Downward Wage Rigidity,
Corporate Investment, and Firm Value

by

DuckKi Cho

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Graduate Supervisory Committee:

Sreedhar Bharath, Co-Chair
Michael Hertzel, Co-Chair
Hendrik Bessembinder
Jiaxu Wang

ARIZONA STATE UNIVERSITY

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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 minimum wage increase, firms reduce their investment rate by 1.17 percentage points. Surprisingly, this labor market friction enhances firm value and production efficiency when firms are subject to other frictions causing overinvestment, consistent with the theory of second best. Finally, I identify increased operating leverage and aggravation of debt overhang as mechanisms by which DWR impedes investment.

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Chapter 1

INTRODUCTION

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 essentially converts a wage claim into a debt-like contract that requires firms to pay a fixed amount, that 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 can crowd out financial leverage,[2] which in turn decreases the firm's ability to finance its investment. Hence, downward wage rigidity can deter new investment. Yet empirical evidence of the effect of labor market frictions on investment is elusive, in part because labor market frictions are difficult to measure and in part because identifying their effects is challenging.

This study addresses these challenges to investigate the link between downward wage rigidity and investment. Applying the method proposed in Lebow, Stockton,

[1] Campbell and Kamlani (1997) provide a review of theories of wage rigidity and investigate potential sources of wage rigidity using a survey. More recently, Baqaee (2015) proposes a model in which asymmetric household expectations about the inflation rate generates downward wage rigidity. Empirical evidence for downward wage rigidity can be found, for example, in Card and Hyslop (1997), Kahn (1997), Lebow, Saks, and Wilson (2003), Daly, Hobijn, and Lucking (2012), Barattieri, Basu, and Gottschalk (2014), and Kurmann, McEntarfer, and Spletzer (2016).

[2] See Simintzi, Vig, and Volpin (2015) and Serfling (2016).

and Wascher (1995), I construct a firm-level, time-varying measure of downward wage rigidity using the Quarterly Workforce Indicators from the U.S. Census Bureau, which contain a rich set of labor market statistics, including worker flows and earnings. 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. I show that the measure increases following a minimum wage increase, affirming its validity.

I first document that my measure is negatively associated with investment. Within firms, a one standard deviation increase in downward wage rigidity is associated with a 1.8% 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 additional tests show that they are unlikely to be driven by labor adjustment with capital-labor complementarity, the business cycle, or inflation. Accounting for measurement errors in Tobin's q and my measure using the linear cumulant equations of Erickson, Jiang, and Whited (2014), I find that the results are robust to these remedies. I also find that the negative impact is more pronounced for firms with higher labor intensity or stickier product prices. These results suggest that labor market frictions indeed drive firms' decisions to reduce investment.

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 the staggered state-level changes in minimum wage laws as a source of exogenous variation in downward wage rigidity. The basic idea is that an increase in the minimum wage puts a higher floor on wages, which makes wages more downward rigid. The identification strategy hinges on the assumption that changes in minimum wage laws are exogenous to individual firm outcomes.

This empirical setting is well suited for testing the causal link between downward wage rigidity and investment in the following three ways. First, it satisfies the relevance condition.[3] I show that my measure indeed increases after the minimum wage increase, and this effect is more pronounced for firms with a higher fraction of minimum wage workers. Second, a change in state-level minimum wage laws can largely be regarded as exogenous to individual firm outcomes. This identifying assumption could be violated if improved investment opportunities in the state prompted the passage of a law that increases the minimum wage. However, the improved local investment opportunity should boost investment, which is likely to bias my tests against finding a negative relation. Third, 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.

I find that, after a minimum wage increase, firms reduce their investment rates by 1.17 percentage points, a 6.2% decrease relative to the median investment rate. The negative effects are more pronounced for firms in industries that are most subject to

[3]If inflation triggers a minimum wage increase, the relevance condition may be violated. Card and Hyslop (1997) document that downward rigidity of nominal wages becomes weaker during a high-inflation period because wage policy is more flexible when inflation is anticipated. Hence, minimum wage increases will have a negative (not positive) impact on downward wage rigidity. Also, the identifying assumption may be violated due to the potential impact of inflation on investment. Therefore I exclude 15 states that have indexed their minimum wage to inflation.

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 strong employment protection laws. These results lend further credence to this identification strategy.

With the negative impact identified, I turn to an examination 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.[4] The newly added friction (e.g., downward wage rigidity) may partially counteract the effect of the existing frictions on investment (e.g., overinvestment) by causing the firm to avoid value-destroying projects, thereby 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 under-investing. 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 currently in the later years of their tenure (Pan, Wang, and Weisbach, 2016). A one standard deviation increase in downward wage rigidity is

[4] 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 it unchanged" (p.12).

associated with a 3.8 percentage point *increase* in Tobin's q for the overly confident group. Consistent with 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 frictions may curb overinvestment problems that are due to managerial overconfidence or agency problems, consistent with the theory of second best.

However, 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.

I explore the channels that may link downward wage rigidity to investment. First, 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 indeed find that downward wage rigidity increases a firm's default risk for a given amount of actual debt. Second, it also increases a firm's operating leverage:[5] a one standard deviation increase in downward wage rigidity is associated with a 5% increase in operating leverage, measured by the sensitivity of changes in earnings to changes in sales. The heightened operating leverage prevents firms from using financial leverage, which decreases a firm's ability to finance its investment. To support this channel, I also investigate the interaction effect of labor market and financing frictions on investment. Financially constrained firms, identi-

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

fied by the amount of maturing long-term debt in the following year (Almeida et al., 2012), further decrease their investment rate as downward wage rigidity increases.[6]

The main contributions of this study are fourfold. First, it adds to a growing body of literature that analyzes the interactions between labor markets and corporate finance; the existing literature (e.g., Agrawal and Matsa, 2013; Kim, 2015; Simintzi, Vig, and Volpin, 2015; Serfling, 2016) focuses primarily on a friction that is associated with firing decisions and investigates its impact on capital structure. In contrast, this study focuses on the friction governing incumbent workers' wages and examines its effect on investment.

Second, this study builds on the literature that investigates the impact of frictions on a firm's real activities. Previous research has documented that financing frictions can have a large and perhaps causal impact on both capital investment and employment.[7] While the link between labor market frictions and employment has long been investigated in economics, much less is known about the role of labor market frictions in determining investment, the subject of this paper.[8]

Third, this article documents new evidence for the positive role of labor market

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

[7] See, e.g., Fazzari, Hubbard, and Petersen (1988); Hennessy and Whited (2007); Almeida and Campello (2007); Chava and Roberts (2008) for the impact on investment, and Chodorow-Reich (2013); Giroud and Mueller (2017); Barrot and Nanda (2016); Benmelech, Bergman, and Seru (2011) for the effect on employment.

[8] Fairhurst and Serfling (2016) show that restraints on a firm's firing decisions have a negative impact on investment.

frictions 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.[9] Similarly, Acharya, Baghai, and Subramanian (2014) provide evidence that employment protection laws against unjust dismissal stimulate (rather than impede) corporate innovation by mitigating holdup problems. This article complements the existing literature by pointing out the countervailing effect of labor market frictions on firm overinvestment, which could improve firm value and production efficiency. These results call for a richer theory on the interaction between labor and other frictions in the firm on its investment.

Finally, this article has policy implications for minimum wage laws, which are a source of political contention, especially during recent presidential election years[10] with the fight for $15-dollar movement in large US cities. Legislators focus mainly on the potential impact of the minimum wage on income inequality and unemployment of low-skilled workers. My findings point out an overlooked but important aspect of minimum wage effects on employment through forgone corporate investment: the investment cuts may shift the labor demand curve to the left, which further reduces

[9]See Acemoglu (2002, 2003) for a generalization of Acemoglu and Pischke (1999) to a broader concept of firms' incentives to raise productivity in the presence of wage compression.

[10]CNBC News reported on 18 Nov. 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."

employment over and above the decline due to the increased wages (Figure 3).[11] Hence, regulators should be aware of the consequences of minimum wage policies on investment.

[11] "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*, 30 Aug. 2016)

Chapter 2

MEASURING DOWNWARD WAGE RIGIDITY

Studies that examine the extent of downward wage rigidity use several types of data: payroll records from a small number of selected firms, panel survey data of households (e.g., the Panel Study of Income Dynamics), and microdata (e.g., the National Compensation Survey by the Bureau of Labor Statistics [BLS] or the Longitudinal Employer Household Dynamics [LEHD] from the U.S. Census Bureau). Using data from a small number of firms is not appropriate for the purposes of this paper which provides evidence from a large sample on the relation between labor market frictions and investment. Moreover, payroll records are, in most cases, proprietary data. The panel survey data may alleviate concerns regarding limited representativeness, and they are usually publicly available. However, survey data are prone to measurement errors caused by rounding and faulty recollections.[1] Most important, they do not have enough observations to construct firm-level measures.

Micro-level data are nearly free from all the aforementioned shortcomings but are not readily accessible because confidentiality issues. Fortunately, the Quarterly Workforce Indicators (QWI) from the U.S. Census Bureau are available online for public use; these are based on the U.S. Census Bureau's LEHD program, which links works to their employers. The data contain a great deal of information on the U.S.

[1]For a discussion of the potential impact of measurement errors on wage rigidity measures, see Akerlof et al. (1996), Gottschalk (2005), and Lunnemann and Wintr (2010), which find that measurement errors will bias the measures toward zero. Indeed, I find a stronger effect of downward wage rigidity on investment after accounting for measurement errors (See Table A3).

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 2.0.2, I construct firm-level downward wage rigidity measures.

2.0.1 Data

The QWI provide a rich set of local labor market statistics at the *aggregate* level by 4-digit NAICS industry, employee demographics (age, gender, education, and race/ethnicity), employer age and size, and geography (state and county). The data utilize a wide range of sources, including the administrative records on employment, Social Security data, federal tax records, and other census and survey data: Unemployment Insurance Earnings Data (UI), Quarterly Census of Employment and Wages (QCEW), Business Dynamics Statistics (BDS), and demographic data sources.[2] 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.[3]

The source of the QWI is unique job-level data (not firm- or person-level data) from the LEHD program. Moreover, the LEHD data cover 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

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

[3]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 in Pissarides (2009), and references therein.

submit quarterly data from existing 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.[4]

2.0.2 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)[5] distribution of wage growth, and then examine whether the empirical wage growth distribution is compressed from the left relative to the notional distribution.

The measure developed by Lebow, Stockton, and Wascher (1995) assumes a symmetric notional distribution and estimates the difference between the cumulative frequencies of empirical distribution above twice the median and below zero wage growth. Because this measure is a pure order statistic, it is less subject to extreme outliers. Using this method and microdata underlying the Employment Cost Index by the

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

[5]A menu cost is a fixed cost that firms must pay to change wages.

BLS, Lebow, Saks, and Wilson (2003) find evidence of downward wage rigidity in the U.S. labor market. Kahn (1997) proposes another method, which does not rely on a symmetry assumption but uses seemingly unrelated regressions with cross-equation constraints, and also finds evidence of this friction. More recently, Kurmann, McEntarfer, and Spletzer (2016) use the confidential data from the LEHD to investigate the extent and consequences of downward wage rigidity in the U.S. They use three asymmetry statistics—missing mass left-of-zero wage growth rate, spike at zero, and excess mass right-of-zero—that are similar to those used in Card and Hyslop (1997). Using the approach of Lebow, Stockton, and Wascher (1995) as a baseline method, I construct a firm-level measure.[6] I also check the robustness of the main results with alternative measures used in Kurmann, McEntarfer, and Spletzer (2016). Detailed definitions of these alternative measures are reported in Section B.

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, McEntarfer, and Spletzer (2016) document that firms 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

[6]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, McEntarfer, and Spletzer (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.

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 control for hiring and separation rates in the main analysis (Section 4.0.4).

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 half or increase fivefold over one quarter.[7]

It should be noted 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 workers and departing workers. The direction of this effect on estimates of downward wage rigidity is unclear *a priori*. However, as empirically shown in Lebow, Saks, and Wilson (2003), the estimates using job-level (aggregated) data are lower than those using individual-level data (see also Barattieri, Basu, and Gottschalk, 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.

Next, for each firm-size (5 groups) and year-quarter pair, I calculate the firm-size-level downward wage rigidity using a rich set of cross-sectional data on wage growth

[7]Using different criteria for removing outliers yields almost the same results.

at state × NAICS 4 digit × employee gender × employee age level:[8]:

$$DWR_{fs,t} = \int_{2 \cdot med_{fs,t}}^{\infty} f_{fs,t}(x)dx - \int_{-\infty}^{0} f_{fs,t}(x)dx \tag{2.1}$$

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. 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 (see Figure 1). Since the observational unit is a group of employees, I calculate number-of-employees weighted medians.

Similarly, for each industry and year-quarter pair, I calculate the NAICS 4-digit-level measure using cross-sectional data on wage growth at state × firm size × employee gender × employee age level:[9]:

$$DWR_{ind,t} = \int_{2 \cdot med_{ind,t}}^{\infty} f_{ind,t}(x)dx - \int_{-\infty}^{0} f_{ind,t}(x)dx \tag{2.2}$$

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 4-digit × firm

[8] Note that the maximum possible number of observations in this cross-sectional distribution is 51 (states) × 313 (NAICS 4-digit industries) × 2 (employee genders) × 8 (employee age groups) = 255,408 for a given firm size and year-quarter.

[9] Note that 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.

size × employee gender × employee age level,[10] I construct the following state-level measure for each year-quarter:

$$DWR_{st,t} = \int_{2 \cdot med_{st,t}}^{\infty} f_{st,t}(x)dx - \int_{-\infty}^{0} f_{st,t}(x)dx \tag{2.3}$$

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, headquarters state) measures as follows:[11]

$$DWR_{i,t} = \frac{1}{3}\left[DWR_{fs=fs_i,t} + \frac{\sum_{ind_j} Sales_{i,ind_j,t} \cdot DWR_{ind=ind_j,t}}{\sum_{ind_j} Sales_{i,ind_j,t}} + DWR_{st=st_i,t}\right] \tag{2.4}$$

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 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.[12]

[10]Note that the maximum possible number of observations in this cross-sectional distribution at quarter t is 313 (NAICS 4-digit industries) × 5 (firm sizes) × 2 (employee genders) × 8 (employee age groups) = 25,040 for a given state and year-quarter.

[11]Note that 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: e.g., some firms report state-level geographic segments whereas other firms use regional geographic segments. As a robustness check, I construct a sub-sample of single-segment firms, and find qualitatively similar results.

[12]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`.

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 sales from the Compustat Segment files as weights.

2.0.3 Descriptive Statistics and Validity Tests

Panel A of Table 1 gives summary statistics for firm-level measures of downward wage rigidity. The sample mean of DWR measure is 1.09%, which implies that, on average, empirical wage growth distribution is compressed from the left by 1.09% relative to the notional distribution. In the absence of downward wage rigidity ($DWR = 0\%$), the expected aggregate wage change conditional on negative wage growth amounts to \$6.13 billion as of 2013. This amount decreases by \$0.72 billion owing to the average level of friction ($DWR = 1.09\%$), which corresponds to 11.70% relative to \$6.13 billion.[13] Alternatively, 11.70% of all jobs that should have expe-

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13

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

$$\$6.13\ billion \times \frac{\overline{DWR}}{\int_{-\infty}^{0} f(x;\mu,\sigma)dx} = \$0.72\ billion$$

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.

rienced wage decreases in the absence of downward wage rigidity will not face wage reductions under the average level of downward wage rigidity.

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 within a firm, affects the degree of downward wage rigidity. Consistent with this notion, downward wage rigidity measures vary considerably: for example, the mean of DWR is 1.09% and the standard deviation is 1.64% (Panel A of Table 1). This sizable cross-sectional and time-series variation in my measure of downward wage rigidity allows for a powerful test.

In Panel B, I sort NAICS sectors (based on two-digit NAICS codes) by DWR using a time-series average rank for each sector from 1994 to 2014. Finance and Insurance, Information, and Manufacturing sectors are the top three sectors among 19 sectors. I also rank the 19 sectors based on the industry unionization rates, which come from the Union Membership and Coverage Database by Hirsch and Macpherson (2003).[14] They define industry unionization rates as the percentage of an industry's workers covered by unions in their collective bargaining with the firm. I use the industry unionization rates as of 2013 to sort NAICS sectors.

I also conduct a validity test of my measure using changes in state minimum wage laws across the United States. (See Section 3.1.2 for institutional and estimation

[14] The data are publicly available at www.unionstats.com.

details.) If the measure is valid, it should grow when firms' wage floor rises, and this effect should be more pronounced for firms with a higher percentage of minimum wage workers. I use minimum wage 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. Panel C of Table 2 lists industries that are most prone to minimum wage increases.

The results in Panel C of Table 1 prove the validity of my measure. In Column (1), which uses the full sample, changes in downward wage rigidity are positively associated with minimum wage increases; however, the relation is not statistically significant. This is partly because a minimum wage increase is one of many factors that affect a firm's downward wage rigidity, and partly because my measure contains measurement errors. If firms belong to industries that are most subject to minimum wage increases, a greater portion of changes in my measure will be explained by those increases. Columns (2) and (3) confirm this prediction. The coefficient almost triples (0.2596) for firms that are most subject to minimum wage, and it is significantly different from 0 at the 1% level of significance.

Last, Panel D of Table 1 provides descriptive statistics for firm-year observations by low and high downward wage rigidity groups based on the median DWR for each year. Column (3) shows mean differences in variables between these two groups.

Chapter 3

DOWNWARD WAGE RIGIDITY AND CORPORATE INVESTMENT

3.1 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 in Almeida, Campello, and Galvao (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 eliminates 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 and/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 in 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).

3.1.1 Downward Wage Rigidity Measures and Corporate Investment

As argued by Tobin (1969) and formally derived by Hayashi (1982), corporate investment is solely determined by marginal q when there is no friction. Once one allows for financing frictions, a firm's cash flow also becomes an important determinant of investment decisions. A standard investment regression used in Fazzari, Hubbard, and Petersen (1988) provides the empirical framework for researchers to investigate the effect of financing frictions on investment. It regresses firm-level investment on

Tobin's q and cash flow in which Tobin's q proxies for unobservable true investment opportunities. Even though the interpretation of cash flow coefficient in this regression is controversial,[1] 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).

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

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} + \epsilon_{i,t} \tag{3.1}$$

where $I_{i,t}$ is investment, $CF_{i,t}$ refers to cash flow, $K_{i,t-1}$ is beginning-of-the-year capital, $Q_{i,t-1}$ indicates Tobin's q as a proxy for investment opportunities, $DWR_{i,t}$ is the measure of downward wage rigidity defined in Section 2, α_t is a set of year fixed effects, which absorb time-varying macroeconomic shocks faced by all firms, and α_i is a set of firm fixed effects, which absorb time-invariant unobservable firm characteristics. 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 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 only exploit a time variation in my measure within a firm, the interpretation is

[1]See Fazzari, Hubbard, and Petersen (1988), Kaplan and Zingales (1997), Fazzari, Hubbard, and Petersen (2000), and Alti (2003) among others.

that firms invest less when they exhibit a high level of downward wage rigidity. With the full set of controls, a one standard deviation (1.72%) increase in my measure of downward wage rigidity implies a 0.34 (0.0172×0.1958) percentage point decrease in the investment rate (i.e., capital expenditure/capital stock). Changing the measure of downward wage rigidity from the 10th percentile (0.13%) of the distribution to the 90th percentile (3.37%) would decrease the investment rate by 0.63 percentage points, which is sizable compared to the median investment rate of 19.21%.[2] In Table A1, I also confirm a strong negative association between downward wage rigidity and investment using alternative measures.

3.1.2 Minimum Wage Laws across the 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 effect, 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 puts a higher floor on wages, which makes wages more downward rigid. The identification strategy hinges on the assumption that changes in minimum wage laws are exogenous to individual firm outcomes. This section describes (i) institutional details on minimum wage laws in the U.S., (ii) identification strategy, (iii) estimation procedures and results, and (iv) a placebo test.

[2]Note that the negative effect is more pronounced for firms with large assets (not reported). Therefore, the effect is not simply driven by a number of small firms, and the aggregate economic impact of downward wage rigidity is even greater.

Institutional Details

The federal minimum wage provisions for employees in the U.S. are contained in the Fair Labor Standards Act (FLSA), the federal legislation that establishes the general minimum wage rates that must be paid to all covered workers. The FLSA also 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 then. More than 130 million workers in more than 7 million workplaces are protected by the FLSA, which is enforced by the Wage and Hour Division of the Department of Labor.

Many states also have their own minimum wage laws, and their minimum wage rates may be different from those set by the federal statutes. Some states specifically set wage rates above the federal rate, while other states index the minimum wage to inflation or increase the rate in legislatively scheduled increments. 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. The federal and state minimum wage rates change at various times and in various increments (see Figure 2).

Identification Strategy

Testing for a causal effect of downward wage rigidity on investment is challenged by identification concerns regarding endogeneity. Downward wage rigidity, which is determined by a firm's wage policy, may be correlated with the firm's demand for capital; it may also be determined at the same time as investment decisions. To alleviate these concerns, I exploit staggered state-level changes in the minimum wage for non-farm private sector employment as a source of exogenous variation in downward wage rigidity. The basic idea here is that an increase in the minimum wage puts a higher floor on wages, which makes wages more downward rigid. Therefore investment decreases after an increase in the minimum wage rates. The identifying assumption is that changes in state-level minimum wage laws are exogenous to individual firm outcomes.

This empirical setting is well suited for testing a causal link between downward wage rigidity and investment in the following three distinct ways. First, a change in state-level minimum wage laws satisfies the relevance condition for a valid instrument. As outlined in Section 3.1.2, each state uses its own adjustment mechanism for minimum wage rates: legislatively scheduled increases, indexing to inflation, reference to the federal rates, or a mix of these three methods. If inflation triggers minimum wage increases, the relevance condition may be violated. Downward wage rigidity becomes weaker during a period of high inflation (Card and Hyslop, 1997); therefore minimum wage increases will have a negative (not positive) impact on downward wage rigidity. Therefore I exclude 15 states that have indexed their minimum wage rates to some measure of inflation.[3] Indexation is not the only mechanism for wage rate adjustment that these 15 states have used, but I conservatively rule out all firms headquartered in these states.[4] In Section 3.1.2, I also test whether my measure indeed grows following the state minimum wage increase.

Second, a change in state-level minimum wage laws can largely be regarded as

[3]Alaska, Arizona, Colorado, Florida, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, Ohio, Oregon, South Dakota, Washington, and Vermont.

[4]I obtain qualitatively similar results when including those 15 states in my analysis, but the statistical significance becomes weaker. This is indirect evidence of the validity of my instrument.

exogenous to individual firm outcomes, which satisfies the exclusion condition. Consider the first case in which a state specifies future rates in legislation. The identifying assumption may be violated if unobservable improvement of investment opportunity in the state facilitates the passage of a law that increases the minimum wage. However, the improved local investment opportunity should boost investment, which is likely to bias my tests against finding a negative relation between minimum wage increases and capital expenditure. For the second case, in which a state maintains the real value of the minimum wage over time by indexing it to inflation, the identifying assumption may be violated by the potential impact of inflation on investment. However, I already exclude those 15 states because they violate the relevance condition. Last, for the case in which a state sets its minimum wage based on the federal rate, whether the identifying assumption is violated depends on how the federal rate is set. Since the Congress either specifies a single rate in the enacting legislation or sets rates in advance, the argument for the first case may apply to this case as well.

Third, because minimum wage increases are staggered, it is possible for firms to be in both the treatment and the control group at different times, which alleviates the potential problem of systematic differences between treatment and control firms. In sum, a change in minimum wage laws across the U.S. states is a valid instrument for examining whether downward wage rigidity has a causal effect on investment.

Figure 2 depicts the time-series of minimum hourly wage rates for California, Connecticut, and Illinois as an illustrative 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.

Estimation

I estimate the following first difference investment regression:

$$\Delta \frac{I_{i,s,t}}{K_{i,s,t-1}} = \alpha_t + \beta_1 \Delta Q_{i,s,t-1} + \beta_2 \Delta \frac{CF_{i,s,t}}{K_{i,s,t-1}} + \beta_3 \mathbb{1}_{\Delta w_{s,t-1}>0} + \beta_4 \Delta X_{s,t-1} + \Delta \epsilon_{i,s,t} \tag{3.2}$$

where $\mathbb{1}_{\Delta w_{s,t-1}>0}$ is a dummy variable indicating minimum wage increases at time t -1 in state s where firm i's headquarters is located. I use the same set of firm control variables, Tobin's q and cash flow, as in the baseline specification and include year fixed effects. I also control for state-level variables, $X_{s,t-1}$, including real GDP growth rates, log of population, and unemployment rates. Section D provides definitions and sources of each state-level variable.

I cluster standard errors at the state-level instead of the firm-level.[5] 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.

Column (1) in Panel B of Table 2 reports the estimates for the coefficients in Equation (3.2). 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 minimum wage increase,

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

firms reduce their investment rates by 117 basis points, which corresponds to a 6.2% decrease relative to the median investment rate.

An alternative explanation is that a potential decrease in employment due to minimum wage increases drives a reduction in capital expenditures through capital-labor complementarities, not through downward wage rigidity. 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, Lester, and Reich, 2010; Neumark and Wascher, 2000; Neumark, Salas, and Wascher, 2014; Meer and West, 2016). Nonetheless, I include changes in hiring and separation rates (or net hiring rates) in the first difference regression, and confirm that neither the statistical nor the economic significance of β_3 changes.

To lend further credence to this identification strategy, I separately estimate Equation (3.2) for 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. *Food services and drinking places* and *Accommodation* are the industries that have the highest fractions (Panel C of Table 2).[6]

The estimates in Columns (2) and (3) of Panel B in Table 2 support this pre-

[6]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. *Wall Street Journal*, "Minimum Wage Increases Likely to Hit Restaurant Profits, Moody's Says," June 11, 2015

diction. The negative effects are more (less) pronounced for firms in the industries that are most (least) subject to the changes in minimum wage laws. The difference between two coefficients, 1.15 percentage points, across regressions is statistically and economically significant.[7]

In addition to the cross-industry tests, I estimate Equation (3.2) across states with high and low level of employment protection legislation. The idea is that 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 a high level 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).

Columns (4) and (5) of Panel B in Table 2 present the estimation results. The negative effects are stronger (weaker) for firms in states with a high level of employment protection. The difference between those two coefficients, 1.27 percentage points, across regressions is statistically and economically significant. Overall, these

[7]Consistent with the results in Panel A of Table 3, the negative effect in Column (3) of Panel B, Table 2, is stronger for firms with higher labor intensity than for firms with lower labor intensity, which indicates that labor market frictions drive my results. For brevity, these results are not reported here.

two cross-sectional findings provide support for the notion that the lower investment is driven by the minimum wage increases.

To complete this analysis, it is essential to show that my measure indeed grows after the minimum wage increases. This is because minimum wage increases may affect investment decisions without affecting downward wage rigidity. Using the same dummy variable in Equation (3.2), I estimate the following first difference regression of changes in the downward wage rigidity measure:

$$\Delta DWR_{i,s,t} = \alpha_t + \beta_1 \mathbb{1}_{\Delta w_{s,t-1}>0} + \Delta\epsilon_{i,s,t} \tag{3.3}$$

Panel C of Table 1 displays the results of Equation (3.3). The measure grows after an increase in the minimum wage, and this relation is stronger for firms in the industries that are most subject to minimum wage increases.[8]

Placebo Test

In this section I perform a placebo test to check whether a *false* minimum wage increase affects investment. Specifically, I repeat the estimation of Equation (3.2) using pseudo changes in minimum wage laws. To construct pseudo minimum wage changes, I randomly assign a firm's headquarters by maintaining a cross-sectional distribution of firm headquarters as well as a panel structure of state minimum wage laws. I repeat this exercise 1,000 times and save the coefficients on $\mathbb{1}_{\Delta w_{s,t-1}>0}$ to gauge the likelihood of obtaining a significant coefficient absent true shocks to a firm's downward wage rigidity.

[8]As discussed in Section 2.0.3, Equation (3.3) also checks the validity of my measure. Including state-level variables (real GDP growth rates, log of population, and unemployment rates) in the equation does not alter the results.

Panel D of Table 2 reports the empirical distribution of the coefficients on $\mathbb{1}_{\Delta w_{s,t-1}>0}$ based on the random sample. The mean and median of the distribution are close to zero. Moreover, the estimate in Column (1) of Panel A (-0.0117) falls below the 1% threshold (see Figure A1). This level of statistical significance is similar to that in the true estimation shown in Panel A. Therefore the negative effect of a minimum wage increase on investment is not obtained by random chance.

3.1.3 Do Labor Market Frictions Drive Investment Cuts?

The baseline results in this paper show a significant decline in investment rates in the presence of downward wage rigidity. In this section, I conduct two conditional analyses to confirm that labor market frictions drive the investment cuts.

Conditional Analysis by Labor Intensity

I first examine whether the magnitudes of the negative effect of downward wage rigidity on investment are different in the least and the most labor-intensive firms. I define labor intensity as a ratio of labor costs to sales, as in Gorodnichenko and Weber (2016).[9]

Panel A of Table 3 reports these findings. Column (1) is based on the least labor-intensive firms, and Column (2) uses the most labor-intensive firms. Downward wage rigidity is negatively associated with investment for the least labor-intensive firms, but the relation is statistically insignificant. However, the most labor-intensive firms exhibit a significant negative relation between the labor market friction and investment. The magnitude of this negative relation (-0.3235) almost doubles from

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

the baseline result (-0.1693) in Column (2) of Panel A in Table 2. For the most labor-intensive firms, a one standard deviation increase (1.70%) in downward wage rigidity leads to a 0.55 (0.0170×0.3235) percentage point decrease in the investment rate. Formal statistical tests that compare coefficients between the least and most labor-intensive firms indicate that the negative effect is statistically stronger for firms that rely heavily on labor input. These findings ensure that the investment cut is indeed driven by labor market frictions.

Conditional Analysis by Product Price Stickiness

In addition, the negative effect of downward wage rigidity should be more acute for inflexible-price firms than for flexible-price firms. The idea is that flexible-price firms are able to share a greater portion of the burden of labor costs with customers through cost pass-through: raising the price of products to compensate for higher input costs.

In Columns (1) and (2) of Panel B of Table 3, I find that the negative effect is stronger for firms with stickier prices than for firms with more flexible prices. I use the inverse of the volatility of PPI (producer price index) growth as a measure of price stickiness at the *industry* level.[10] To construct this measure, I use monthly PPI data by NAICS 5-digit industries from the BLS.

I also use the frequency of price adjustment (FPA) as an alternative measure of price stickiness. Using method similar to that used by Gorodnichenko and Weber (2016), I define *industry-level* FPA as the fraction of months with PPI changes during

[10] 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.

the sample period. PPI changes are defined as observations with PPI growth greater than 0.5% or less than -0.5%.[11] I find similar results in Columns (3) and (4). Overall, these conditional analyses provide evidence that labor market friction is a key driver of investment cuts.

[11]Defining PPI changes as observations with non-zero monthly PPI growth yields qualitatively similar results.

Chapter 4

ALTERNATIVE EXPLANATIONS AND ROBUSTNESS

In this section, I investigate the validity of alternative explanations and the robustness of the main results to measurement errors.

4.0.4 Does Labor Adjustment with Capital-Labor Complementarities Drive These Findings?

One potential alternative explanation for a firm's decision to reduce capital expenditures is the need to adjust capital in response to labor adjustments since a firm manages cash flow shortfalls by dismissing current employees (Ofek, 1993; John, Lang, and Netter, 1992; Kang and Shivdasani, 1997). In such cases, downward wage rigidity would have little direct impact on investment decisions, and a firm would reduce its capital expenditures under capital-labor complementarities. Therefore, I control for a firm's labor adjustment by including net hiring rates in the basic specification:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} + \beta_4 NHR_{i,t} + \epsilon_{i,t} \tag{4.1}$$

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, $H_{i,t} = N_{i,t} - N_{i,t-1}$.

In Panel A of Table A2, consistent with the view of capital-labor complementarities, net hiring rates are strongly positively associated with capital expenditures. 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.

A negative shock to cash flow might also require firms to reduce wages of job stayers. Hence, separation rates are likely to be negatively associated with downward wage rigidity. If capital and labor inputs are complements, then lower downward wage rigidity (accompanied by higher layoffs) should be associated with lower investment, which yields a *positive* relation between downward wage rigidity and investment. Hence, layoff decisions are likely to bias my tests against finding a negative relation.

Nevertheless, I include firm-level hiring and separation rates in the following specification in order to re-examine the main results:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} + \beta_4 HR_{i,t} + \beta_5 SR_{i,t} + \epsilon_{i,t} \quad (4.2)$$

where $H(S)R_{i,t}$ refers to firm i's hiring (separation) rate at t. Using the number of employees variable from Compustat does not allow me to separately calculate hiring rates and separation rates. Therefore I calculate $H(S)R_{i,t}$ using hiring (separation) rate data in the QWI from the U.S. Census Bureau (details in Section C).

Similar to Panel A of Table A2, Panel B presents robust negative effects of downward wage rigidity on corporate investment after controlling for labor adjustment. Again, 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), which shows that layoffs are positively associated with corporate investment.[1]

[1] 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.

4.0.5 *Effects of the Business Cycle and Inflation*

Another concern relate 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 entire U.S. economy, the year fixed effects will absorb this possibility. Moreover, Kurmann, McEntarfer, and Spletzer (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. These empirical findings are also consistent with the common notion that inflation is negatively associated with both future economic output and downward wage rigidity. 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 drives the negative relation between them. Indeed, Card and Hyslop (1997) document that downward rigidity of nominal wage becomes weaker during a period of high inflation because firms set their workers' wages more flexibly when inflation is anticipated. Therefore, if inflation stimulates corporate investment, the negative effects reported in this paper could simply be driven by inflation.

In general, inflation has two conflicting effects on corporate investment (Hochman and Palmon, 1983): depreciation and interest effects. 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. Moreover, using an equilibrium market valuation model, Chen and Boness (1975) show that the risk-standardized cost of capital will be overstated (understated), hence leading to under-investment (over-investment), if inflation (deflation) is expected. Therefore, inflation is likely to reduce corporate investment, which biases my tests against finding a negative relation between downward wage rigidity and investment.

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

The empirical proxies for marginal q (or investment opportunities) and downward wage rigidity are likely to contain measurement errors. Using high-order cumulant estimators (Erickson, Jiang, and Whited, 2014), I assess the robustness of the link between downward wage rigidity and corporate investment when these proxies are subject to measurement errors. In addition to Tobin's q, I assume the measure of downward wage rigidity is measured with error because it is based on three-dimensional measures that are estimated from the aggregated microdata.

In Column (1) of Table A3, I report the baseline fixed effect OLS estimators from Column (2) of Panel A in Table 2 for comparison across estimations. Columns (2)-(4) display Erickson, Jiang, and Whited (2014) higher-order cumulant estimators for the fourth, fifth, and sixth cumulants. Consistent with Erickson, Jiang, and Whited (2014), the coefficients on Tobin's q (*Cash Flow*) based on the cumulant estimation are larger (smaller) than those from fixed effect OLS estimation. The coefficients on downward wage rigidity remain significant for all orders of cumulants, and the magnitude of the coefficients becomes even larger. Overall, these results ensure that the relation between labor market frictions and investment is unlikely to be driven by mismeasured Tobin's q or the downward wage rigidity measure.

Chapter 5

VALUE IMPLICATIONS: THE THEORY OF SECOND BEST

The analyses in Section 3.1.1 and 3.1.2 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 implications of labor market frictions in the context of corporate investment.

Consider a typical optimization problem, in which a firm maximizes shareholder value. Imposing an additional friction (e.g., downward wage rigidity), which is binding, 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. The newly added friction may partially counteract the effect of existing frictions on investment (e.g., overinvestment due to overconfidence or to agency problems). Note that if agency problems cause overinvestment, the objective function may also include managers' private benefits from growing a firm. 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. Nonetheless, I conduct two indirect tests of investment efficiency across over- and underinvesting firms using a modified version of valuation regression originally developed by Fama and French (1998) and a revenue-based total factor productivity growth regression following the approach of Kogan et al. (2016).

5.0.7 Valuation Regressions

To examine the relation between labor market friction and firm value, I employ a modified version of the valuation regression developed by Fama and French (1998). 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, Stulz, and Williamson, 2006). I estimate the following valuation regression separately for over- and underinvesting groups:

$$Q_{i,t} = \alpha_{ind} + \alpha_t + \beta_1 Earnings_{i,t} + \beta_2 \Delta Earnings_{i,t} + \beta_3 \Delta Earnings_{i,t+1} + \beta_4 \Delta NAssets_{i,t} \tag{5.1}$$

$$+ \beta_5 \Delta NAssets_{i,t+1} + \beta_6 RD_{i,t} + \beta_7 \Delta RD_{i,t} + \beta_8 \Delta RD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} \Delta Interest_{i,t}$$

$$+ \beta_{11} \Delta Interest_{i,t+1} + \beta_{12} Dividends_{i,t} + +\beta_{13} \Delta Dividends_{i,t} + \beta_{14} \Delta Dividends_{i,t+1}$$

$$+ \beta_{15} \Delta Q_{i,t+1} + \beta_{16} \Delta PP\&E_{i,t} + \beta_{17} \Delta PP\&E_{i,t+1} + \beta_{18} DWR_{i,t} + \epsilon_{i,t}$$

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. $PP\&E_t$ is gross property, plants, and equipment, and $CAPEX_t$ is capital expenditures. *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, plants, and equipment; RD is research and development expenditures; $Interest$ is interest expense; and $Dividends$ is common dividends paid. α_t is the set of year fixed effects, and α_{ind} is the set of industry 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) in the main specifications. 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. Overly confident CEOs have a tendency to overinvest given level of cash flows; the top quintile of the debt overhang correction measure proxies for underinvestment. 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. Following Hennessy (2004), 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.

In Panel A of Table 4, 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 Q for overly confident group, which is 2.13% relative to the median Tobin's q. These valuation regression results of overinvesting firms imply that labor market frictions are not necessarily detrimental to firm value because they might inhibit firms from engaging in wasteful expenditure. This countervailing effect is consistent with the theory of second best.

As a robustness check, I use residuals from the investment regression provided that it yields unbiased estimates of the optimal level of investment. Residuals are sorted into quintiles. The bottom quintile proxies for underinvestment and the top quintile proxies for overinvestment. Note, however, that this method is subject to the joint hypothesis of model misspecification.[1] In Columns (1) and (2) of Panel A of Table A4, I report results that use residuals from the full-sample investment regression with firm and year fixed effects. Similar to the results in Panel A of Table 4, only for overinvesting firms, downward wage rigidity is positively related to firm value. Because using the full sample is subject to look-ahead bias, I use rolling (and expanding) windows to estimate residuals in Columns (3) and (4). The results are stronger, and the underinvesting group now exhibits a negative association between downward wage rigidity and firm value.

I also use CEO tenure as an alternative measure of overinvestment in Panel B of Table A4. Following Pan, Wang, and Weisbach (2016), I break a CEOs' 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 in CEO tenure. 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 × [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 4, 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.

[1]The main proxies for under- or overinvestment used in Table 4 are not subject to this joint hypothesis because they do not depend on a specific investment regression model.

However, the labor market friction is negatively associated with firm value when firms are prone to underinvestment owing to debt overhang (Columns (3) and (4) of Panel A in Table 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 that are caused by the long-term debt it holds. Overall, valuation regression results provide evidence that is consistent with the theory of second best: labor market friction could yield more efficient outcomes by adjusting investment closer to the optimal level.

5.0.8 Total Factor Productivity Growth

The results in Section 5.0.7 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 firm 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 the labor market friction, this finding sheds some light on a mechanism through which the labor market friction can be beneficial to firm value.

I follow an approach similar that used by Kogan et al. (2016) and estimate the following fixed effect regression separately for over- and underinvesting groups using

CEO overconfidence and debt overhang correction measures:

$$TFP_{i,t} - TFP_{i,t-1} = \alpha_{ind} + \alpha_t + \beta_1 DWR_{i,t} + \beta_2 X_{i,t-1} + \epsilon_{i,t} \tag{5.2}$$

where $TFP_{i,t}$ refers to firm i's revenue-based total factor productivity at t, $DWR_{i,t}$ is the downward wage rigidity measure defined in Section 2, α_{ind} is a set of industry fixed effects, α_t is a set of year fixed effects, and $X_{i,t-1}$ is a set of firm-level control variables at t -1: $ln(PP\&E)$, $ln(EMP)$, 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).[2] $ln(PP\&E)$ 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 Q as a ratio of market value of assets to book value of assets, $Leverage$ 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. I add additional controls based on the results in İmrohoroğlu and Tüzel (2014).

Panel B of Table 4 displays the results of the estimation. Consistent with the results from valuation regressions in Section 5.0.7, 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 $\times$ 0.4560) increase in revenue-based productivity of overinvesting firms (Column (2)), whereas the same increase (1.63%) is related to a 1.60% (0.0163 $\times$ 0.9790) decrease in productivity of underinvesting firms (Column (4)).

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

Taken together, the results from Section 5.0.7 and 5.0.8 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 to avoid value-destructive projects.

Chapter 6

MECHANISMS

I examine two potential mechanisms through which downward wage rigidity reduces corporate investment: the debt overhang channel and the operating leverage channel. Both channels rely on the argument that downward wage rigidity converts a wage claim into a debt-like contract that requires firms to pay a fixed amount even though the marginal productivity of labor falls below the current wage. As a result, downward wage rigidity exacerbates the debt overhang problem and increases operating leverage. The operating leverage channel is motivated by the existing literature on the crowding-out effect of operating leverage. Specifically, downward wage rigidity increases operating leverage, which will prevent a firm from using financial leverage when the firm needs to finance its investment. This in turn decreases the ability to finance new investment, and thus decreases capital expenditures. Notice that these two channels are not mutually exclusive or exhaustive. I provide some supporting evidence for these channels.

6.0.9 Debt Overhang Channel

Downward Wage Rigidity and the Likelihood of Default

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 an indirect test by examining the future likelihood of default. The idea is that 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 rates, 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 1 if a firm defaults within the next five years. I include controls following Hovakimian, Kayhan, and Titman (2012).

Column (1) in Panel A of Table 5 shows the result for estimating the fixed effect logistic regression of default indicator on downward wage rigidity, which is estimated using a conditional logistic specification. Controlling for leverage, firms with more downward rigid wages are more likely to default. Column (2) and (3) use linear probability models with industry and firm fixed effects, respectively. The results are robust. These findings are consistent with those of D'Acunto et al. (2015), who document that firms with inflexible output prices are more likely to default.

6.0.10 Operating Leverage Channel

Does Downward Wage Rigidity Increase Operating Leverage?

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 becomes more responsive to a given percentage change in sales. When risk is higher, the firm has less capacity to make new investments. Moreover, operating leverage will crowd out financial leverage, which eventually decreases the firm's ability to finance its investment and thus decreases capital expenditures.

Using an approach similar to that used in 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:

$$\Delta ln\ EBIT_{i,t} = \alpha_i + \alpha_t + \beta_1 \Delta ln\ Y_{i,t} + \beta_2 DWR_{i,t} + \beta_3 \Delta ln\ Y_{i,t} \times DWR_{i,t} + \epsilon_{i,t} \quad (6.1)$$

where $\Delta\ ln\ EBIT$ is a change in the log earnings before interest and taxes and Δ lnY is a change in the log sales.

Panel B of Table 5 provides evidence that is consistent with the operating leverage mechanism. In the absence of downward wage rigidity, given a percentage change in sales, earnings change by 1.06% (Column (2)). A one standard deviation increase (1.69%) in downward wage rigidity is associated with an *additional* 0.05% (0.0169×3.1159) movement in earnings, which is an almost 5% increase relative to the baseline case (1.06%). Therefore the coefficient on the interaction term is statistically and economically significant, which supports the operating leverage channel that links downward wage rigidity to investment

Interaction Effects of Labor Market Frictions and Financing Frictions

As shown in the previous section (Section 6.0.10), downward wage rigidity leads to greater operating leverage. This heightened operating leverage will crowd out financial leverage (e.g., Simintzi, Vig, and Volpin, 2015; Serfling, 2016), and as a result, a firm's ability to finance its investment decreases. These financing constraints cause the firm to reduce investment. If the negative effect of downward wage rigidity on investment is due to the operating leverage channel, I would expect the negative effect to be more acute for firms that are financially constrained. In this section, I investigate the interaction effect of labor market frictions and financing frictions on corporate investment to shed light on a mechanism through which downward wage rigidity affects investment.

A large body of investment literature proposes a number of financial constraint measures (e.g., Kaplan and Zingales, 1997; Whited and Wu, 2006; Hadlock and Pierce, 2010). However, several studies cast doubt on the appropriateness or coherence of those measures. For example, Hennessy and Whited (2007) find that many commonly used ways of measuring financing constraints actually classify firms as less financially constrained as they increase financing cost parameters when generating simulated data. They point out that those measures may represent an endogenous response to the firms' actual financing conditions, either the cost of external funds or the need for funds. Hoberg and Maksimovic (2015) report low correlations among these common financial constraint measures and propose an alternative text-based measure using the information from 10-Ks.

Instead of relying on these financing constraint measures that are prone to endogeneity concerns, I use maturing long-term debt as an identification tool, which was first proposed by Almeida et al. (2012). This strategy exploits heterogeneity in the maturity of long-term debt, which was issued 2, 3, and 4 years before the year of interest, across and within firms.[1] The advantage of using this method is whether a firm had to refinance its long-term debt is plausibly exogenous to its current outcomes or decisions. Exogeneity comes from the fact that long-term debt is typically difficult to renegotiate on short notice in part because of a dispersed creditor structure.

[1]Benmelech, Bergman, and Seru (2011) use a similar strategy to examine the effect of finance on employment.

For groups of firms with the same level of downward wage rigidity, I examine whether firms with long-term debt maturing in the following year reduce their investment by more than firms not required to refinance their long-term debt. Equivalently, for firms that need to refinance, I investigate whether firms with a high level of downward wage rigidity reduce their investment by more than firms with a low level of downward wage rigidity.

$$\begin{aligned}\frac{I_{i,t}}{K_{i,t-1}} &= \alpha_i + \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 DWR_{i,t} \\ &+ \beta_4 \mathbb{1}_{LTD_{i,t}>threshold} + \beta_5 \mathbb{1}_{LTD_{i,t}>threshold} \times DWR_{i,t} + \epsilon_{i,t}\end{aligned} \tag{6.2}$$

where $\mathbb{1}_{LTD_{i,t}>threshold}$ is a dummy variable indicating financing constraints based on the amount of long-term debt (LTD) maturing in the following year that was issued before 2, 3, and 4 years ago. I use three different thresholds to define the dummy variables. Thresholds of 0% and 1% of total assets are somewhat arbitrary even though such a fixed number is used in the literature. However, firms in a certain industry might inherently have a large amount of long-term debt, which makes fixed number thresholds meaningless to those firms. Therefore I also use a time-series median of maturing long-term debt within a firm as an alternative threshold, which varies across firms. This alternative threshold could be a long-run average of the amount of long-term debt maturing in the following year. If LTD is greater (less) than the threshold, a firm becomes more (less) financially constrained.

Table 6 presents the interaction effects of downward wage rigidity and financing frictions on corporate investment decisions. Consistent with the findings in the literature, firms with long-term debt maturing in the following year invest substantially less during the current year. Column (1) shows that firms decrease their investment rates by 2.56 percentage points, which is about 14% relative to the median investment rate. When firms also face downward wage rigidity, they further decrease their investment. A one standard deviation increase (1.71%) in downward wage rigidity is associated with an additional 0.78 (0.0171×0.4571) percentage point decrease in the investment rate, more than a 4% decrease of the median investment rate. Using different thresholds yields qualitatively similar results as shown in the remaining columns.

Chapter 7

CONCLUSION

This paper studies the effect of labor market frictions 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 frictions. Exploiting variation in state-level minimum wage rates as shocks to downward wage rigidity, I find that, following an increase in the minimum wage, firms reduce their investment rate by 1.17 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 frictions drive the main results.

Remarkably, I find that, among firms that overinvest, investment cuts due to downward wage rigidity enhance firm value and production efficiency. This result provides suggestive evidence 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 frictions.

To shed light on mechanisms through which downward wage rigidity affects investment, I show that downward wage rigidity increases a firm's default risk and magnifies its 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. As a result, downward wage rigidity exacerbates the debt overhang problem. Moreover, heightened operating leverage will prevent firms from using financial leverage, which in turn decreases their ability to finance new investment.

The evidence from 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 labor market frictions could play a positive role in improving outcomes by curbing overinvestment when firms are also subject to overinvestment-related frictions. In addition, it has important policy implications by pointing out the unintended consequences of minimum wage policy on corporate investment. More broadly, this paper is part of a larger research agenda designed to investigate 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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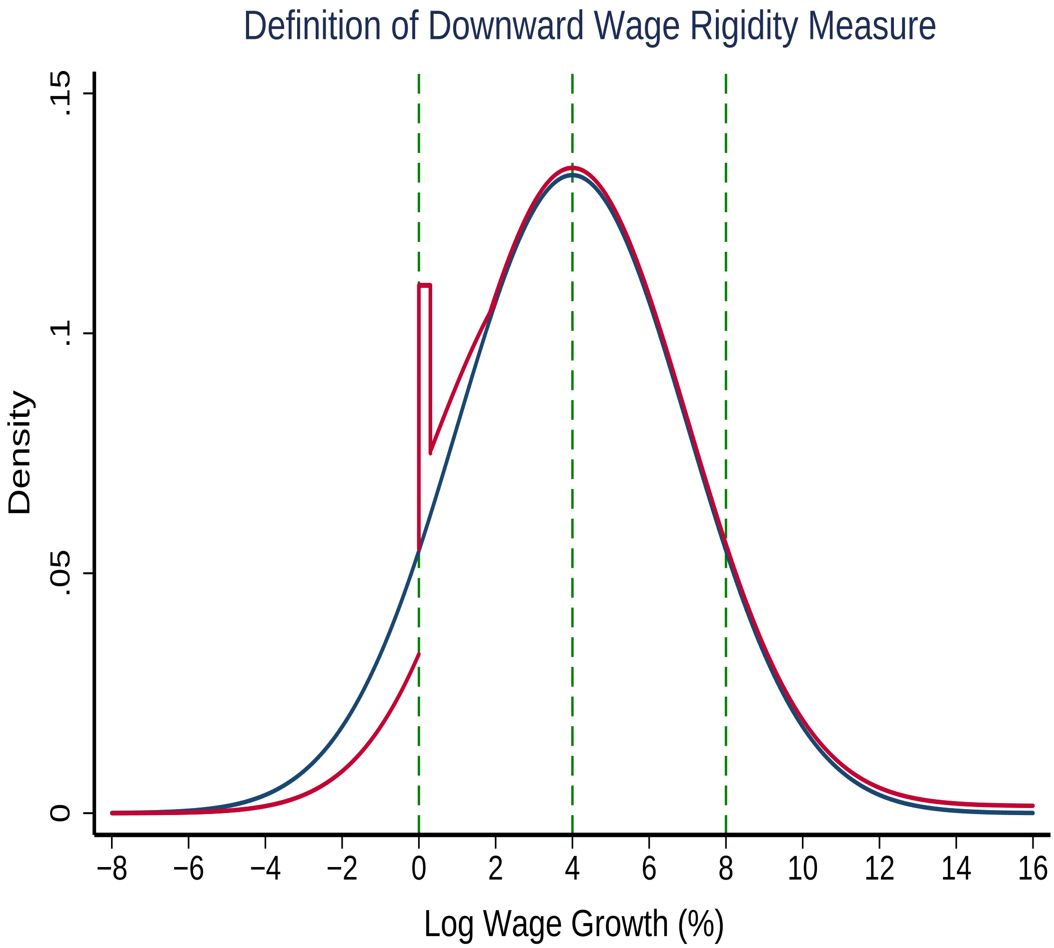
APPENDIX A

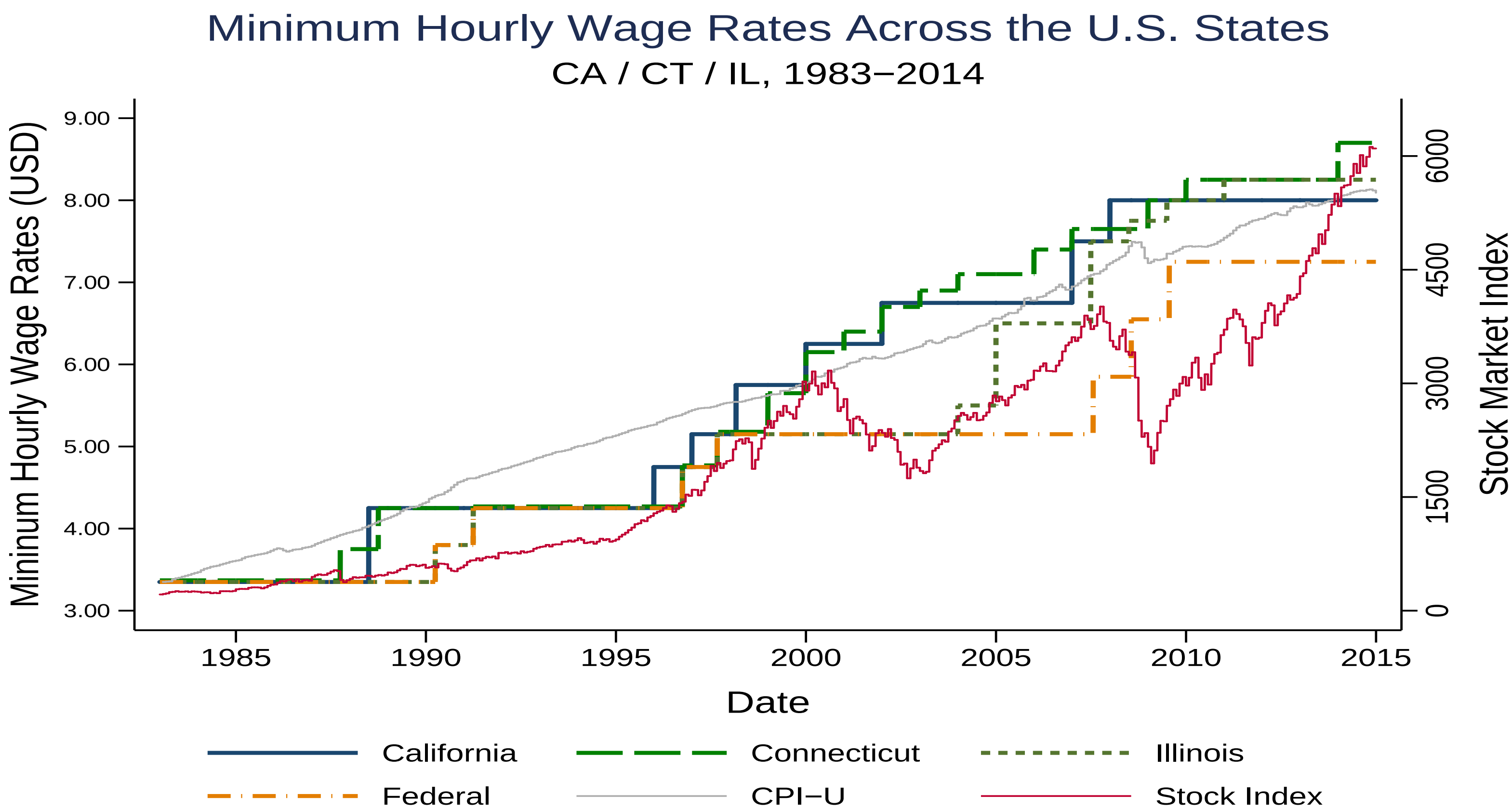
MAIN FIGURES AND TABLES

Figure 1: Measuring Downward Wage Rigidity



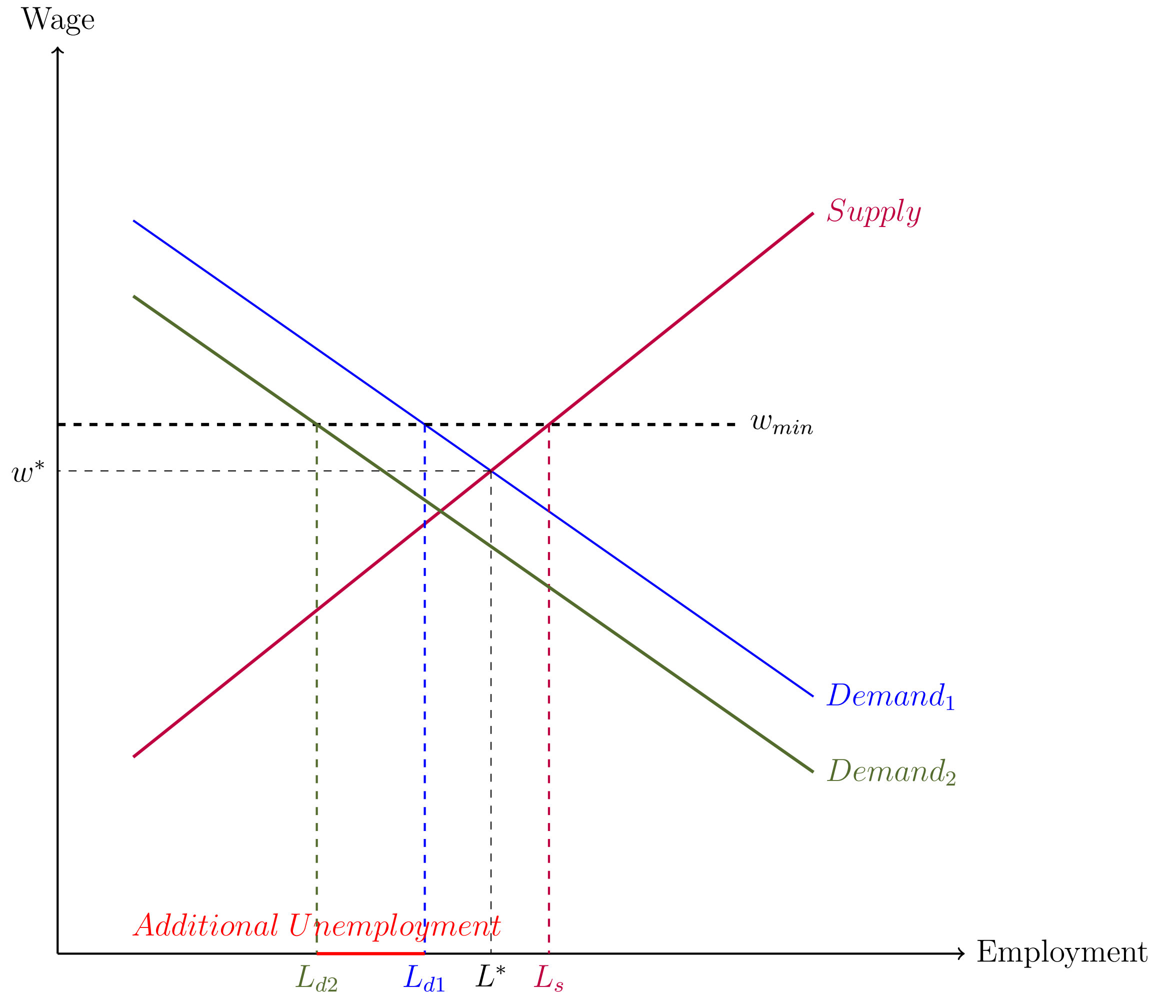
This figure plots the basic concept of downward wage rigidity measures used in Lebow, Stockton, and Wascher (1995) and Kurmann, McEntarfer, and Spletzer (2016). X-axis is the log wage growth and Y-axis shows density. Blue solid line indicates a notional (rigidity free) distribution of wage growth whereas 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. Detailed definitions of downward wage rigidity measures are described in Section 2 and B.

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



This figure shows the time-series of minimum hourly wage rates for California, Connecticut, Illinois, and Federal as an example. I use the historical changes in minimum wages for non-farm private sector employment under state laws reported by the Tax Policy Center that collects data from the Wage and Hour Division (WHD) in the U.S. Department of Labor and from the *Monthly Labor Review* by the Bureau of Labor Statistics. In cases where an employee is subject to both the state and federal minimum wage laws, the employee is entitled to the higher of the two under Section 18 of the Fair Labor Standard Act. I also plot the time-series of the Consumer Price Index for All Urban Consumers (CPI-U) in which the base period is January 1983 (=\$3.25), and the time-series of the value-weighted stock market (NYSE/AMEX/NASDAQ) index. Sample period runs from 1983 to 2014.

Figure 3: Additional Source of Unemployment through Investment Cut: Policy Implication



This figure illustrates an additional source of employment reduction through forgone corporate investment triggered by 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^*. My findings suggest that this might not be the whole story of minimum wage effect. The investment cut resulting from the minimum wage increase will shift demand curve to the left ($Demand_2$), which amplifies employment reduction on the top of imposing minimum wage itself. $L_{d1} - L_{d2}$ is the additional unemployment due to the investment cut. As a caveat, note that this graphical illustration is simplistic in that it does not take into account general-equilibrium effects of minimum wage increase on factor or output prices.

Table 1: Measures of Downward Wage Rigidity and Validity Tests

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. Detailed definitions are reported in Section 2 and B. Panel B presents two lists of NAICS sectors (based on two-digit NAICS codes) ranked by DWR and by unionization rates. To sort NAICS sectors by DWR, I use a time-series average rank for each sector from 1994 to 2014 Q3. Industry unionization rates data comes from the Union Membership and Coverage Database by Hirsch and Macpherson (2003), which is publicly available at www.unionstats.com. They define industry unionization rates as the percentage of an industry's workers covered by unions in their collective bargaining with the firm. I use industry unionization rates as of 2013 to sort NAICS sectors.

Panel A. Descriptive Statistics (%)

DWR Measures	N	Mean	Std. Dev.	p10	p50	p90
DWR	88,438	1.0864	1.6354	0	.5278	2.8983
γ	88,438	1.2016	1.7308	0	.6371	3.1651
η	88,438	.5177	.8416	0	.2401	1.3381
ζ	88,438	1.0801	1.5961	0	.5517	2.7655

Panel B. Lists of NAICS Sectors Ranked by DWR and Unionization Rates

Rank	NAICS Sector	
	DWR Measure	Unionization Rates
1	Finance and Insurance (52)	Educational Services (61)
2	Information (51)	Transportation and Warehousing (48-49)
3	Manufacturing (31-33)	Utilities (22)
4	Transportation and Warehousing (48-49)	Construction (23)
5	Utilities (22)	Manufacturing (31-33)
6	Agriculture, Forestry, Fishing and Hunting (11)	Information (51)
7	Mining, Quarrying, and Oil and Gas Extraction (21)	Health Care and Social Assistance (62)
8	Professional, Scientific, and Technical Services (54)	Arts, Entertainment, and Recreation (71)
9	Other Services (except Public Administration) (81)	Mining, Quarrying, and Oil and Gas Extraction (21)
10	Admin. and Support / Waste Mgt. and Remediation (56)	Real Estate and Rental and Leasing (53)
11	Health Care and Social Assistance (62)	Wholesale Trade (42)
12	Real Estate and Rental and Leasing (53)	Admin. and Support / Waste Mgt. and Remediation (56)
13	Educational Services (61)	Retail Trade (44-45)
14	Management of Companies and Enterprises (55)	Other Services (except Public Administration) (81)
15	Arts, Entertainment, and Recreation (71)	Management of Companies and Enterprises (55)
16	Construction (23)	Accommodation and Food Services (72)
17	Wholesale Trade (42)	Finance and Insurance (52)
18	Accommodation and Food Services (72)	Professional, Scientific, and Technical Services (54)
19	Retail Trade (44-45)	Agriculture, Forestry, Fishing and Hunting (11)

Table 1: Measures of Downward Wage Rigidity and Validity Tests (continued)

Panel C presents results from validity tests on downward wage rigidity measure. I run the first difference regressions of *changes* in DWR (in percentage) on a dummy variable indicating minimum wage increase. I use the historical changes in minimum wages under state laws reported by the Tax Policy Center. The Tax Policy Center uses data from the Wage and Hour Division (WHD) in the U.S. Department of Labor and from the *Monthly Labor Review* by the Bureau of Labor Statistics. In cases where an employee is subject to both the state and federal minimum wage laws, the employee is entitled to the higher of the two under Section 18 of the Fair Labor Standard Act. I exclude 15 states that have indexed their minimum wage rates to inflation for the reason discussed in Section 3.1.2. $\mathbb{1}_{\Delta w_{s,t-1}>0}$ is a dummy variable indicating minimum wage increase at time t -1 in state s where a firm's headquarters is located. Industries that are most (or least) subject to minimum wages are defined as those with above (or below) median percentage of hourly workers with earnings at or below the prevailing federal minimum wage as of 2015. Minimum wage workers data comes from the *Labor Force Statistics from the Current Population Survey* by the Bureau of Labor Statistics. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by state.

Panel C. Validity Tests of Downward Wage Rigidity Measure: Using Changes in Minimum Wage Laws in the States

	Dependent Variable: Δ(DWR)		
	Full Sample	Industries Least Subject to Min Wage	Industries Most Subject to Min Wage
	(1)	(2)	(3)
$\mathbb{1}_{\Delta w_{s,t-1}>0}$	.0885	.0255	.2596***
	(.0789)	(.0947)	(.0827)
H_0: $\mathbb{1}_{\Delta w_{s,t-1}>0}$ in (2) - (3) = 0		-0.2341***	
[p-value]		[.0068]	
Year FE	Y	Y	Y
# of Firm-Year Obs.	38,560	28,422	9,533
Adjusted R^2	.0968	.0995	.1141

Table 1: Measures of Downward Wage Rigidity and Validity Tests (continued)

Panel D provides descriptive statistics for firm-year observations from 1994 to 2014 Q3. *Low DWR* and *High DWR* groups are based on the median DWR for every year. Column (3) shows mean differences in variables between *Low DWR* and *High DWR* groups. Detailed definition of each variable is reported in Section D. *Log Assets* is the log book value of assets converted into December 2012 constant dollars using the Consumer Price Index for All Urban Consumers (CPI-U) inflation rates, *Investment* is defined as capital expenditures normalized by the beginning-of-the-year capital stock (property, plants, and equipment), *R&D* as research and development expenditures normalized by the beginning-of-the-year capital stock, *NHR* as net hiring rates, *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock, *Q* as a ratio of market value of assets to book value of assets, *Cash* as cash and short-term investments normalized by book value of assets, *Profitability* as income before extraordinary items plus depreciation and amortization normalized by book value of assets, and *Leverage* as book value of long-term debt plus debt in current liabilities normalized by book value of assets. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel D. Firm-Year Observations: Low DWR vs. High DWR

Variables	(1)	(2)	(3)
	Mean		
	Low DWR	High DWR	(2)-(1)
DWR(%)	0.2026	2.0223	1.8197 ***
Log Assets	6.6975	6.7496	0.0522***
Investment	0.2634	0.2633	-0.0002
R&D	0.1949	0.2339	0.0390***
NHR(Net Hiring Rate)	0.0286	0.0310	0.0024
Cash Flow	0.3265	0.3761	0.0496***
Q	1.6488	1.7298	0.0810***
Cash	0.1280	0.1358	0.0078***
Profitability	0.0561	0.0609	0.0048***
Leverage	0.2883	0.2832	-0.0051***

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. Detailed definitions are reported in Section 2. The dependent variables are *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plants, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and Q as a ratio of market value of assets to book value of assets. Column (3) uses firm-year observations with positive downward wage rigidity measure. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm.

Panel A. Using Downward Wage Rigidity Measure

	Dependent Variable: Corporate Investment		
	With Dummy	Without Dummy	
		Full	Cond. on $\exists$ DR
	(1)	(2)	(3)
$\mathbb{1}_{DWR>0}$	.0026		
	(.0023)		
DWR	-.1958***	-.1693***	-.2462***
	(.0548)	(.0515)	(.0584)
Cash Flow	.0382***	.0382***	.0441***
	(.0023)	(.0023)	(.0030)
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 B shows results from the first difference regressions of *changes* in corporate investment on a dummy variable indicating minimum wage increase (Equation (3.2)). I use the historical changes in minimum wages under state laws reported by the Tax Policy Center. The Tax Policy Center uses data from the Wage and Hour Division in the U.S. Department of Labor and from the *Monthly Labor Review* by the Bureau of Labor Statistics (BLS). In cases where an employee is subject to both the state and federal minimum wage laws, the employee is entitled to the higher of the two under Section 18 of the Fair Labor Standard Act. I exclude 15 states that have indexed their minimum wage rates to inflation for the reason discussed in Section 3.1.2. $\mathbb{1}_{\Delta w_{s,t-1}>0}$ is a dummy variable indicating minimum wage increase at time t -1 in state s where a firm's headquarters is located. I also control for state-level macro-variables: real GDP growth rates, log of population, and unemployment rates. 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 as of 2015. Minimum wage workers data comes from the *Labor Force Statistics from the Current Population Survey* by the BLS. States with high (low) level of employment protection legislation (EPL) are defined as those having *Wrongful Discharge Law Score* of 2 or 3 (0 or 1). Detailed definition of the score is reported in Section D. $[p-value]$ below H_0: $\mathbb{1}_{\Delta w_{s,t-1}>0}$ in (2)-(3)[(4)-(5)] = 0 is based on a one-tailed test. Standard errors in parentheses are robust to heteroskedasticity and clustered by state.

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

	Dependent Variable: Δ(Corporate Investment)				
	Full Sample	Industries Least Subject to Min Wage	Industries Most Subject to Min Wage	States with Low EPL	States with High EPL
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}_{\Delta w_{s,t-1}>0}$	-.0117*** (.0038)	-.0080* (.0041)	-.0195*** (.0067)	-.0016 (.0036)	-.0143*** (.0040)
$\Delta CashFlow$	.0231*** (.0021)	.0276*** (.0028)	.0139*** (.0042)	.0159*** (.0032)	.0252*** (.0026)
ΔQ	.0707*** (.0027)	.0671*** (.0039)	.0762*** (.0028)	.0654*** (.0100)	.0714*** (.0026)
$\Delta GDP\ growth$	.0016 (.0011)	.0010 (.0011)	.0028 (.0017)	-.0010 (.0013)	.0021* (.0013)
$\Delta ln(Population)$	-.2417 (.1779)	-.2004 (.1616)	-.4592 (.3819)	-.2649 (.1643)	-.1424 (.2449)
$\Delta Unemp$	-.0016 (.0032)	-.0026 (.0030)	.0024 (.0041)	-.0013 (.0040)	-.0012 (.0039)
H_0: $\mathbb{1}_{\Delta w_{s,t-1}>0}$ in (2)-(3) [(4)-(5)] = 0		0.0115*		0.0127***	
[p-value]		[.0670]		[.0079]	
Year FE	Y	Y	Y	Y	Y
# of Firm-Year Obs.	33,310	24,818	8,430	8,677	24,633
Adjusted R^2	.1057	.0986	.1285	.0789	.1135

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

Panel C lists industries that are most prone to the minimum wage rates. Panel D repeats the estimation of Column (1) of Panel B using 1,000 random samples where I randomly assign a firm's headquarters, and shows the empirical distribution of the coefficients on $\mathbb{1}_{\Delta w_{s,t-1}>0}$. The sample period runs from 1994 to 2014 Q3. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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

2012 Census Industry Classification	2012 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

Panel D. Placebo Test: Regression Coefficients from Bootstrapped Sample

	(1) of Panel B	Mean	p1	p5	p10	p25	p50	p75	p90	p95	p99
$\mathbb{1}_{\Delta w_{s,t-1}>0}$	-0.0117	.0002	-.0061	-.0043	-.0034	-.0018	.0003	.0020	.0036	.0050	.0072

Table 3: Conditional Analysis by Labor Intensity and Product Price Stickiness: Differential Effects of Downward Wage Rigidity on Corporate Investment

Panel A presents fixed effect OLS regression results conditional on labor intensity. Column (1) is based on the least labor-intensive firms whereas Column (2) uses the most labor-intensive firms. I define labor intensity as a ratio of labor costs to sales. I first calculate median value of these ratios for a given SIC industry every year, then sort all industries into quintiles based on the time series median of each industry's labor intensity. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct the *DWR* measure. Detailed definitions are reported in Section 2. The dependent variables are *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock. I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and Q as a ratio of market value of assets to book value of assets.

Panel A. Labor Intensity

	Dependent Variable: Corporate Investment	
	Least Labor Intensive Firms	Most Labor Intensive Firms
	(1)	(2)
DWR	-.0325	-.3235**
	(.0930)	(.1367)
Cash Flow	.0499***	.0270***
	(.0064)	(.0041)
Q	.0917***	.0752***
	(.0072)	(.0043)
H_0: DWR_{Least} - $DWR_{Most} = 0$	0.2910**	
[p-value]	[.0391]	
Firm and Year FE	Y	Y
# of Firm-Year Obs.	13,371	12,761
Adjusted R^2	.1393	.1863

Table 3: Conditional Analysis by Labor Intensity and Product Price Stickiness: Differential Effects of Downward Wage Rigidity on Corporate Investment (continued)

Panel B presents fixed effect OLS regression results conditional on product price stickiness. Column (1) and (2) are based on the inverse of the volatility of PPI (Producer Price Index) growth while the remaining columns are based on the frequency of price adjustment (FPA). To construct these measures, I use monthly PPI data by NAICS 5-digit industries from the BLS. Using a similar method used in Gorodnichenko and Weber (2016), I define *industry-level* FPA as a fraction of months with PPI changes during the sample period. PPI changes are defined as observations with PPI growth greater than 0.5% or less than -0.5%. These product price stickiness measures are then sorted into terciles. [$p-value$] below H_0: DWR_{Least} - $DWR_{Most} = 0$ is based on a one-tailed test. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel B. Product Price Stickiness

	Dependent Variable: Corporate Investment			
	Least Sticky (Low $\frac{1}{vol(\Delta PPI)}$)	Most Sticky (High $\frac{1}{vol(\Delta PPI)}$)	Least Sticky (High FPA)	Most Sticky (Low FPA)
	(1)	(2)	(3)	(4)
DWR	-.0552	-.2594**	-.0439	-.2211*
	(.0642)	(.1202)	(.0660)	(.1205)
Cash Flow	.0488***	.0477***	.0409***	.0447***
	(.0104)	(.0041)	(.0098)	(.0038)
Q	.0911***	.0737***	.0896***	.0745***
	(.0054)	(.0039)	(.0055)	(.0038)
H_0: DWR_{Least} - $DWR_{Most} = 0$	0.2042*		0.1772*	
[p-value]	[.0665]		[.0980]	
Firm and Year FE	Y	Y	Y	Y
# of Firm-Year Obs.	17,470	19,782	16,705	19,905
Adjusted R^2	.1532	.1996	.1491	.1985

Table 4: Downward Wage Rigidity, Firm Value and Production Efficiency: Differential Effects Across Over- and Underinvestment Using CEO Overconfidence and Debt Overhang Correction

Panel A presents the results from a modified version of the valuation regression developed by Fama and French (1998), a fixed effect OLS regression of Tobin's q on downward wage rigidity 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 debt overhang correction measure of Hennessy (2004), total recovery value of long-term debt at default normalized by total amount of capital. The 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. Detailed definitions are reported in Section 2. 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 ΔQ_{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, plants, and equipment; $NAssets$ is the book value of total assets minus gross property, plants, and equipment; RD is research and development expenditures; $Interest$ is interest expense; and $Dividends$ is common dividends paid.

Panel A. Valuation Regression Using Tobin's q

	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 4: Downward Wage Rigidity, Firm Value and Production Efficiency: Differential Effects Across Over- and Underinvestment Using CEO Overconfidence and Debt Overhang Correction (continued)

Panel B presents the results from fixed effect OLS regressions of revenue-based total factor productivity (TFP) growth on downward wage rigidity 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 are: $ln(PP\&E)$, $ln(EMP)$, 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. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by industry (SIC 2-digit). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel B. Total Factor Productivity Growth

	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

Table 5: Mechanisms: Debt Overhang and Operating Leverage

Panel A presents fixed effect regressions of future defaults on downward wage rigidity. The dependent variable is a binary variable which equals 1 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. Detailed definitions are reported in Section 2. Control variables are: *Market-to-Book*, *Tangibility*, *RD*, *Selling Expense*, *Profitability*, *Leverage*, *ln(Sales)*, and *ln(age)*. I define *Market-to-Book* 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, *RD* 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 whereas Column (2) and (3) use linear probability models with fixed effects. The sample period runs from 1994 to 2007. Standard errors in parentheses are robust to heteroskedasticity and clustered by either industry (SIC 2-digit) or firm.

Panel A. Debt Overhang Channel: Downward Wage Rigidity and Likelihood of Default

	Dependent Variable: $\mathbb{1}_{\{firm\ defaults\ within\ the\ next\ five\ years\}}$		
	Conditional Logit	Linear Prob. Model	Linear Prob. Model
	(1)	(2)	(3)
DWR	4.9321***	.1084**	.0551*
	(1.7981)	(.0502)	(.0299)
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)
RD	-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: Mechanisms: Debt Overhang and Operating Leverage (continued)

Panel B presents fixed effect OLS regressions of change in the log earnings before interest and taxes, $\Delta\ ln\ EBIT$, on change in the log sales, $\Delta\ lnY$. I interact the log sales with *DWR*. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel B. Operating Leverage Channel

	Dependent Variable: Δ *ln EBIT*	
	With Dummy	Without Dummy
	(1)	(2)
Δ ln Y	1.0541***	1.0648***
	(.0404)	(.0289)
$\mathbb{1}_{DWR>0}$	-.0137	
	(.0091)	
$\mathbb{1}_{DWR>0} \times \Delta$ ln Y	.0189	
	(.0505)	
DWR	.4788*	.3352
	(.2662)	(.2448)
DWR $\times\ \Delta$ ln Y	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 6: Interaction Effect of Labor Market and Financing Frictions on Corporate Investment

This table presents fixed effect OLS regression results conditional on firms' financing frictions. Financing frictions are measured by the amount of long-term debt maturing in the following year that was issued before 2, 3, and 4 years ago (Almeida et al., 2012). I use three different thresholds to define dummy variable, $\mathbb{1}_{LTD>threshold}$: 0%, 1% of total assets (TA), and time-series (TS) median of maturing long-term debt within a firm. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct *DWR*. Detailed definitions are reported in Section 2. Column (1) through (3) include interaction terms between $\mathbb{1}_{LTD>threshold}$ and *DWR*. I separately run regressions for below median and above median groups based on time-series median threshold in Column (4) and (5). The dependent variable in all columns is *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock. Control variables are *Cash Flow* and *Q*. $[p-value]$ below H_0: DWR_{Below} - $DWR_{Above} = 0$ is based on a one-tailed test. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Corporate Investment				
	Long-Term Debt Due Threshold				
	0% of TA	1% of TA	TS Median	TS Median	
				Below Median	Above Median
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}_{DWR>0}$	-.0068 (.0066)	-.0023 (.0044)	.00002 (.0035)	-.0009 (.0039)	.0010 (.0034)
DWR	.2783 (.1915)	.1711 (.1211)	-.0024 (.0875)	.0075 (.0985)	-.1541** (.0753)
$\mathbb{1}_{LTD>threshold}$	-.0256*** (.0066)	-.0203*** (.0043)	-.0145*** (.0036)		
$\mathbb{1}_{LTD>threshold} \times \mathbb{1}_{DWR>0}$	.0105 (.0069)	.0056 (.0049)	.0029 (.0044)		
$\mathbb{1}_{LTD>threshold} \times$ DWR	-.4571** (.1996)	-.4091*** (.1319)	-.1802* (.1087)		
H_0: DWR_{Below} - $DWR_{Above} = 0$ [p-value]				0.1616* [.0942]	
Controls / Firm and Year FE	Y	Y	Y	Y	Y
# of Firm-Year Obs.	45,932	45,932	45,932	26,232	19,700
Adjusted R^2	.1538	.1544	.1541	.1515	.1478

APPENDIX B

ALTERNATIVE MEASURES OF DOWNWARD WAGE RIGIDITY

I construct the following three alternative measures (γ, η, and ζ) of downward wage rigidity. For each firm-size and year-quarter pair, I calculate firm-size-level downward wage rigidity measures using a rich set of cross-sectional data on wage growth at state $\times$ NAICS 4 digit $\times$ employee gender $\times$ employee age level.

$$\begin{aligned}
\gamma_{d,t} &= \int_{2\cdot med_{d,t}+0.005}^{\infty} f_{d,t}(x)dx - \int_{-\infty}^{-0.005} f_{d,t}(x)dx \qquad \text{(B.1)}\\
\eta_{d,t} &= \int_{-0.005}^{0.005} f_{d,t}(x)dx - \int_{2\cdot med_{d,t}-0.005}^{2\cdot med_{d,t}+0.005} f_{d,t}(x)dx \\
\zeta_{d,t} &= \left[0.5 - \int_{-\infty}^{0.005} f_{d,t}(x)dx\right] - \left[\int_{-\infty}^{2\cdot med_{d,t}-0.005} f_{d,t}(x)dx - 0.5\right]
\end{aligned}$$

$$where\ \ d\ \in\ \{fs\ (firm\ size),\ ind\ (industry),\ st\ (state)\}$$

where $f_{d,t}$ 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. γ essentially compare 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 calculate number-of-employees weighted medians.

To construct a firm-level measure, I first calculate, for a given firm, the value-weighted average of industry-level downward wage rigidity measures (Equation B.1) across the business segments in which the firm operates. I use sales from the Compustat Segment files as weights. Then I define the firm-level measure as an average of three-dimensional (firm-size, industry, headquarters state) measures as follows:

$$\gamma_{i,t} = \frac{1}{3}\left[\gamma_{fs=fs_i,t} + \frac{\sum_{ind_j} Sales_{i,ind_j,t}\cdot\gamma_{ind=ind_j,t}}{\sum_{ind_j} Sales_{i,ind_j,t}} + \gamma_{st=st_i,t}\right] \qquad \text{(B.2)}$$

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. $\eta_{i,t}$ and $\zeta_{i,t}$ are similarly defined.

APPENDIX C

HIRING / SEPARATION RATES

I calculate firm-level hiring (separation) rates using hiring (separation) rate data in the Quarterly Workforce Indicator from the U.S. Census Bureau. Hiring (separation) rate is defined as hirings (separations) as a fraction of 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), 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 only at the aggregate level. 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 where segment-sales weighted industry level hiring (separation) rates are used for the industry dimension (see Equation 2.4).

APPENDIX D

OTHER VARIABLE DEFINITIONS

Variables	Definition (variables in brackets refer to Compustat designations where appropriate)
Investment	capital expenditures [CAPX] normalized by the beginning-of-the-year capital stock (property, plants, and equipment) [PPENT]
Cash Flow	earnings before extraordinary items [IB] plus depreciation [DP] normalized by the beginning-of-the-year capital stock [PPENT]
Q	Tobin's q: 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
Δ *ln EBIT*	changes in the log earnings before interest and taxes [EBIT]
Δ *ln Y*	changes in the log sales [SALE]
PP&E	gross property, plants, and equipment [PPEGT] normalized by book value of assets [AT]
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, plants, and equipment [PPEGT] normalized by book value of assets [AT]
RD	research and development expenditures [XRD] 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]
Leverage	book value of long-term debt [DLTT] plus debt in current liabilities [DLC] normalized by book value of assets [AT]
Size	book value of assets [AT]
Profitability	income before extraordinary items [IB] plus depreciation and amortization [DP] normalized by book value of assets [AT]

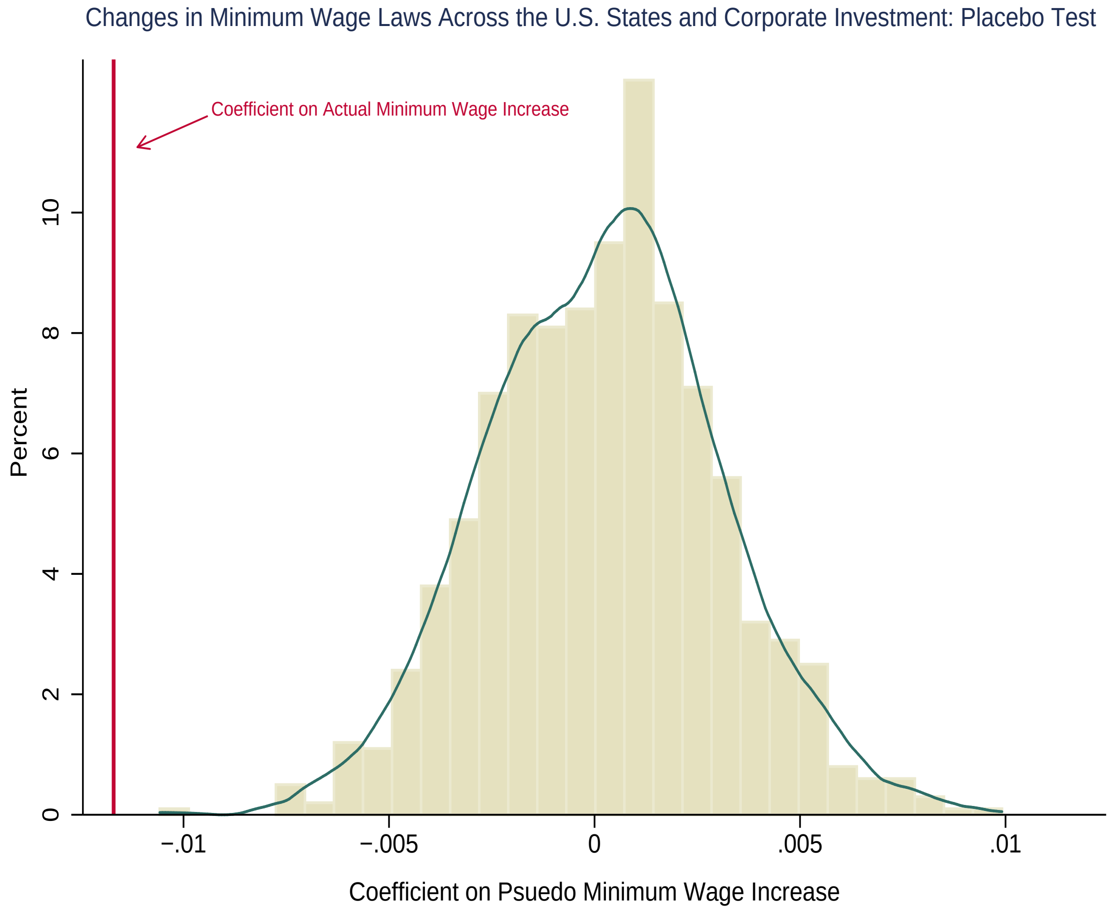
Cash	cash and short-term investment [CHE] normalized by book value of assets [AT]
ln(Sales)	the log of sales [SALE]
ln(PP&E)	the log of capital stock (property, plants, and equipment) [PPENT]
ln(ME)	the log of market value of equity where market value of equity is defined as common shares outstanding [CSHO] times fiscal-year closing price [PRCC_F]
ln(EMP)	the log of number of employees [EMP]
Tangibility	net property, plants, and equipment [PPENT] nomalized by book value of assets [AT]
Selling Expense	selling, general, and administrative expense [XSGA] nomalized by sales [SALE]
NHR	net hiring rates: $NHR_t = H_t/[0.5 \times (N_{t-1} + N_t)]$ 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 ($H_t = N_t - N_{t-1}$)
Labor Intensity	total staff expense [XLR] over sales [SALE]
Wrongful Discharge Law Score	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.
CEO Overconfidence	CEO overconfidence measure of Campbell et al. (2011)
Debt Overhang Correction	Debt overhang correction measure of Hennessy (2004): total recovery value of long-term debt at default normalized by total amount of capital, calculated using 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
TFP	revenue-based total factor productivity, constructed using the methodology of Olley and Pakes (1996) and the procedure of İmrohoroğlu and Tüzel (2014)
$\dfrac{1}{vol(\Delta PPI)}$	inverse of the volatility of monthly PPI (Producer Price Index) growth

FPA	frequency of price adjustment, constructed using a similar methodology of Gorodnichenko and Weber (2016): a fraction of months with PPI changes during the sample period where PPI changes are defined as observations PPI growth greater than 0.5% or less than -0.5%
$\mathbb{1}_{\{firm\ defaults\ within\ the\ next\ five\ years\}}$	binary variable which equals 1 if a firm defaults within the next five years, constructed using bankruptcy filing information from the UCLA-LoPucki Bankruptcy Research Database
$\mathbb{1}_{LTD>threshold}$	binary variable which equals 1 if *LTD* is greater than *threshold* where *LTD* refers to the amount of long-term debt maturing in the following year that was issued before 2, 3, and 4 years ago, and *threshold* is one of the following: 0% or 1% of total assets, or time-series median of *LTD* within a firm (Almeida et al., 2012)
$Tenure\ Dummy_{\ years\ [3,5] (years\ 6\ and\ after)}$	binary variables for the second (third) period in CEO tenure where I break a CEO's entire tenure length into three periods following Pan, Wang, and Weisbach (2016): years [0,2], years [3,5], and years 6 and after
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

APPENDIX E

ADDITIONAL FIGURES AND TABLES

Figure A1: Changes in Minimum Wage Laws Across the U.S. States and Corporate Investment: Placebo Test



This figure is based on the following first difference regressions:

$$\Delta \frac{I_{i,s,t}}{K_{i,s,t-1}} = \alpha_t + \beta_1 \Delta Q_{i,s,t-1} + \beta_2 \Delta \frac{CF_{i,s,t}}{K_{i,s,t-1}} + \beta_3^{Pseudo} \mathbb{1}^{Pseudo}_{\Delta w_{s,t-1}>0} + \beta_4 \Delta X_{s,t-1} + \Delta \epsilon_{i,s,t}$$

where $I_{i,s,t}$ is investment, $CF_{i,s,t}$ refers to cash flow, $K_{i,s,t-1}$ is beginning-of-the-year capital, $Q_{i,s,t-1}$ indicates Tobin's q as a proxy for investment opportunities, α_t is a set of year fixed effects, and $X_{s,t-1}$ is a set of state-level macro-variables: real GDP growth rates, log of population, and unemployment rates. $\mathbb{1}^{Pseudo}_{\Delta w_{s,t-1}>0}$ is a dummy variable indicating minimum wage increases at time t -1 in state s where firm i's *hypothetical* headquarters is located. I randomly assign a firm's headquarters, and repeat the estimation 1,000 times. The above figure is a density plot of β_3^{Pseudo}. 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 green line shows kernel density. The sample period runs from 1994 to 2014 Q3. Standard errors are clustered by state.

Table A1: The Effects of Downward Wage Rigidity on Corporate Investment: Using Alternative Measures

This table present 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. Detailed definitions are reported in Section 2. The dependent variables in all columns are *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plants, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and Q as a ratio of market value of assets to book value of assets. Column (3), (6) and (9) use firm-year observations with positive 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. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Corporate 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 A2: Labor Adjustments and The Effects of Downward Wage Rigidity on Corporate Investment

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. Details are described in Section C. The dependent variables in all columns are *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plants, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and Q as a ratio of market value of assets to book value of assets. Column (3) uses firm-year observations with positive *DWR*. I use the Quarterly Workforce Indicators from the U.S. Census Bureau to construct *DWR*. Detailed definitions of the measure are reported in Section 2. The sample period runs from 1994 to 2014 Q3. Standard errors in parentheses are robust to heteroskedasticity and clustered by firm. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Net Hiring Decisions

	Dependent Variable: Corporate Investment		
	With Dummy	Without Dummy	
		Full Sample	Cond. on ∃ DR
	(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)
Q	.0700***	.0700***	.0682***
	(.0022)	(.0022)	(.0024)
Firm and Year FE	Y	Y	Y
# of Firm-Year Obs.	65,923	65,923	48,919
Adjusted R^2	.2052	.2052	.2075

Table A2: Labor Adjustments and The Effects of Downward Wage Rigidity on Corporate Investment (continued)

Panel B. Hiring and Layoff Decisions

	Dependent Variable: Corporate Investment		
	With Dummy	Without Dummy	
		Full Sample	Cond. on ∃ DR
	(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)
Q	.0762***	.0762***	.0737***
	(.0022)	(.0022)	(.0025)
Firm and Year FE	Y	Y	Y
# of Firm-Year Obs.	69,661	69,661	51,060
Adjusted R^2	.1721	.1721	.1770

Table A3: Measurement Errors in Tobin's q and Downward Wage Rigidity Measure: Linear Cumulant Equations

This table presents the results of regressing corporate investment on *DWR* using the linear high-order cumulant equations (Erickson, Jiang, and Whited, 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*. Detailed definitions are reported in Section 2. The dependent variables in all columns are *Investment* measured as capital expenditures normalized by the beginning-of-the-year capital stock (property, plants, and equipment). I measure *Cash Flow* as earnings before extraordinary items plus depreciation normalized by the beginning-of-the-year capital stock and 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 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 Column (2)-(4), bootstrapped standard errors that are robust to within firm correlation are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Corporate 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)
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 A4: Downward Wage Rigidity and Firm Value: Differential Effects Across Over- and Underinvestment Using Alternative Measures

Panel A presents the results from a modified version of the valuation regression developed by Fama and French (1998), a fixed effect OLS regression of Tobin's q on downward wage rigidity for underinvestment and overinvestment groups. I use residuals from investment regressions to identify under(over)investment. Residuals are sorted into quintiles, hence Q1 proxies for underinvestment whereas Q5 proxies for overinvestment. Column (1) and (2) are based on full sample, firm and year fixed effects investment regression whereas Column (3) and (4) are based on rolling window, firm and year fixed effects investment regression to avoid a look-ahead bias. 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 *DWR*. Detailed definitions are reported in Section 2. 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 ΔQ_{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. Detailed definitions of these control variables are reported in Section D. $[p - value]$ below H_0: DWR_{Q5} - $DWR_{Q1} = 0$ is based on a one-tailed test. Standard errors in parentheses are robust to heteroskedasticity and clustered by industry (SIC 2-digit).

Panel A. Residuals from Investment Regressions

	Dependent Variable: Tobin's q			
	Residuals from			
	Full Sample FE OLS		Rolling FE OLS	
	Q1	Q5	Q1	Q5
	(1)	(2)	(3)	(4)
DWR	.8983	2.3830***	-.4847	1.9333***
	(.9566)	(.4753)	(.8395)	(.7216)
H_0: $DWR_{Q5} - DWR_{Q1} = 0$	1.4847*		2.4180**	
[p-value]	[0.0958]		[0.0172]	
Controls / Industry and Year FE	Y	Y	Y	Y
# of Firm-Year Obs.	11,305	11,740	5,091	6,959
Adjusted R^2	.2601	.2561	.2538	.2870

Table A4: Downward Wage Rigidity and Firm Value: Differential Effects Across Over- and Underinvestment Using Alternative Measures (continued)

Panel B uses a CEO tenure as a measure for overinvestment (Pan, Wang, and Weisbach, 2016). Following Pan, Wang, and Weisbach (2016), I break a CEO's entire tenure length 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 in CEO tenure. Standard errors in parentheses are clustered by firm. The sample period runs from 1994 to 2014 Q3. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel B. 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 × $Tenure\ Dummy_{years\ [3,5]}$	.7121	.6918
	(.6705)	(.7513)
DWR × $Tenure\ Dummy_{years\ 6\ and\ after}$	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