts like an all-equity firm. If this channel is valid, the investment cut should be concentrated in a state where bankruptcy or financial distress is more likely to occur.

I use an interest coverage ratio and modified Altman (1968) Z-score as proxies for financial strength. An interest coverage ratio is a ratio of EBIT to interest expenses. The modified Altman (1968) Z-score is calculated as [1.2 × working capital + 1.4 × retained earnings + 3.3 × EBIT + 0.999 × sales]/total assets. The ratio of market value of equity to book value of total liabilities is omitted from the original calculation because market-to-book enters the investment regressions as a separate variable (i.e., *Tobin's q*). I sort my sample into terciles, based on these financial strength measures, and interact downward wage rigidity measure with these dummy variables in the investment regressions.

[Insert Panel B of Table 5 here.]

Panel B of Table 5 reports the results. The results in columns (1) and (2) that use the interest coverage ratio indicate that the investment cuts are concentrated on the bottom and middle terciles. I obtain similar results using modified Z-score in columns (3) and (4). There results are consistent with the debt overhang channel.

3.3 Operating Leverage Channel

In the presence of downward wage rigidity, a firm's wage does not fall as much as labor productivity does when there is a negative shock, which makes the firm's earnings more volatile: the firm's earnings become more responsive to a change in sales. Heightened operating leverage will then crowd out financial leverage, which decreases the firm's ability to finance its investment and thus decreases capital expenditures.

Using an approach similar to that used by Eisfeldt and Papanikolaou (2013), I estimate the sensitivity of changes in earnings to changes in sales and examine how downward wage rigidity affects this sensitivity:

$$\Delta ln(EBIT_{i,t}) = \alpha_i + \alpha_t + \beta_1 \Delta ln(Sales_{i,t}) + \beta_2 DWR_{i,t} \\ + \beta_3 \Delta ln(Sales_{i,t}) \times DWR_{i,t} + \epsilon_{i,t}, \quad (11)$$

where Δ ln($EBIT$) is a change in the log of earnings before interest and taxes and Δ ln($Sales$) is a change in the log sales. If downward wage rigidity makes a firm's earnings more responsive to a change in sales, the coefficient on the interaction term (β_3) would be positive.

[Insert Table 6 here.]

Table 6 shows the estimation results. In the absence of downward wage rigidity (i.e., $DWR = 0$), earnings increase by 1.06% as sales increase by 1% as shown in column (2). The coefficient on the interaction term (β_3) is statistically and economically significant. A one standard deviation increase in downward wage rigidity is associated with an additional 0.05% increase in earnings, which is an almost 5% increase relative to the baseline case (1.06%). These results support the operating leverage channel that links downward wage rigidity to investment.

4 Value Implications: The Theory of Second Best

The analyses in Section 2 show a strong negative impact of downward wage rigidity on corporate investment using both the firm-level measure and state-level changes in minimum wage laws. In this section, I investigate the value consequences of this impact.

Consider a typical optimization problem, in which a firm maximizes shareholder value. Imposing an additional, binding friction (e.g., downward wage rigidity) restricts the choice sets of the firm and seems to lower the value function. However, the theory of second best (Viner, 1950; Lipsey and Lancaster, 1956) suggests that this may not always be true.[32] The

[32] Lipsey and Lancaster (1956) describe one of main principles of the theory as follows: "in a situation in which there exist many constraints which prevent the fulfilment of the Paretian optimum conditions, the removal of any one constraint may affect welfare or efficiency either by raising it, by lowering it, or by leaving

newly added friction may partially counteract the effect of existing frictions on investment (e.g., overinvestment due to managerial overconfidence or agency problems). Therefore this countervailing effect could lead to more efficient outcomes by allowing the firm to avoid value-destructive projects, thereby improving efficiency. Testing this theoretical prediction is empirically challenging because researchers cannot directly observe either investment efficiency or the optimal level of investment. I conduct two tests of investment efficiency across over- and underinvesting firms using a valuation regression of Fama and French (1998) and a revenue-based total factor productivity growth regression following the approach of Kogan et al. (2017).

4.1 Valuation Regressions

Even though this method is ad hoc in the sense that it is not based on a theoretical model's functional form, it has been used in the literature because it explains a large portion of the variation in firm value (e.g., Pinkowitz et al., 2006). I estimate the following valuation regression for over- and underinvesting firms:

$$\begin{aligned} Tobin's\ q_{i,t} = {} & \alpha_{ind} + \alpha_t + \beta_1 Earnings_{i,t} + \beta_2 \Delta Earnings_{i,t} + \beta_3 \Delta Earnings_{i,t+1} \\ & + \beta_4 \Delta NAssets_{i,t} + \beta_5 \Delta NAssets_{i,t+1} + \beta_6 R\&D_{i,t} + \beta_7 \Delta R\&D_{i,t} + \beta_8 \Delta R\&D_{i,t+1} \\ & + \beta_9 Interest_{i,t} + \beta_{10} \Delta Interest_{i,t} + \beta_{11} \Delta Interest_{i,t+1} + \beta_{12} Dividends_{i,t} \\ & + \beta_{13} \Delta Dividends_{i,t} + \beta_{14} \Delta Dividends_{i,t+1} + \beta_{15} \Delta Tobin's\ q_{i,t+1} + \beta_{16} \Delta PP\&E_{i,t} \\ & + \beta_{17} \Delta PP\&E_{i,t+1} + \beta_{18} DWR_{i,t} + \epsilon_{i,t}, \end{aligned} \tag{12}$$

where X_t is the level of variable X in year t normalized by total assets in year t, ΔX_t is the change in the level of X from year $t-1$ to t normalized by total assets in year t except for $DWR_{i,t}$, $(X_t - X_{t-1})/A_t$, and ΔX_{t+1} is the change in the level of X from year t to $t+1$ normalized by total assets in year t, $(X_{t+1} - X_t)/A_t$, where A is the book value of total assets. *Earnings* is earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits; *NAssets* is the book value of total assets minus gross property, plant,

it unchanged" (p.12).

and equipment; $R\&D$ is research and development expenditures; $Interest$ is interest expense; $Dividends$ is common dividends paid, and $PP\&E$ is gross property, plant, and equipment. α_{ind} is the set of industry fixed effects and α_t is the set of year fixed effects. β_{18} is of main interest, and it captures whether downward wage rigidity is beneficial or detrimental to firms.

To identify whether firms over- or underinvest, I use the CEO overconfidence measure (Malmendier and Tate, 2005; Campbell et al., 2011) and the debt overhang correction measure (Hennessy, 2004). The overconfidence measure captures the friction that comes from a manager's inflated perception of investment opportunities, and the debt overhang correction measure proxies for the severity of debt overhang problem. To identify CEOs that can be classified as overconfident, I closely follow the methodology used by Malmendier and Tate (2005) and Campbell et al. (2011). Since I do not have detailed, grant-level data on a CEO's stock option holdings and exercise, I rely on the ExecuComp data that provide aggregated information on grants within a given year. I define CEOs as overconfident if the CEOs hold stock options that are more than 100% in the money for each year, and zero otherwise. I cannot classify CEO-year observations if CEOs only have out-of-the-money options or do not have any options. The debt overhang correction measure is defined as the total recovery value of long-term debt at default normalized by the total amount of capital.

[Insert Table 7 here.]

Panel A of Table 7 shows the results. The results indicate that a positive relation between downward wage rigidity and firm value only shows up in overly confident group that is prone to overinvestment. A one standard deviation increase (1.43%) in downward wage rigidity is associated with a 3.79 (0.0143×2.6491) percentage point increase in *Tobin's q* for overly confident group, which is 2.13% relative to the median *Tobin's q*. However, the labor market friction is negatively associated with firm value when firms are prone to underinvestment owing to debt overhang as shown in columns (3) and (4). A one standard deviation increase (1.80%) in the rigidity measure is related to a 5.68 (0.0180×3.1560) percentage point decrease in *Tobin's q* for the top quintile debt overhang correction group, which is 4.78% relative to the median *Tobin's q*. This implies that facing additional friction in the labor market reduces firm value when a firm already suffers from debt overhang caused by its long-term debt.

As a robustness check, I use a CEO tenure as an alternative measure of overinvestment. Pan et al. (2016) argue that CEOs are likely to overinvest in the later years of their tenure due to the agency problems. Following Pan et al. (2016), I break a CEO's tenure into three periods: years [0,2], years [3,5], and years 6 and after. $Tenure\ Dummy_{years\ [3,5] (years\ 6\ and\ after)}$ is an indicator variable for the second (third) period of CEO tenure. Panel B of Table 7 presents the results. A positive coefficient on $DWR \times Tenure\ Dummy_{years\ 6\ and\ after}$ is economically and statistically significant. A one standard deviation increase (1.61%) in downward wage rigidity is associated with a 2.84 ($0.0161 \times [1.3712 + 0.3926]$) percentage point increase in *Tobin's q* for years 6 and after in a CEO's tenure, which is 1.90% relative to the median *Tobin's q*. Consistent with Panel A of Table 7, these results imply that downward wage rigidity is positively associated with firm value only in the later years of a CEO's tenure, which are prone to overinvestment owing to the agency problems.

Taken together, these valuation regression results imply that downward wage rigidity is not necessarily detrimental to firm value because it might inhibit firms from engaging in wasteful expenditure. This countervailing effect is consistent with the theory of second best: labor market friction could yield more efficient outcomes by pulling investment closer to the optimal level.

4.2 Total Factor Productivity Growth

The results in Section 4.1 rely on the market's assessment of a firm, which does not necessarily reflect the *true* changes in a firm's fundamentals. To verify whether the fundamentals indeed change along with downward wage rigidity, I examine revenue-based total factor productivity (TFP) growth. TFP is a measure of efficiency in production that does not depend on the use of observable factor inputs. Essentially, an increase in TFP implies a northeast shift in the isoquants of a production function: an increase in output given the same amount of observable inputs. If a firm's TFP growth is systematically associated with labor market friction, this finding sheds some light on a mechanism through which the friction can benefit firm value.

I follow an approach similar that used by Kogan et al. (2017) and estimate the following fixed effect regression for over- and underinvesting groups using CEO overconfidence and debt overhang correction measures:

$$TFP_{i,t} - TFP_{i,t-1} = \alpha_{ind} + \alpha_t + \beta_1 DWR_{i,t} + \beta_2 X_{i,t-1} + \epsilon_{i,t}, \tag{13}$$

where $TFP_{i,t}$ refers to firm i's revenue-based total factor productivity at t, α_{ind} is a set of industry fixed effects, α_t is a set of year fixed effects, $DWR_{i,t}$ is the downward wage rigidity measure defined in Section 1, and $X_{i,t-1}$ is a set of firm-level control variables at $t-1$: ln(*PP&E*), ln(EMP), *Tobin's q*, *Leverage*, $Profitability$, ln(ME) and ln(*Age*). I construct a revenue-based TFP measure following the methodology of Olley and Pakes (1996) and the procedure of İmrohoroğlu and Tüzel (2014).[33] The definitions of other variables are provided in Appendix A.

Panel C of Table 7 displays the results of the estimation. Consistent with the results from valuation regressions in Section 4.1, downward wage rigidity is positively (negatively) associated with TFP growth for the overly confident CEO group (those in the top quintile of debt overhang correction). A one standard deviation increase (1.42%) in downward wage rigidity is associated with a 0.65% (0.0142 × 0.4560) increase in the revenue-based productivity of overinvesting firms in column (2). The same increase (1.63%) is related to a 1.60% (0.0163 × 0.9790) decrease in the productivity of underinvesting firms as shown in column (4). The results in Sections 4.1 and 4.2 suggest that labor market frictions do not always destroy firm value or production efficiency. Firms that have a tendency to overinvest owing to certain frictions could be better off when they also face labor market frictions: these labor market frictions partially counteract the existing ones and lead to a more efficient outcome by helping firms avoid value-destructive projects.

[33] I thank Şelale Tüzel for providing codes for estimating TFPs on her website: `http://www-bcf.usc.edu/~tuzel/`.

5 Conclusion

This paper studies the effect of downward wage rigidity on corporate investment decisions. I construct a firm-level, time-varying downward wage rigidity measure using aggregated Census data and show that firms reduce investment when they face labor market friction. Exploiting variation in state-level minimum wage rates as shocks to downward wage rigidity, I find that, following a one standard deviation increase in minimum wage, firms reduce their investment rate by 2.68 percentage points. The negative impact of downward wage rigidity is more acute for firms with a higher fraction of minimum wage workers, higher employment protection, higher labor intensity, or stickier product prices. These findings suggest that labor market friction drives the main results. Furthermore, I show that downward wage rigidity creates additional debt overhang on top of the actual amount of debt and also magnifies operating leverage. These results are consistent with the notion that downward wage rigidity essentially converts a wage claim into a debt-like contract that requires firms to pay a fixed amount, even though the marginal product of labor falls below the current wages. Remarkably, I find that, among firms that overinvest, investment cuts, due to downward wage rigidity, enhance firm value and production efficiency. This result suggests that labor market friction partially counteracts the effect of other frictions (e.g., agency problems or managerial overconfidence) on investment by inhibiting firms from initiating value destructive projects. This countervailing effect is consistent with the theory of second best. However, firms that underinvest perform worse when facing labor market friction.

The evidence in this study implies that labor market frictions, particularly the inability or unwillingness of firms to adjust wages downward, are important drivers of corporate investment. It also suggests that the labor market friction governing incumbent workers' wages could help improve outcomes by curbing overinvestment when firms are subject to overinvestment-related frictions. In addition, it highlights the unintended consequences of minimum wage policy on corporate investment. More broadly, this paper investigates the interdependence of corporate policies with labor markets and to provide insights into how labor markets affect corporate policies, firm value, and production efficiency.

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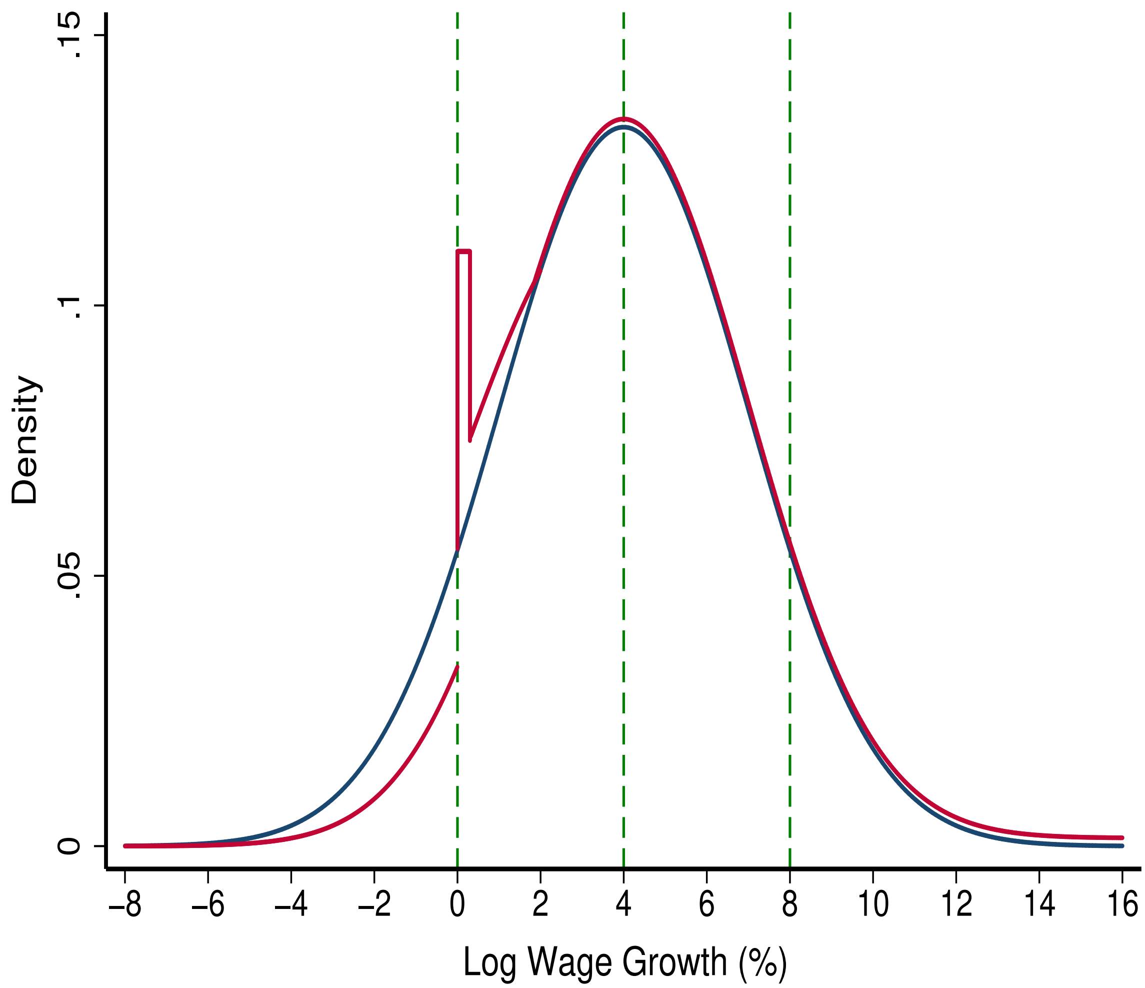
Appendix A Variable Definitions

Variables	Definition [Compustat designations where appropriate]
Investment	Capital expenditures [CAPX] normalized by the beginning-of-the-year capital stock (property, plant, and equipment) [PPENT]
Cash Flow	Earnings before extraordinary items [IB] plus depreciation [DP] normalized by the beginning-of-the-year capital stock [PPENT]
Tobin's q	A ratio of market value of assets to book value of assets [AT] where market value of assets is defined as total assets [AT] plus market equity minus book equity in which market equity is defined as common shares outstanding [CSHO] times fiscal-year closing price [PRCC_F]; book equity is calculated as stockholders' equity [SEQ] minus preferred stock liquidating value [PSTKL] plus balance sheet deferred taxes and investment tax credit [TXDITC] when available minus post-retirement assets [PPROR] when available
$\mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$	An indicator variable set to one if firm i belongs to industries that are most subject to minimum wages. These industries are defined as those with an above-median percentage of hourly workers with earnings at or below the prevailing federal minimum wage as of 2015. Minimum-wage worker data comes from the Labor Force Statistics from the Current Population Survey by the Bureau of Labor Statistics (BLS)
$\mathbb{1}_{s\in\{States\ with\ High\ EPL\}}$	An indicator variable set to one if state s has a high level of employment protection legislation (EPL), which is defined as having a *Wrongful Discharge Law Score* of 2 or 3. *Wrongful Discharge Law Score* is a number of exceptions each state recognizes as of 1994 among the three common law exceptions to the traditional employment at-will rule: good faith, implied contract, and public policy exceptions (data source: Serfling (2016)) Note that Louisiana has a score of 0 before 1998 and a score of 1 since 1998.
$\mathbb{1}_{i\in\{Labor\ Intensive\ Ind\}}$	An indicator variable set to one if firm i belongs to labor intensive industries. For each NAICS industry and year, I first calculate a cross-sectional median of labor intensity where labor intensity is defined as a ratio of total staff expense [XLR] to sales [SALE]. I define industry-level labor intensity as the time series median for each industry. Finally, labor intensive industries are defined as those with an above-median industry-level labor intensity.

$\mathbb{1}_{i \in \{Sticky\ Price\ Ind\}}$	An indicator set to one if firm i belongs to industries with sticky product prices. I define product price stickiness as the inverse of the volatility of Producer Price Index (PPI) growth using monthly PPI data by NAICS industries from the BLS. Sticky price industries are defined as those with an above-median product price stickiness.
GDP growth	State-level annual growth rate of real GDP from the Bureau of Economic Analysis
$\ln(Population)$	The log of intercensal estimates of the resident population for each states from the U.S. Census Bureau
Unemp	State-level unemployment rate from the Bureau of Labor Statistics
NHR	Net hiring rates which is defined as $NHR_t = H_t/[0.5 \times (N_{t-1} + N_t)]$ where N_t is the number of employees [EMP], and net hiring, H_t, is the change in the number of employees from year $t-1$ to year t ($H_t = N_t - N_{t-1}$)
$\mathbb{1}_{\{firm\ defaults\ within\ the\ next\ five\ years\}}$	An indicator variable set to one if a firm defaults within the next five years. This variable is constructed using bankruptcy filing information from the UCLA-LoPucki Bankruptcy Research Database
Tangibility	Net property, plant, and equipment [PPENT] normalized by book value of assets [AT]
Profitability	Income before extraordinary items [IB] plus depreciation and amortization [DP] normalized by book value of assets [AT]
Selling Expense	Selling, general, and administrative expense [XSGA] normalized by sales [SALE]
$\ln(Sales)$	The log of sales [SALE]
Leverage	Book value of long-term debt [DLTT] plus debt in current liabilities [DLC] normalized by book value of assets [AT]
$\ln(Age)$	The log of firm age
R&D	Research and development expenditures [XRD] normalized by book value of assets [AT]
IntCov T2 (T3)	An indicator variable set to one if firm i belongs to the second (third) tercile of the distribution of interest coverage ratio. Interest coverage ratio is defined as a ratio of EBIT to interest expenses.
MZscore T2 (T3)	An indicator variable set to one if firm i belongs to the second (third) tercile of the distribution of modified Z-score. Modified Altman (1968) Z-score is calculated as [1.2 $\times$ working capital + 1.4 $\times$ retained earnings + 3.3 $\times$ EBIT + 0.999 $\times$ sales]/total assets. The ratio of market value of equity to book value of total liabilities is omitted from the original calculation because market-to-book enters the investment regressions as a separate variable.

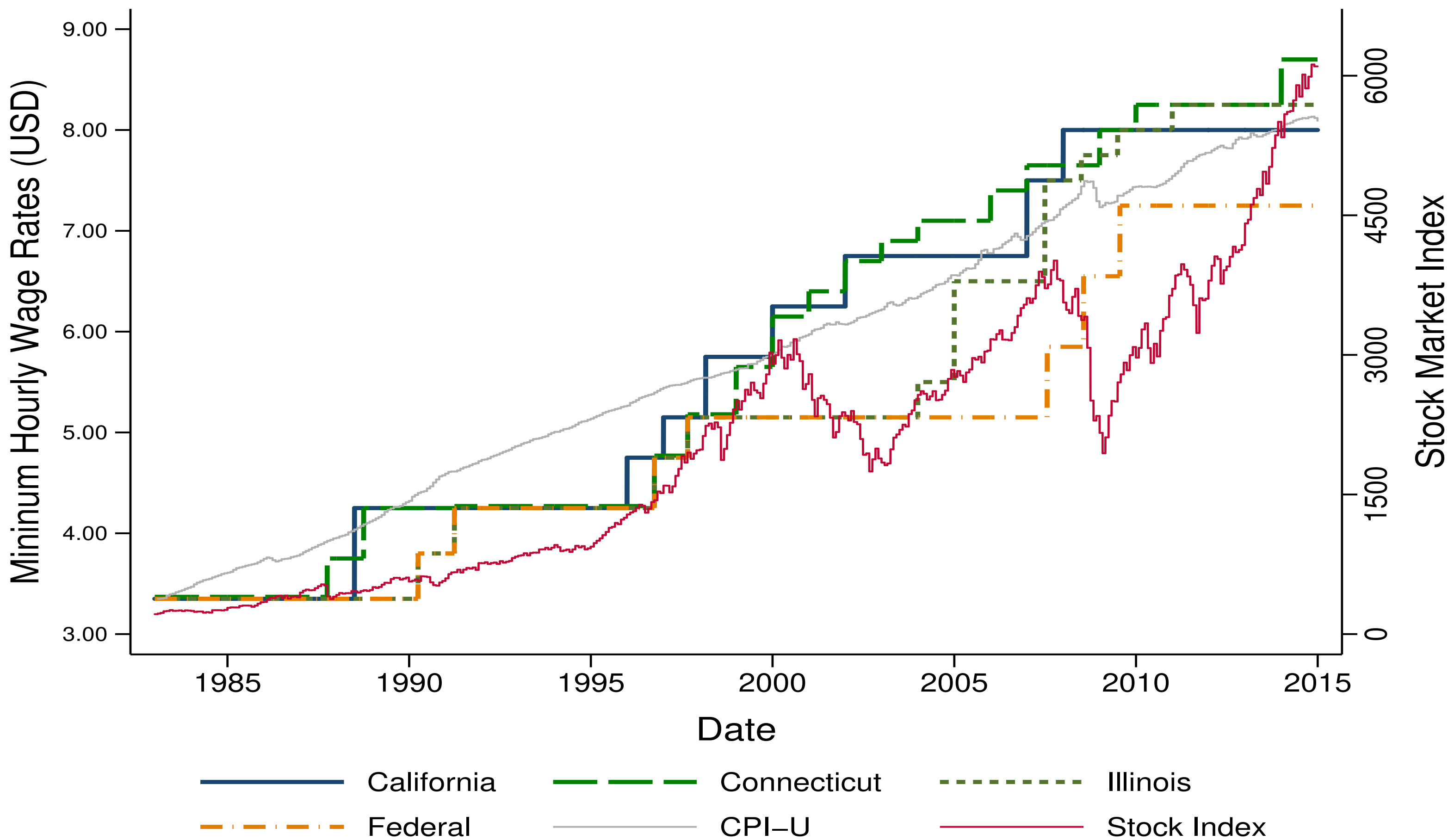
Δ *ln(EBIT)*	A change in the log earnings before interest and taxes [EBIT]
Δ *ln(Sales)*	A change in the log sales [SALE]
CEO Overconfidence	An indicator variable set to one if a CEO is classified as overconfident. I closely follow the methodology used by Campbell et al. (2011). We define CEOs as overconfident if the CEOs hold stock options that are more than 100% in the money for each year, and zero otherwise. We cannot classify CEO-year observations if CEOs only have out-of-the-money options or do not have any options.
Debt Overhang Correction	A debt overhang correction measure of Hennessy (2004). This measure is defined as total recovery value of long-term debt at default normalized by total amount of capital. I use recovery ratios by three-digit SIC code from Altman and Kishore (1996), and default probabilities by bond rating over a 20-year horizon from Moody's
Earnings	Earnings before extraordinary items [IB] plus interest [XINT], deferred tax credits [TXDI], and investment tax credits [ITCI] normalized by book value of assets [AT]
NAssets	Book value of total assets [AT] minus gross property, plant, and equipment [PPEGT] normalized by book value of assets [AT]
Interest	Interest expense [XINT] normalized by book value of assets [AT]
Dividends	Common dividends paid [DVC] normalized by book value of assets [AT]
PP&E	Gross property, plant, and equipment [PPEGT] normalized by book value of assets [AT]
Tenure Dummy	An indicator variables for the second (third) period in CEO tenure where I break a CEO's entire tenure length into three periods following Pan et al. (2016): years [0,2], years [3,5], and years 6 and after
ln(*PP&E*)	The log of capital stock (property, plant, and equipment) [PPENT]
ln(*EMP*)	The log of number of employees [EMP]
ln(*ME*)	The log of market value of equity where market value of equity is defined as common shares outstanding [CSHO] times fiscal-year closing price [PRCC_F]
TFP Growth	A growth rate of revenue-based total factor productivity, constructed using the methodology of Olley and Pakes (1996) and the procedure of İmrohoroğlu and Tüzel (2014)

Figure 1: Measuring Downward Wage Rigidity



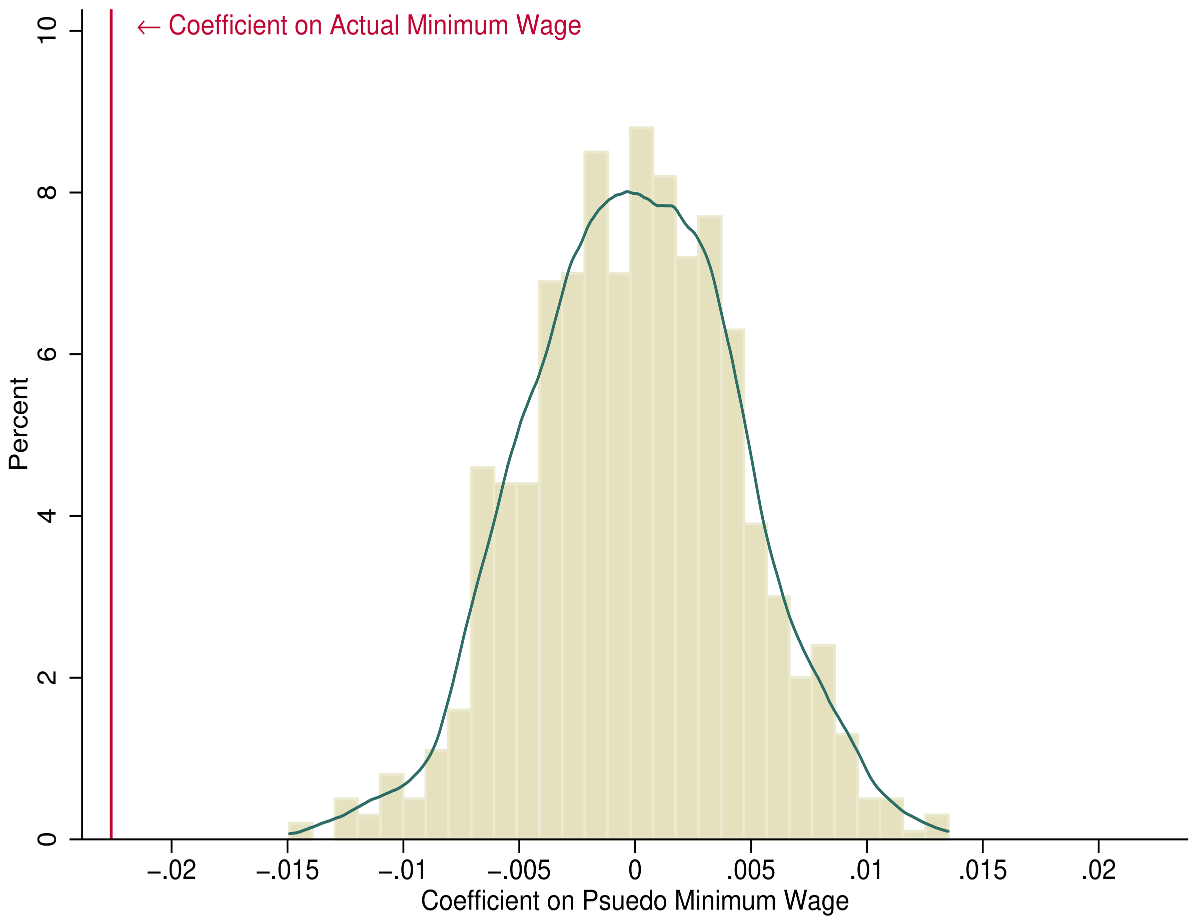
This figure plots the basic concept of downward wage rigidity measures used by Lebow et al. (1995) and Kurmann et al. (2016). The X-axis is the log wage growth and Y-axis shows density. The blue line indicates a notional (rigidity free) distribution of wage growth, and the red line is an empirical counterpart. The notional distribution is drawn from normal distribution with a mean of four and a standard deviation of three for illustrative purposes. The detailed definitions of downward wage rigidity measures are described in Sections 1 and 2.5.1.

Figure 2: Minimum Hourly Wage Rates Across the U.S. States (California, Connecticut, and Illinois), 1983-2014



This figure plots the time-series of minimum hourly wage rates for California, Connecticut, Illinois, and the federal government for the time period 1983 to 2014. I obtain the historical changes in minimum wages for non-farm private sector employment under state laws from the Tax Policy Center. These data are sourced from the Wage and Hour Division of the U.S. Department of Labor and from the *Monthly Labor Review* by the Bureau of Labor Statistics. Under Section 18 of the Fair Labor Standard Act, when an employee is subject to both the state and federal minimum wage laws, the employee is entitled to the higher of the two standards. I also plot the time-series of the Consumer Price Index for All Urban Consumers (CPI-U) by setting the index value in January 1983 to a wage rate of $3.25 per hour on the left axis and the time-series of the value-weighted stock market (NYSE/AMEX/NASDAQ) index on the right axis.

Figure 3: Changes in Minimum Wage Laws Across the U.S. States and Corporate Investment: Placebo Test

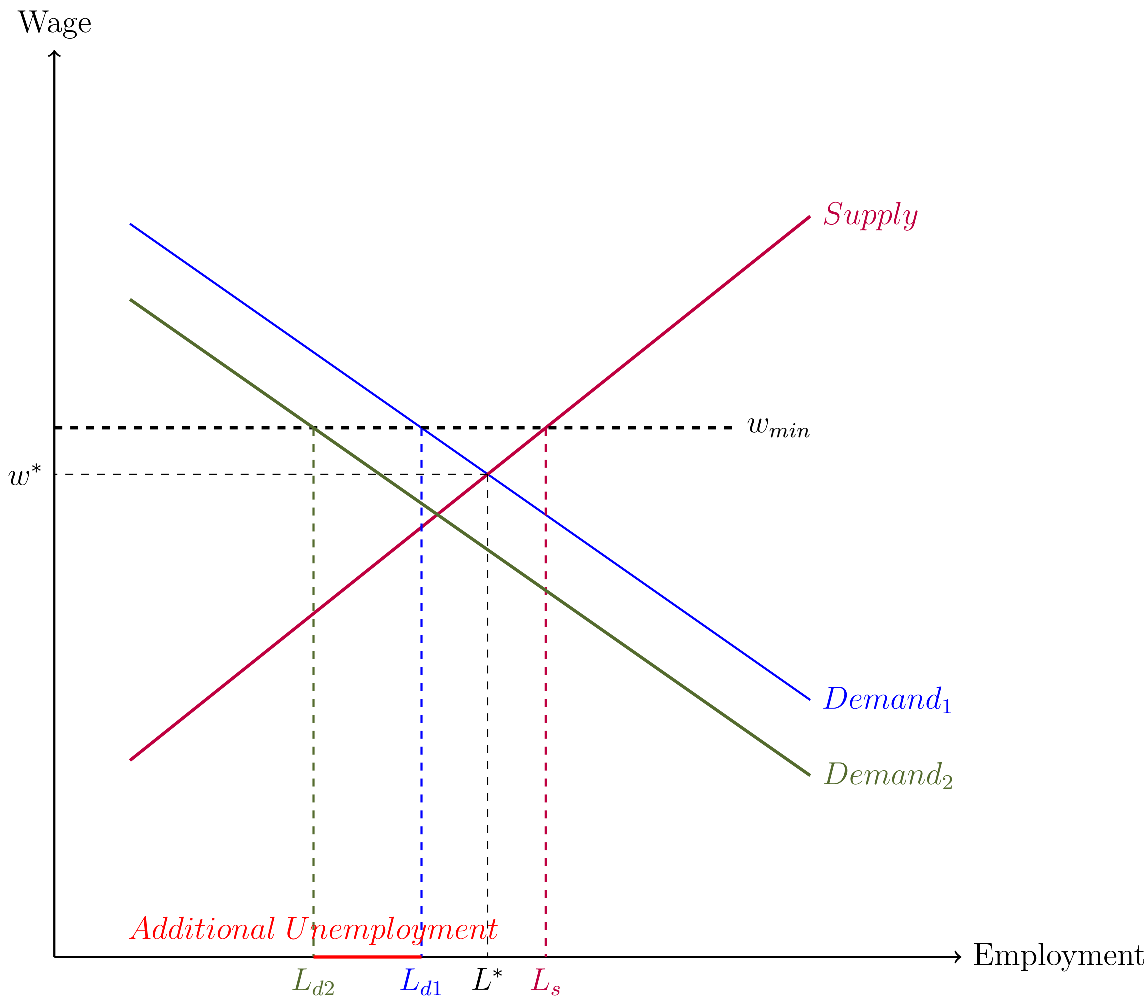


This figure is based on the following investment regressions:

$$\frac{I_{i,s,t}}{K_{i,s,t-1}} = \alpha_i + \alpha_t + \beta_1 Tobin's\ q_{i,s,t-1} + \beta_2 \frac{CF_{i,s,t}}{K_{i,s,t-1}} + \beta_3^{Pseudo} w_{i,s,t-1}^{Pseudo} + \beta_4 X_{s,t-1}^{Pseudo} + \epsilon_{i,s,t},$$

where i, s, and t index firms, states, and years; $\frac{I_{i,s,t}}{K_{i,s,t-1}}$ is investment rate; α_i is a set of firm fixed effects, which absorb time-invariant unobservable firm characteristics, and α_t is a set of year fixed effects, which absorb time-varying macroeconomic shocks faced by all firms; $Tobin's\ q_{i,s,t-1}$ indicates *Tobin's q* as a proxy for investment opportunities; $\frac{CF_{i,s,t}}{K_{i,s,t-1}}$ refers to cash flow; and $X_{s,t-1}^{Pseudo}$ is a set of pseudo state-level macro-variables: real GDP growth rates, log of population, and unemployment rates. To construct a pseudo minimum wage variable ($w_{i,s,t-1}^{Pseudo}$), I randomly assign each firm i to a particular state s. With this pseudo state, I define $w_{i,s,t-1}^{Pseudo}$ as the minimum wage at time $t-1$ in state s where firm i's hypothetical headquarters is located. Once all firms in the sample are assigned in this manner, I reestimate the investment regression and repeat this procedure 1,000 times. The figure plots the empirical distribution of the coefficient β_3^{Pseudo}. The green line shows kernel density. The vertical red line indicates the actual β_3 obtained from the regression based on the actual data (column (1) of Panel B in Table 2). The sample period runs from 1994 to 2014 Q3. Standard errors are clustered by state.

Figure 4: Additional Source of Unemployment through Investment Cut: Policy Implication



This figure illustrates an additional source of employment reduction through forgone corporate investment triggered by a minimum wage increase. $Demand_1$ represents the demand curve in the absence of minimum wage policy. Equilibrium occurs when supply equals demand, which generates the competitive employment L^* and wage w^*. Once the government imposes a minimum wage (w_{min}), which is greater than w^*, L_{d1} will be the new level of employment that is lower than L^*. The main findings in this study suggest that the investment cut resulting from the minimum wage increase will shift the demand curve to the left ($Demand_2$), which amplifies the employment reduction on top of imposing the minimum wage itself. $L_{d1} - L_{d2}$ is the additional unemployment due to the investment cut. As a caveat, note that this illustration is simplistic in that it does not take into account general-equilibrium effects of a minimum wage increase on factor or output prices.

Table 1: Descriptive Statistics

These tables provide descriptive statistics for 69,661 firm-year observations from 1994 to 2014 Q3. Panel A provides descriptive statistics for the firm-level, time-varying measures of downward wage rigidity: *DWR*, γ, η, and ζ. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct these measures. The detailed definitions of these measures are provided in Sections 1 and 2.5.1. Panel B provides descriptive statistics of key variables for *Low DWR* and *High DWR* groups. I define *Low* (*High*) *DWR* as firm-year observations with a below-(above-)median *DWR* for each year. *Investment* is measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plant, and equipment). *Cash Flow* is calculated as earnings before extraordinary items plus depreciation, normalized by the beginning-of-the-year capital stock. *Tobin's q* is defined as a ratio of market value of assets to book value of assets. The detailed definition of each variable is provided in Appendix A. Column (3) shows mean differences in variables between *Low DWR* and *High DWR* groups. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

Panel A. Measures of Downward Wage Rigidity

DWR Measures (%)	Mean	Std. Dev.	p10	p50	p90
DWR	1.0786	1.6093	0	.5375	2.8291
γ	1.1908	1.7019	0	.6450	3.0942
η	.5165	.8240	0	.2499	1.3289
ζ	1.0723	1.5762	0	.5658	2.7253

Panel B. Low DWR vs. High DWR

	(1)	(2)	(3)
Variables	Mean		Mean Differences
	Low DWR	*High DWR*	(2)-(1)
Investment	.2706	.2688	-.0018
			(.0021)
Cash Flow	.3369	.3898	.0529
			(.0084)
Tobin's q	1.6430	1.7224	.0794
			(.0083)

Table 2: The Effects of Downward Wage Rigidity on Corporate Investment

Panel A presents fixed effect OLS regressions of corporate investment on downward wage rigidity measure (DWR). I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct the measure. The details of the construction are provided in Section 1. The dependent variable is *Investment*, measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plant, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and *Tobin's q* as a ratio of market value of assets to book value of assets. The estimation in column (3) is based on firm-year observations with a positive value of downward wage rigidity measure. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm. Panel B shows results from validity tests on downward wage rigidity measure. I run a fixed effect OLS regression of $DWR_{i,s,t}$ (in percentage) on the minimum wage ($w_{i,s,t-1}$) at time $t-1$ in state s where firm i's headquarters is located. I obtain the historical changes in minimum wages under state laws from the Tax Policy Center. These data are sourced from the Wage and Hour Division of the U.S. Department of Labor and from the *Monthly Labor Review* by the Bureau of Labor Statistics (BLS). Under Section 18 of the Fair Labor Standard Act, when an employee is subject to both the state and federal minimum wage laws, the employee is entitled to the higher of the two standards. $\mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$ is an indicator variable set to one if firm i belongs to industries that are most subject to minimum wages. These industries are defined as those with an above-median percentage of hourly workers with earnings at or below the prevailing federal minimum wage as of 2015. Minimum-wage worker data comes from the Labor Force Statistics from the Current Population Survey by the BLS. Panel C lists those industries that are most prone to minimum wage rates. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by state.

Panel A. Downward Wage Rigidity and Corporate Investment

	Dependent Variable: *Investment*		
	With Dummy	Without Dummy	
		Full	Cond. on DWR
	(1)	(2)	(3)
$\mathbb{1}_{DWR>0}$	.0026		
	(.0023)		
DWR	-.1958	-.1693	-.2462
	(.0548)	(.0515)	(.0584)
Cash Flow	.0382	.0382	.0441
	(.0023)	(.0023)	(.0030)
Tobin's q	.0764	.0764	.0741
	(.0022)	(.0022)	(.0025)
Firm and Year FE	Y	Y	Y
# of Firm-Year Obs.	69,661	69,661	51,060
Adjusted R^2	.1713	.1713	.1757

Table 2: The Effects of Downward Wage Rigidity on Corporate Investment (continued)

Panel D shows results from fixed effect OLS regressions of corporate investment on the minimum wage in Equation (7). I also control for state-level macro-variables including real GDP growth rates, log of population, and unemployment rates. $\mathbb{1}_{s\in\{States\ with\ High\ EPL\}}$ indicates states with a high level of employment protection legislation (EPL), which is defined as those having a *Wrongful Discharge Law Score* of 2 or 3. $\mathbb{1}_{i\in\{Labor\ Intensive\ Ind\}}$ indicates firms that belong to labor intensive industries. $\mathbb{1}_{i\in\{Sticky\ Price\ Ind\}}$ indicates industries with sticky product prices. The detailed definitions of these variables are provided in Appendix A. Standard errors in parentheses are robust to heteroskedasticity and clustered by state. Panel E repeats the estimation of column (1) of Panel D, using 1,000 random samples where I randomly assign a firm's headquarters. The empirical distribution of the estimated coefficients on $w^{Pseudo}_{i,s,t-1}$ is presented. The sample period runs from 1994 to 2014 Q3.

Panel B. Validity Tests of Downward Wage Rigidity Measure

	Dependent Variable: DWR	
		Differential Effects Across Industries Least and Most Subject to Min Wage
	(1)	(2)
$w_{i,s,t-1}$	.1461	.1354
	(.0631)	(.0625)
$w_{i,s,t-1} \times \mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$		.0499
		(.0253)
$\mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$		-.1828
		(.1741)
Firm and Year FE	Y	Y
# of Firm-Year Obs.	48,296	48,296
Adjusted R^2	.1333	.1334

Panel C. List of Industries Most Subject to Minimum Wage Rates

Census Industry Classification	NAICS Codes
Food services and drinking places	722
Accommodation	721
Arts, entertainment, and recreation	71
Private household	814
Agriculture and related industries	11
Other services, except private households	81, except 814
Retail trade	44, 45
Educational services	61
Management, administrative, and waste services	55, 56
Information	51

Table 2: The Effects of Downward Wage Rigidity on Corporate Investment (continued)

Panel D. Using Exogenous Variation in Downward Wage Rigidity: Minimum Wage Laws

	Dependent Variable: Investment				
		Conditional Analysis			
		Ind Most s.t. MW	States with High EPL	Ind Most Labor Intensive	Ind with Stikcy Price
	(1)	(2)	(3)	(4)	(5)
$w_{i,s,t-1}$	-.0226	-.0188	-.0111	-.0127	-.0167
	(.0110)	(.0107)	(.0065)	(.0084)	(.0058)
$w_{i,s,t-1} \times \mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$		-.0177			
		(.0019)			
$\mathbb{1}_{i\in\{Ind\ Most\ s.t.\ Min\ Wage\}}$		.0943			
		(.0246)			
$w_{i,s,t-1} \times \mathbb{1}_{s\in\{States\ with\ High\ EPL\}}$			-.0123		
			(.0061)		
$\mathbb{1}_{s\in\{States\ with\ High\ EPL\}}$			*(omitted)*		
$w_{i,s,t-1} \times \mathbb{1}_{i\in\{Labor\ Intensive\ Ind\}}$				-.0158	
				(.0039)	
$\mathbb{1}_{i\in\{Labor\ Intensive\ Ind\}}$				.1001	
				(.0198)	
$w_{i,s,t-1} \times \mathbb{1}_{i\in\{Sticky\ Price\ Ind\}}$					-.0152
					(.0082)
$\mathbb{1}_{i\in\{Sticky\ Price\ Ind\}}$					.0956
					(.0549)
Cash Flow	.0355	.0357	.0355	.0353	.0364
	(.0021)	(.0021)	(.0020)	(.0021)	(.0025)
Tobin's q	.0769	.0764	.0767	.0760	.0779
	(.0033)	(.0034)	(.0033)	(.0031)	(.0039)
GDP growth	.0026	.0026	.0025	.0027	.0024
	(.0006)	(.0006)	(.0006)	(.0006)	(.0006)
ln(Population)	-.1485	-.1487	-.1108	-.1701	-.2015
	(.1056)	(.1027)	(.1085)	(.0997)	(.1081)
Unemp	-.0004	-.0002	-.0003	.0002	.0006
	(.0020)	(.0020)	(.0023)	(.0021)	(.0027)
Firm and Year FE	Y	Y	Y	Y	Y
# of Firm-Year Obs.	39,959	39,959	39,959	39,459	32,063
Adjusted R^2	.1771	.1780	.1775	.1773	.1836

Panel E. Placebo Test: Regression Coefficients from Bootstrapped Sample

	(1) of Panel B	Mean	p1	p5	p10	p25	p50	p75	p90	p95	p99
$w_{i,s,t-1}$	-.0226	-.0001	-.0112	-.0071	-.0060	-.0032	-.0000	.0031	.0057	.0077	.0103

Table 3: Robustness Results

Panel A presents fixed effect OLS regressions of corporate investment on three alternative measures of downward wage rigidity: γ, η, and ζ. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct these measures. The detailed definitions are reported in Section 2.5.1. The dependent variables in all columns are *Investment*, measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plant, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and *Tobin's q* as a ratio of market value of assets to book value of assets. Columns (3), (6), and (9) use firm-year observations with positive values of downward wage rigidity measures. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

Panel A. Using Alternative Measures of Downward Wage Rigidity

	Dependent Variable: *Investment*								
	With Dummy	Without Dummy		With Dummy	Without Dummy		With Dummy	Without Dummy	
		Full	Cond. on DWR		Full	Cond. on DWR		Full	Cond. on DWR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\mathbb{1}_{\gamma>0}$	.0019								
	(.0023)								
γ	-.1445	-.1271	-.1607						
	(.0505)	(.0479)	(.0521)						
$\mathbb{1}_{\eta>0}$				-.0029					
				(.0023)					
η				-.2993	-.3476	-.2958			
				(.1029)	(.0983)	(.1078)			
$\mathbb{1}_{\zeta>0}$							.0038		
							(.0024)		
ζ							-.1821	-.1498	-.2272
							(.0540)	(.0513)	(.0567)
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm and Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
# of Firm-Year Obs.	69,661	69,661	51,811	69,661	69,661	52,493	69,661	69,661	54,094
Adjusted R^2	.1713	.1713	.1795	.1714	.1714	.1779	.1713	.1713	.1782

Table 3: Robustness Results (continued)

Panel B presents the results of regressing corporate investment on *DWR* using the linear high-order cumulant equations (Erickson et al., 2014) to address measurement errors in *Tobin's q* and *DWR*. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct *DWR*. The detailed definitions are reported in Section 1. The dependent variables in all columns are *Investment*, measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plant, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and *Tobin's q* as a ratio of market value of assets to book value of assets. ρ^2 is an estimate of the R^2 of the regression, and τ^2_{DWR} and τ^2_Q are indices of measurement quality for the two proxy variables, *DWR* and *Tobin's q*. Column (1) reports the fixed effect OLS regression result in column (2) of Panel A, Table 2. The sample period runs from 1994 to 2014 Q3. In column (1), standard errors in parentheses are robust to heteroskedasticity and clustered by firm. In columns (2)-(4), bootstrapped standard errors that are robust to within firm correlation are reported in parentheses.

Panel B. Measurement Errors in Tobin's q and Downward Wage Rigidity Measure: Linear Cumulant Equations

	Dependent Variable: *Investment*			
	OLS-FE	EJW Higher-order Cumulant Estimator		
		4th Cum	5th Cum	6th Cum
	(1)	(2)	(3)	(4)
DWR	-.1693	-.6473	-1.7391	-1.1983
	(.0515)	(.3514)	(.4401)	(.2272)
Cash Flow	.0382	.0213	.0199	.0260
	(.0023)	(.0028)	(.0027)	(.0026)
Tobin's q	.0764	.1814	.1923	.1535
	(.0022)	(.0080)	(.0065)	(.0071)
Firm and Year FE	Y	Y	Y	Y
# of Firm-Year Obs.	69,661	69,661	69,661	69,661
Adjusted R^2	.1713			
ρ^2		.2808	.2935	.2527
τ^2_{DWR}		0.1599	0.1243	0.1658
τ^2_Q		0.4736	0.4495	0.5413

Table 4: Labor Adjustments with Capital-Labor Complementarities Channel

These tables present fixed effect OLS regressions of corporate investment on *DWR* and net hiring rates (*NHR*) in Panel A and hiring (*HR*) and separation (*SR*) rates in Panel B. Net hiring rates, $HR_{i,t}$, are defined as $H_{i,t}/[0.5 \times (N_{i,t-1} + N_{i,t})]$ in which $N_{i,t}$ is the number of employees and net hiring, $H_{i,t}$, is the change in the number of employees from year t−1 to year t, $H_{i,t} = N_{i,t} - N_{i,t-1}$. Hiring and separation rates are calculated from the Quarterly Workforce Indicators from the U.S. Census Bureau. The details of variable construction are described in Section 3.1. The dependent variables in all columns are *Investment*, measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plant, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and *Tobin's q* as a ratio of market value of assets to book value of assets. Column (3) uses firm-year observations with a positive value of *DWR*. The detailed definitions of the DWR measure are reported in Section 1. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

Panel A. Net Hiring Decisions

	Dependent Variable: *Investment*		
	With Dummy	Without Dummy	
		Full	Cond. on DWR
	(1)	(2)	(3)
$\mathbb{1}_{DWR>0}$	.0006		
	(.0023)		
DWR	-.2009	-.1947	-.2409
	(.0607)	(.0568)	(.0640)
NHR	.1784	.1784	.1764
	(.0063)	(.0063)	(.0072)
Cash Flow	.0314	.0314	.0367
	(.0023)	(.0023)	(.0030)
Tobin's q	.0700	.0700	.0682
	(.0022)	(.0022)	(.0024)
Firm & Year FE	Y	Y	Y
# of Obs.	65,923	65,923	48,919
Adjusted R^2	.2052	.2052	.2075

Panel B. Hiring and Layoff Decisions

	Dependent Variable: *Investment*		
	With Dummy	Without Dummy	
		Full	Cond. on DWR
	(1)	(2)	(3)
$\mathbb{1}_{DWR>0}$	.0014		
	(.0023)		
DWR	-.1622	-.1476	-.1970
	(.0547)	(.0512)	(.0585)
HR	.3932	.3977	.4473
	(.1276)	(.1269)	(.1588)
SR	.1041	.1024	.2615
	(.1128)	(.1127)	(.1411)
Cash Flow	.0381	.0381	.0441
	(.0023)	(.0023)	(.0030)
Tobin's q	.0762	.0762	.0737
	(.0022)	(.0022)	(.0025)
Firm & Year FE	Y	Y	Y
# of Obs.	69,661	69,661	51,060
Adjusted R^2	.1721	.1721	.1770

Table 5: Debt Overhang Channel

Panel A presents fixed effect regressions of future defaults on the downward wage rigidity measure. The dependent variable is a binary variable that equals one if a firm defaults within the next five years. I use bankruptcy filing information from the UCLA-LoPucki Bankruptcy Research Database. To construct *DWR*, I use the Quarterly Workforce Indicators from the U.S. Census Bureau. The detailed definitions are provided in Section 1. Control variables are *Tobin's q*, *Tangibility*, *R&D*, *Selling Expense*, *Profitability*, *Leverage*, ln(*Sales*), and ln(*Age*). I define *Tobin's q* as a ratio of market value of assets to book value of assets, *Tangibility* as net property, plant, and equipment scaled by book value of assets, *R&D* as research and development expense scaled by book value of assets, *Selling Expense* as selling, general, and administrative expense over sales, *Profitability* as income before extraordinary items plus depreciation and amortization divided by book value of assets, *Leverage* as book value of total debt normalized by book value of assets, ln(*Sales*) as the log of sales, and ln(*Age*) as the log of firm age. Column (1) reports results from fixed effect logit regression that are estimated using a conditional logit specification. Columns (2) and (3) use linear probability models with industry and firm fixed effects, respectively. The sample period runs from 1994 to 2007. Standard errors in parentheses are robust to heteroskedasticity and clustered by either industry (SIC two-digit) or firm.

Panel A: Downward Wage Rigidity and Likelihood of Default

	Dependent Variable: $\mathbb{1}_{\{firm\ defaults\ within\ the\ next\ five\ years\}}$		
	Conditional Logit	Linear Probability Model	Linear Probability Model
	(1)	(2)	(3)
DWR	4.9321	.1084	.0551
	(1.7981)	(.0502)	(.0299)
Tobin's q	-.6926	-.0027	-.0012
	(.1248)	(.0011)	(.0009)
Tangibility	-.5361	-.0162	.0114
	(.3771)	(.0096)	(.0142)
Profitability	-2.2847	-.0909	.0040
	(.3221)	(.0199)	(.0099)
Selling Expense	.3461	.0017	.0057
	(.5330)	(.0109)	(.0087)
ln(*Sales*)	.2592	.0049	.0095
	(.0324)	(.0010)	(.0031)
Leverage	3.1809	.0998	.1212
	(.2338)	(.0108)	(.0130)
ln(*Age*)	-.0518	-.0016	-.0004
	(.0710)	(.0017)	(.0050)
R&D	-4.0360	-.0676	.0147
	(2.5345)	(.0400)	(.0323)
Fixed Effects	Industry & Year	Industry & Year	Firm & Year
SE clustered by	Industry	Industry	Firm
# of Firm-Year Obs.	50,701	52,557	52,567
Pseudo (or Adjusted) R^2	.1279	.0312	.0226

Table 5: Debt Overhang Channel (continued)

Panel B presents fixed effect OLS regressions of corporate investment on DWR and its interaction terms with financial strength measures: interest coverage ratio and modified Altman (1968) Z-score. I sort my sample into terciles by these financial strength measures. Interest coverage ratio is defined as a ratio of EBIT to interest expenses. Modified Altman (1968) Z-score is calculated as [1.2 × working capital + 1.4 × retained earnings + 3.3 × EBIT + 0.999 × sales]/total assets. The ratio of market value of equity to book value of total liabilities is omitted from the original calculation because market-to-book enters the investment regressions as a separate variable (*Tobin's q*). To construct DWR, I use the Quarterly Workforce Indicators from the U.S. Census Bureau. The detailed definitions are provided in Section 1. Columns (2) and (4) display the total effects of downward wage rigidity on investment for each tercile group. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

Panel B: Acting Like All-Equity Firms (Financial Strength)

	Dependent Variable: *Investment*			
	Interest Coverage		Modified Z-Score	
		Total Effects		Total Effects
	(1)	(2)	(3)	(4)
DWR	-.2743	-.2743	-.2969	-.2969
	(.0876)	(.0876)	(.0814)	(.0814)
DWR × *IntCov T2*	.0128	-.2615		
	(.1103)	(.0731)		
DWR × *IntCov T3*	.3638	.0895		
	(.1334)	(.1006)		
IntCov T2	.0336			
	(.0029)			
IntCov T3	.0430			
	(.0038)			
DWR × *MZscore T2*			.1765	-.1204
			(.1122)	(.0800)
DWR × *MZscore T3*			.2882	-.0087
			(.1334)	(.1057)
MZscore T2			.0297	
			(.0039)	
MZscore T3			.0418	
			(.0052)	
Cash Flow	.0368		.0369	
	(.0025)		(.0025)	
Tobin's q	.0723		.0735	
	(.0023)		(.0022)	
Firm and Year FE	Y		Y	
# of Firm-Year Obs.	65,321		65,737	
Adjusted R^2	.1698		.1724	

Table 6: Operating Leverage Channel

This table presents fixed effect OLS regressions of change in the log earnings before interest and taxes (Δ $ln\ EBIT$) on change in the log sales ($\Delta\ lnY$). I interact the log sales with *DWR*. To construct *DWR*, I use the Quarterly Workforce Indicators from the U.S. Census Bureau. The detailed definitions are provided in Section 1. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

	Dependent Variable: Δ ln($EBIT$)	
	With Dummy	Without Dummy
	(1)	(2)
Δ ln($Sales$)	1.0541	1.0648
	(.0404)	(.0289)
$\mathbb{1}_{DWR>0}$	-.0137	
	(.0091)	
$\mathbb{1}_{DWR>0} \times \Delta$ ln($Sales$)	.0189	
	(.0505)	
DWR	.4788	.3352
	(.2662)	(.2448)
$DWR \times \Delta$ ln($Sales$)	2.8881	3.1159
	(1.5184)	(1.3440)
Firm and Year FE	Y	Y
# of Firm-Year Obs.	69,993	69,993
Adjusted R^2	.1001	.1000

Table 7: Downward Wage Rigidity and Firm Value: Differential Effects Across Over- and Underinvestment

Panel A presents the results from fixed effect OLS regression of *Tobin's q* on the downward wage rigidity measure for overinvestment and underinvestment groups. I use CEO overconfidence measure (Campbell et al., 2011) to identify firms that are prone to overinvestment. To identify firms that are likely to underinvest, I construct the debt overhang correction measure of Hennessy (2004), total recovery value of long-term debt at default normalized by total amount of capital. The debt overhang measure is then sorted into quintiles. *Tobin's q* is defined as a ratio of market value of assets to book value of assets. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct the *DWR* measure. The detailed definitions are provided in Section 1. The control variables are $Earnings_t$, $\Delta Earnings_t$, $\Delta Earnings_{t+1}$, $\Delta PP\&E_t$, $\Delta PP\&E_{t+1}$, $\Delta NAssets_t$, $\Delta NAssets_{t+1}$, RD_t, ΔRD_t, ΔRD_{t+1}, $Interest_t$, $\Delta Interest_t$, $\Delta Interest_{t+1}$, $Dividends_t$, $\Delta Dividends_t$, $\Delta Dividends_{t+1}$, and $\Delta Tobin's\ q_{t+1}$ where X_t is the level of variable X in year t normalized by total assets in year t. ΔX_t is the change in the level of X from year $t-1$ to t normalized by total assets in year t, $(X_t - X_{t-1})/A_t$, and ΔX_{t+1} is the change in the level of X from year t to $t+1$ normalized by total assets in year t, $(X_{t+1} - X_t)/A_t$ where A is the book value of total assets. *Earnings* is earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits; $PP\&E$ is gross property, plant, and equipment; $NAssets$ is the book value of total assets minus gross property, plant, and equipment; $R\&D$ is research and development expenditures; *Interest* is interest expense; and *Dividends* is common dividends paid. The details on these variables are reported in Appendix A. $[p - value]$ below H_0: $DWR_{High/Q5}$ - $DWR_{Low/Q1} = 0$ is based on a one-tailed test. Standard errors in parentheses are robust to heteroskedasticity and clustered by industry.

Panel A. Using CEO Overconfidence and Debt Overhang Correction Measures

	Dependent Variable: *Tobin's q*			
	Overinvestment (CEO Overconfidence)		Underinvestment (Debt Overhang Correction)	
	Low/Moderate	High	Q1	Q5
	(1)	(2)	(3)	(4)
DWR	.5022	2.6491	.0229	-3.1560
	(.5836)	(1.0739)	(1.1942)	(1.7246)
H_0: $DWR_{High/Q5} - DWR_{Low/Q1} = 0$	2.1469		-3.1789	
[p-value]	[0.0161]		[0.0213]	
Controls / Industry and Year FE	Y	Y	Y	Y
# of Firm-Year Obs.	9045	7462	722	807
Adjusted R^2	.3909	.364	.3941	.2683

Table 7: Downward Wage Rigidity and Firm Value: Differential Effects Across Over- and Underinvestment (continued)

Panel B uses a CEO tenure as a measure for overinvestment (Pan et al., 2016). Following Pan et al. (2016), I break a CEO's tenure into three periods: years [0,2], years [3,5], and years 6 and after. $Tenure\ Dummy_{years\ [3,5](years\ 6\ and\ after)}$ is an indicator variable for the second (third) period of CEO tenure. Standard errors in parentheses are clustered by firm.

Panel B. Using CEO Investment Cycles (CEO Tenure)

	Dependent Variable: *Tobin's q*	
	Full Sample	Firms with at least 9 years of observations
	(1)	(2)
DWR	.3926	.1496
	(.4439)	(.4492)
$DWR \times Tenure\ Dummy_{years\ [3,5]}$	.7121	.6918
	(.6705)	(.7513)
$DWR \times Tenure\ Dummy_{years\ 6\ and\ after}$	1.3712	1.5853
	(.6367)	(.6834)
$Tenure\ Dummy_{years\ [3,5]}$	-.0038	.0056
	(.0139)	(.0145)
$Tenure\ Dummy_{years\ 6\ and\ after}$	.0233	.0247
	(.0167)	(.0170)
Controls / Firm and Year FE	Y	Y
# of Firm-Year Obs.	22,559	20,142
Adjusted R^2	.3000	.3087

Table 7: Downward Wage Rigidity and Firm Value: Differential Effects Across Over- and Underinvestment (continued)

Panel C presents the results from fixed effect OLS regressions of revenue-based total factor productivity (TFP) growth on the downward wage rigidity measure for overinvestment and underinvestment groups. TFP is constructed using the methodology of Olley and Pakes (1996) and the procedure of İmrohoroğlu and Tüzel (2014). The control variables include *ln(PP&E)*, *ln(EMP)*, *Tobin's q*, *Leverage*, *Profitability*, *ln(ME)* and *ln(Age)*. *ln(PP&E)* is the log of capital stock, *ln(EMP)* is the log of number of employees, *ln(ME)* is the log of market value of equity, and *ln(Age)* is the log of firm age. I measure *Leverage* as book value of total debt normalized by book value of assets, and *Profitability* as income before extraordinary items plus depreciation and amortization divided by book value of assets. $[p-value]$ below H_0: $DWR_{High/Q5}$ - $DWR_{Low/Q1} = 0$ is based on a one-tailed test. Standard errors in parentheses are robust to heteroskedasticity and clustered by industry.

Panel C. Downward Wage Rigidity and Production Efficiency

	Dependent Variable: *TFP Growth*			
	Overinvestment (CEO Overconfidence)		Underinvestment (Debt Overhang Correction)	
	Low/Moderate	High	Q1	Q5
	(1)	(2)	(3)	(4)
DWR	.0341	.4560	.2095	-.9790
	(.1593)	(.1963)	(.3659)	(.3178)
H_0: $DWR_{High/Q5} - DWR_{Low/Q1} = 0$	0.4219		-1.1885	
[p-value]	[0.0595]		[0.0154]	
Controls / Industry and Year FE	Y	Y	Y	Y
# of Firm-Year Obs.	8,614	7,009	610	630
Adjusted R^2	.0373	.0613	.0385	.0246