Wage Rigidity and Debt Financing: Evidence from Labor Contract Renewal During the Financial Crisis

Jiaping Qiu
DeGroote School of Business
McMaster University
1280 Main Street West, Hamilton, ON, Canada L8S 4M4
qiu@mcmaster.ca

Yue Zhang
Louvain Finance and CORE
Université catholique de Louvain
Voie du Roman Pays 34, Louvain-la-Neuve, Belgium 1348
yue.zhang@uclouvain.be

Abstract

This paper studies the differential impacts of the 2008 financial crisis on the financing policies and real activities of firms with flexible labor contracts and those with binding labor contracts. We find that flexible-contract firms significantly reduced their labor costs during the crisis, while binding-contract firms lacked such flexibility. Compared to flexible-contract firms, binding-contract firms experienced a larger drop in bond prices and were less likely to issue new bonds. Moreover, binding-contract firms reduced investments, bank borrowing, and equity financing significantly more. Our analysis provides new causal evidence on how labor-market frictions affect firms' financing in economic downturns.

1. Introduction

Labor cost rigidity could play a key role in the cyclicality of firms' financial conditions. Recent literature explored the interaction between labor cost rigidity and economic conditions to understand their joint impacts on asset pricing, credit spread, capital structure, and investments. For example, Favilukis, Lin, and Zhao (2019) develop a general equilibrium model showing that wage rigidity creates a labor leverage effect that increases firms' credit risk, because sticky wage payments make interest payments riskier when firms are hit by a negative economic shock. Firms with higher labor leverage, therefore, tend to have higher credit risk and lower financial leverage. Schoefer (2015) proposes that wage rigidity can squeeze internal funds in a recession, leading firms to reduce hiring and delay other profitable investments. To avoid such an exacerbation, firms with higher wage rigidity will maintain a lower leverage ratio. A key observation emerging from this line of inquiry is that the interaction between labor cost rigidity and economic conditions could have a significant bearing in explaining firms' financial policies. Yet there is little direct empirical evidence on the causal effect of wage rigidity on firms' financing behavior. The purpose of this paper is to fill this important void.

The impact of wage rigidity on firm financing cost and behavior could be quite complex in practice. On the one hand, fixed labor contracts can shield workers from business cycle risks and provide workers with insurance (Danthine and Donaldson, 2002). Gift-exchange models (Akerlof 1982; Akerlof 1984) and the fair wage-effort hypothesis (Akerlof and Yellen 1990) suggest that workers' effort depends on their gratitude and loyalty to the firm, which, in turn, is related to stability in their compensations. Campbell and Kamlani (1997) find that wage cuts generate negative feelings among employees and thus lead to less effort. In a field experiment, Kube, Maréchal, and Puppe (2013) show that wage cuts have a detrimental and persistent impact on

productivity. Rigid labor contracts that prevent wage cuts could improve the motivation of the workforce, resulting in better firm performance that lowers financing cost. This "insurance" effect suggests that wage rigidity could improve workers' performance, leading to lower default risk and financing cost.

On the other hand, firms with more rigid wages have less flexibility in adjusting their labor cost in response to economic conditions. The inertial wages could be detrimental to firms in bad economic times when cost control is crucial for their survival. For example, in its 2009 financial report, Harley-Davidson, the iconic American motorcycle manufacturer, listed achieving workers' flexible and cost-effective agreements as one of their most important strategies to combat the recession. Wage rigidity is akin to an increase in operating leverage that creates a lower sensitivity of labor cost to economic shocks. This "operating leverage" effect indicates that wage rigidity will increase the default risk of firms and their financing cost, especially during an economic downturn.

To identify the causal impact of labor cost rigidity on firms' financing over the course of a recession, the challenge is to overcome the self-selection of labor contract terms in anticipation of economic conditions. Our study takes advantage of the heterogeneity in the timing of the collective labor agreement renewal for a sample of U.S. firms during the 2008 financial crisis and explores how the pre-determined labor cost rigidity affects a firm's financing. Specifically, we examine whether firms with collective labor agreements that did not expire for renewal during the financial crisis (binding-contract firms) experienced more difficulties in financing than firms with collective agreements that expired and were renegotiated during the financial crisis (flexible-contract firms). Since firms renew their labor contracts upon the expiration of the previous contracts, the renewal dates of labor contracts are pre-determined before the financial crisis. Flexible-contract firms had opportunities to adjust labor costs during the crisis while binding-contract firms were not able to

do so. Furthermore, the 2008 financial crisis is "an almost universally unanticipated crisis" as noted by Alan Greenspan (2013). The exogeneity of labor contract renewal dates and shocks from a financial crisis provide a unique setting to identify the causal effect of labor market frictions induced by wage rigidity on firms' financing in economic downturns.

We start by examining how labor contract rigidity affects the cost of debt and debt issuances. We find that binding-contract firms experienced a larger drop in bond prices at the beginning of the financial crisis and were less likely to issue new bonds than flexible-contract firms. The negative effect is stronger for binding-contract firms with more debt that matured during the crisis. We also conduct a placebo test by replicating our tests over non-crisis (placebo) periods and find that wage rigidity has no impact on financing for non-crisis periods. These results are consistent with the "operating leverage" effect of labor cost rigidity, highlighting the interactive effect of wage rigidity and economic downturns on firms' financing.

We then examine the difference in the adjustment of labor costs between flexible-contract and binding-contract firms during the financial crisis. Labor economics literature finds that firms are typically hesitant to cut wages (Dickens et al., 2007), possibly due to concerns about fairness and adverse selection (Blinder and Choi, 1990; Campbell and Kamlani, 1997). As such, it is not clear whether and to what extent flexible-contract firms cut wages during the financial crisis. We find that flexible-contract firms took the opportunity of contract renewal to cut their labor costs significantly. After the onset of the crisis in 2008, flexible-contract firms adjusted their labor contracts with a 0.7-percentage-point reduction in the average annual wage growth rate, about 20 percent of the average wage growth in 2007. A back-of-the-envelope calculation suggests that the 0.7 percent wage cut is associated with a 6 percent increase in net income. In contrast, the binding-

contract firms lacked the opportunity of adjusting wages as their agreements were not up for renewal during the recessionary period.

We further examine the real effects of wage rigidity on firms by investigating how labor contract rigidity affects employee performance and investment activities. We find that there is no significant difference between flexible- and binding-contract firms in their employee performance, inconsistent with the "insurance" effect which predicts that rigid wage could enhance workers' engagement and performance. On the other hand, our results show that, compared to flexible-contract firms, binding-contract firms experienced a significantly larger reduction in investments.

Finally, we examine how rigid wage affects bank loans and equity financing during the crisis. We find that loan financing of binding-contract firms experienced a similar decline as bond financing. Binding-contract firms are associated with a nearly 10 percent higher drop in the likelihood of loan financing during the financial crisis, and equity reacted significantly more negatively for binding-contract firms. The findings are consistent with a growing body of literature that shows that operating leverage adds another dimension of risk to firms and results in a higher expected return required by shareholders (Donangelo, 2014; Kuehn, Simutin, and Wang, 2017; Chen, Chen, Li, and Li, 2018).

Our paper contributes to a growing body of literature on the interaction between a firm's workforce and its financial policies. Existing literature shows that a firm's capital structure is related to unemployment risk because workers will demand higher wage premiums for the insecurity of working for financially distressed firms (Agrawal and Matsa, 2013; Graham, Kim, Li, and Qiu, 2017). Firms choose financial leverage strategically to control wage demand when their employees have higher bargaining power (Matsa, 2010; Ellul and Pagano, 2017). Firms lower financial leverage in response to higher operating leverage caused by labor market regulations that

increase labor firing cost (Messina and Vallanti, 2007; Serfling 2016). Labor unions could lower firms' cost of debt if unions discourage firms from making risky investments (Chen, Kacperczyk, and Ortiz-Molina, 2012) or increase firms' cost of debt if unions increase firms' bankruptcy cost (Campello, Gao, Qiu, and Zhang, 2018). Schoefer (2015) finds that firms with greater cash holdings are more stable in their employments in recessions as cash provides a buffer when incumbent workers' wage rigidity reduces firms' cash flow. Our paper takes advantage of the predetermined heterogeneity in the timing of labor-agreement renewal during the financial crisis and provides novel evidence of the effect of wage rigidity on firms' financing in an economic downturn. Wage rigidity is a pervasive feature of labor markets (Calvo,1982; Hall, 2006; Gertler and Trigari, 2009). This study advances our understanding of the role of this important labor market friction in influencing financing decisions.

Our study adds to an emerging body of literature that studies the role of wage rigidity in asset pricing and credit risk. Favilukis and Lin (2016) argue that with sticky wage, wage growth should be negatively related to future stock returns because falling wages are associated with even bigger falls in output, resulting in higher operating leverage and firm risk. They find supportive evidence that wage growth is negatively associated with future stock returns in aggregate, industry and U.S. state-level data. Tuzel and Zhang (2017) show that average returns in the industries with less wage rigidity, measured by the co-movement of wages with aggregate shock, are relatively low. Favilukis, Lin, and Zhao (2019) find that wage growth (labor share), a proxy for wage rigidity, is significantly negatively (positively) correlated with aggregate U.S. Baa-Aaa credit spreads, which is consistent with their theoretical predications that wage rigidity increases firms' credit risk. Donangelo, Gourio, Kehrig, and Palacios (2018) show that because wages are smoother than productivity, and labor and capital are strict complements, labor can generate a form of operating

leverage that results in firms with high labor share demanding higher expected asset returns. A key proposition in these studies is that rigid wages create an operating leverage effect that increases firm risk by reducing cash flow in bad economic states. Our study contributes to this literature by providing new causal firm-level evidence of the impact of wage rigidity on financial policies and real activities.

The remainder of our paper is organized as follows: Section 2 discusses the data and sample selection; Section 3 provides summary statistics; Section 4 investigates how labor contract renewal affects firm bond financing during a recession; Section 5 analyzes the impact of labor contract rigidity on wages and employment; Section 6 explores the real effects of binding labor contracts; Section 7 studies the relation between binding labor contracts and other forms of financing; Section 8 concludes the paper.

2. Sample Selection

2.1 Data Source

Firms in the U.S. are generally not required to disclose their labor contracts. However, if firms have unionized workers, their labor contracts and the negotiation of the contracts are regulated by the National Labor Relations Act (NLRA). Under the NLRA, employers have a legal duty to meet at reasonable times to bargain in good faith about wages, hours, vacation time, insurance, safety practices, and other mandatory subjects with the representative of their workers, and to sign any collective bargaining agreement that has been reached. Employees and employers are expected to respect all the terms and conditions of an agreed-upon collective bargaining agreement, and the agreement has legally binding force.

According to NLRA, a notice of bargaining (F-7) needs to be filed with the Federal Mediation and Conciliation Service (FMCS) upon contract expiration.[1] The F-7 notices contain information of employer names, employer locations, bargaining unions and representatives, contract expiration dates, and the number of workers involved. We obtain the data of FMCS F-7 notices from the database of Bloomberg BNA Labor Plus.[2]

Publicly-traded corporate bond information is from the Mergent Fixed Income Securities Database and WRDS Bond Returns Database. Bank loan information is from the DealScan database. Equity information is from the CRSP database. Firms' Financial information is from the COMPUSTAT database. Detailed definitions of variables constructed using these databases are given in Appendix A. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles.

2.2 Binding-contract versus Flexible-contract Firms

We take September 15, 2008, the day on which Lehman Brothers bankrupted, as the onset of the financial crisis. We adopt a difference-in-differences methodology, and the sample period spans six years, from 2005 to 2010, covering roughly a three-year pre-crisis period (2005-2007) and a three-year in-crisis period (2008-2010). We collect the information of FMCS F-7 notices from 2008 to 2015 and manually match the names of employers in the notices to company names in the COMPUSTAT database. After excluding firms that were bailed out by the government during the 2008 financial crash and any contract with fewer than 100 workers, the final merged data consist of 551 firms. Binding-contract firms are defined as those that had no contract up for renewal during the financial crisis period, from September 15, 2008 to the end of 2010. Flexible-contract firms are defined as those that had labor contracts up for renewal during the crisis period. Out of the 551

[1] See the information on the following website for the detailed procedures. https://www.fmcs.gov/services/resolving-labor-management-disputes/collective-bargaining-mediation/

[2] Bloomberg BNA is a leading publisher of labor relations news and reference products and maintains one of the U.S. largest collections of labor relation information.

firms, 194 firms were bound by existing labor contracts while 357 firms negotiated their contracts during the financial crisis.

Our sample is comparable to that of Yi (2016) who identifies 377 firms that negotiated at least one contract with 500 or more employees between 1995 and 2014. 165 of our 551 sample firms were included in the S&P 500 index in 2007. The sample also covers small and medium-sized firms. The total asset value of our sample firms in 2007 is about 70 percent of that of the S&P 500 firms.[3]

[Figure 1 about here]

Panel A of Figure 1 shows the contract renewal information of Curtiss-Wright Corporation, a binding-contract firm whose two contracts (both signed in 2005) expired and were renewed on June 3rd and July 14th, 2008, just before the financial crisis. During the financial crisis, there was no contract renewal; workers and the firm were bound by the pre-crisis agreement terms.

Panel B of Figure 1 provides the contract renewal information of Textron Corp., a flexible-contract firm. The last contract Textron signed before the financial crisis came into effect in June 2006 and would expire in June 2009, amidst the financial crisis. Panel C of Figure 1 provides another example of flexible-contract firms, Kellogg Company, which has multiple union units with expired contracts almost every year. Firms like Kellogg would be able to renew some, but not all, of their contracts during the financial crisis. These types of firms are also counted as flexible-contract firms because they could partially adapt their labor costs to the changing economic condition.

[3] In 2007, the total asset value of our sample firms is about $8,401 billion, while the total asset value of the S&P 500 firms is about $29,554 billion.

3. Summary Statistics

Panel A of Table 1 compares performance characteristics of binding-contract and flexible-contract firms in 2007, the year preceding the financial crisis. The results show that binding-contract firms are not significantly different from flexible-contract firms in various characteristics, including profitability, size, financial leverage, cash, and growth.

[Table 1 about here]

Panel B of Table 1 compares the bond characteristics of binding-contract and flexible-contract firms in 2007. Column (1) shows that the average bond-to-assets ratio (total bond value normalized by total assets) of these two groups in 2007 are not statistically different. Columns (2) and (3) compare the original maturity and the remaining maturity. The averages of original maturity (remaining maturity) of outstanding bonds are around 15 (8) years for both groups, between which the differences are statistically insignificant. Finally, Columns (4) to (6) compare the values of bonds that would mature during 2008 to 2010 (normalized by total assets). Again, we find that the values are very close between the two groups, and the difference is not statistically significant. The similarity in bond values and bond maturity profiles preceding the crisis indicates that it is unlikely that firms changed their financing policy in anticipation of the crisis. As such, if binding-contract and flexible-contract firms differ in their bond valuation and issuance during the financial crisis, it should not be attributable to their difference in bond features before the crisis.

[Table 2 about here]

Table 2 compares labor contract terms between binding-contract and flexible-contract firms before the crisis. Although firms are not required to disclose the content of contracts (e.g., wage growth), Bloomberg BNA Labor Plus collects information on contract terms reported through newspapers, union publications or direct reports. We collect the wage growth information from

the database of Contract Settlement Summaries of Bloomberg BNA Labor Plus. The results in Panel A show that the annual wage growth rates of both groups stayed around 3 percent from 2005 to 2007, and the difference between the two groups is insignificant. The results in Panel B show that the average duration of labor contracts was four years for both groups over years preceding the crisis. The evidence in Table 2 indicates that binding-contract firms and flexible-contract firms had similar labor contract terms before the financial crisis.

Taken together, the results in Tables 1 and 2 show that binding-contract firms and flexible-contract firms had similar financial characteristics and labor contract terms before the financial crisis. There is no evidence that binding-contract and flexible-contract firms are self-selected in anticipation of the financial crisis. We now examine if their difference in labor contract renewal dates causes any difference in their financing behaviors during the financial crisis.

4. Wage Rigidity and the Debt Financing

In this section, we investigate the impact of labor contract flexibility on bond cost and financing.

4.1 Bond Return

We first study the joint impact of labor cost rigidity and the financial crisis on the value of existing bonds. We focus on senior, unsecured bonds, the major form of debt financing of firms, and estimate their cumulative abnormal returns (CARs) over several time windows to gauge creditors' reactions.[4] Since the bond market is not as liquid as the equity market, our analysis is based on the monthly returns of bonds.

Following Bessembinder, Panayides, and Venkataraman (2009), we calculate abnormal bond returns in three steps. First, we find a benchmark portfolio for each bond based on its risk. In

[4] Senior, unsecured bonds account for 68 percent of corporate debt while subordinated debt makes up only 5 percent. Bank loans and revolving credit facilities make up for most of the rest of debt financing (Gomes, Jermann, and Schmid, 2016).

particular, we classify all senior, unsecured bonds into three-by-three portfolios according to their credit ratings and time-to-maturity.[5] We next compute the average return for each benchmark portfolio using the returns of each bond in that portfolio. We define the abnormal return (*AR*) of a bond as the difference between the bond return and the benchmark return.[6] Finally, we sum the abnormal return of a firm from month t_1 to month t_2 and define it as the cumulative abnormal return for the firm for that period ($CAR(t_1, t_2)$). We take September 2008, the month in which Lehman Brothers bankrupted, as the event month (month 0).

[Table 3 about here]

Table 3 reports the differences in cumulative abnormal returns between binding-contract firms and flexible-contract firms in response to the financial crisis. We accumulate the abnormal returns from July 2008 as IndyMac Bank, the largest savings and loan association in the Los Angeles area and the seventh largest mortgage originator in the U.S., failed in July 2008 when negative news began to mount. Table 3 shows that bond price of binding-contract firms suffered nearly a 1 percent larger decline in bond CARs in July 2008 than flexible-contract firms. The result is significant at the 5 percent level. As we extend the return period to September 2008 when Lehman Brothers collapsed, bonds of binding-contract firms dropped by 2 percent, significantly more than those of flexible-contract firms. The difference in bond market reactions widened as we extend the sample period. A quarter after the outbreak of the financial crisis, bond prices of binding-contract firms dropped by 6.4 percent more than the bond prices of flexible-contract firms, and the differences in CARs between the two groups then stayed relatively stable.

[5] Bonds are classified into nine benchmark portfolios according to whether their credit rating is investment grade (AAA to BAA3), speculative grade (BA1 to B3) or extremely speculative grade (CAA1 to C), and whether the time to maturity is no more than five years, longer than five years but no more than 10 years, or more than 10 years.

[6] If a firm has more than one bond outstanding, the abnormal return of the firm is defined as the average abnormal return of all its bonds.

4.2 New Bond Issuance

If labor rigidity has a negative impact on the value of a firm's existing bonds during the financial crisis, we would expect that the rising cost of bonds will limit the issuance of new bonds. To examine the effect of contract flexibility on the likelihoods of new bond issuance, we use a difference-in-differences approach and estimate the following equation:

$$Bond\ Issuance_{i,t} = \beta_1 Binding\text{-}Contract\ Firm * Crisis + \beta_2 Controls_{i,t-1} + \alpha_i + \gamma_t + \varepsilon_{i,t}, \quad (1)$$

where $Bond\ Issuance_{i,t}$ takes the value of one if firm *i* issued a bond in year *t* and zero otherwise*;* *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for binding-contract firms and zero for flexible-contract firms, and *Crisis,* which equals one for years 2008, 2009, and 2010, and zero for years 2005, 2006, and 2007; $Controls_{i,t-1}$ are a vector of firm-level controls including profitability, firm size, financial leverage, cash flow, cash holdings, and Tobin's Q; α_i and γ_t are firm and year fixed effects; $\varepsilon_{i,t}$ is the regression residual. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level. The variable of main interest is the interaction term, which captures and measures the effect of labor contract rigidity during the financial crisis. When the dependent variable is a dichotomy, the key assumptions of the linear regression are violated. A conditional fixed-effect logistic model is typically recommended if the model includes fixed effects. However, given that the odds ratio in a conditional fixed-effect logistic model is hard to interpret and that in many cases the linear probability model fits equally well (Hellevik, 2009), a linear model is still widely used to model dichotomous outcomes. We therefore adopt both models for appropriate statistical inference and intuitive interpretation of estimates.

[Table 4 about here]

Table 4 presents the results. Columns (1) and (2) show the results based on a conditional fixed-effect logistic model. Column (1) includes only year and firm fixed effects, while Column (2) includes both fixed effects and other control variables. The coefficients on the *Binding-Contract Firm*Crisis* interaction term for both specifications are significantly negative. Columns (3) and (4) show the results based on a linear probability model.[7] The results are statistically similar to those based on a logistic model. The result in Column (4) indicates that binding-contract firms were 8.5 percent significantly less likely to issue bonds during the financial crisis than similar flexible-contract firms. Overall, the findings are consistent with the "operating leverage" effect in that labor cost rigidity increases binding-contract firms' credit risk, resulting in lower bond value and less debt issuance during the economic downturn.

4.3 Refinancing Risk

Debt maturity plays an important role in determining a firm's credit risk as the debt market liquidity dried up during the 2008 financial crisis (Ivashina and Scharfstein, 2010; Cornett, McNutt, Strahan, and Tehranian, 2011; He and Xiong, 2012). Almeida, Campello, Laranjeira, and Weisbenner (2007) show that firms with a large fraction of long-term debt maturing at the time of the crisis found it difficult to refinance their obligations and had to cut investments more than similar firms who did not have to refinance a large amount of debt. If rigid wage increases a firm's operating leverage that results in higher credit risk, its impact would be stronger for firms with greater refinancing risk as credit risk would matter more for firms with a greater need for refinancing.

[7] The number of observations varies between the two models due to the fact that the conditional fixed-effect logistic model relies on within-firm variability. If there is no variability within a subject (in our case, bond issuance) over time, the firm would be dropped.

To measure the refinancing risk of firms, we follow Almeida, Campello, Laranjeira, and Weisbenner (2007) and calculate the soon-to-mature debt maturity ratio which equals to long-term debt maturing in three years normalized by total assets in 2007.[8] This debt maturity ratio measures the refinancing need of firms during the financial crisis period. A high debt maturity ratio indicates that a firm needed to refinance a large fraction of its debt during the financial crisis to maintain its current capital structure.

[Table 5 about here]

We split our sample firms into two groups by using the median soon-to-mature debt maturity ratio in 2007 of the sample and examine the impact of wage rigidity on bond financing for each group. The results are reported in Table 5. Columns (1) and (2) report the impacts of labor cost rigidity on the likelihood of bond issuance for high refinancing risk firms (firms with a debt maturity ratio above the sample median) and low refinancing risk firms (firms with a debt maturity ratio below the sample median), respectively, and the results are based on a conditional fixed-effect logistic model. The results show that labor contract rigidity has a significantly negative impact on firms with high refinancing risk. In particular, the coefficient on the *Binding-Contract Firm*Crisis* interaction is -1.157, significant at the 5 percent level, for high refinancing risk firms. Columns (3) and (4) of Table 5 present the results based on a linear probability model. The results are statistically and quantitatively similar to those based on the conditional fixed-effect logistic model. For high refinancing risk firms, binding labor contracts are associated with a 15 percent decrease in the likelihood of issuing new bonds. On the other hand, binding labor contracts have no significant impact on the financing activity of low refinancing risk firms.

[8] COMPUSTAT annual items dd1, dd2, and dd3 represent, respectively, the amount of long-term debt maturing during the first, second and third year after the annual report.

During the financial crisis, firms experienced great difficulties in financing because of credit supply contraction. The results show that it could be even more difficult for firms to raise capital if they happened to have a binding labor contract during the crisis. It is consistent with the notion that wage rigidity increases the operating leverage that lowers the sensitivity of cash flow to economic conditions, making firms even more vulnerable to negative economic shocks. The finding highlights that refinancing risk and operational risk could interact with each other and amplify the overall credit risk of firms during an economic downturn.

4.4 Labor Contract Coverage

In previous analysis, we did not differentiate firms with renegotiable contracts that cover only a small proportion of their workers from those with renegotiable contracts that cover a large proportion of workers. To take labor contract coverage into consideration, following Yi (2016), we first calculate the average number of workers who renewed their contracts between 2003 and 2007. We then classify firms into high-rigidity (low-rigidity) firms if the number of workers whom a firm renegotiated with for a new contract in the crisis period is equal to or smaller (greater) than the average.

[Table 6 about here]

We estimate Equation (1) by replacing the independent variable *Binding-Contract Firm*Crisis* with *Labor-Contract Rigidity*Crisis,* where *Labor-Contract Rigidity* equals one for high-rigidity firms and zero for low-rigidity firms. Table 6 reports the regression results based on a conditional fixed-effect logistic model and a linear probability model. As expected, the coefficients on the interaction term are significantly negative for all specifications. After controlling for firm characteristics that are related to financing policy and year and firm fixed effects, high-rigidity firms are 12.3 percent less likely than low-rigidity firms to issue a bond in

the crisis period. The findings echo those in Table 4, indicating that labor cost flexibility has an important impact on firm financing during economic downturns.

4.5 Placebo Tests

The "operating leverage" effect argues that binding labor contracts prevent firms from lowering wage in bad states when negative cash flow shocks occur. The operating leverage effect of rigid wage is less likely to be a significant factor in normal states when firms have regular cash flow and little need to adjust wage downward. We conduct falsification tests of operating leverage channel by examining the difference in financing policies between flexible-contract and binding-contract firms in non-recessionary periods (placebo periods).

[Table 7 about here]

We take January 1, 2004, January 1, 2005, and January 1, 2006, as the start dates of the placebo financial crisis, respectively. For the tests using January 1, 2005 as the start date, we use years 2002, 2003 and 2004 as the placebo pre-crisis period, and the years 2005, 2006 and 2007 as the placebo crisis period. Firms with labor contracts that were signed before and expired after the placebo crisis period are binding-contract firms, while firms with labor contracts that expired and were renegotiated during the placebo crisis period are flexible-contract firms. We estimate Equation (1) by using the placebo sample. Column (2) of Table 7 shows that the coefficient on the *Binding-Contract Firm*Crisis* interaction term is not significantly different from zero.

Similarly, we conduct tests using January 1, 2004 and January 1, 2006 as the placebo start days of the financial crisis, respectively. To avoid overlapping with the dot-com bubble in 2000 and 2001, and the 2008 global financial crisis, we define the pre-crisis period as two years before the placebo start day of the financial crisis, and the crisis period as two years after when using January 1, 2004 and January 1, 2006 as the placebo financial crisis start day. The results show that

all coefficients on *Binding-Contract Firm*Crisis* are insignificant, consistent with our expectation that the operating leverage channel effect of labor contract rigidity matters most in economic downturns when firms experience negative cash flow shocks.

To summarize, our results show that wage rigidity significantly increases the cost of bonds and reduces bond issuances during the financial crisis. The negative effect of wage rigidity on bond financing is especially significant for firms with higher refinancing risk and with more workers covered by binding labor contracts. These findings are consistent with the operating leverage effect of rigid wage.

5. Labor Contract Flexibility, Wage, and Employment

In this section, we examine the difference between flexible-contract and binding-contract firms in their wage and employment adjustments during the financial crisis.

5.1 Wage Adjustment

Binding-contract firms by design do not have the opportunities to adjust their wage during the financial crisis. For flexible-contract firms, Figure 2 shows their average wage growth before and during the financial crisis. Their annual growth rates, on average, stayed around 3 percent before 2008 and peaked at 3.57 percent in 2008. Following the start of the financial crisis in September 2008, the average wage growth dropped immediately and became 2.93 percent and 2.54 percent in 2009 and 2010, respectively.

[Figure 2 about here]

To investigate the wage growth of flexible firms while controlling for the effects of firm characteristics, we estimate the following equation for flexible-contract firms:

$$Wage\ Growth_{i,t} = \beta_1 Crisis_t + \beta_2 Controls_{i,t-1} + \alpha_i + \varepsilon_{i,t}, \quad (2)$$

where $\text{Wage Growth}_{i,t}$ is the annual wage growth rate specified in the collective agreements of firm *i* in year *t*; Crisis_t is a dummy variable that equals one if the contract was signed before September 15, 2008 and zero after that; $\text{Controls}_{i,t-1}$ are a vector of firm-level controls relevant to wage growth including profitability, firm size, liability ratio, cash flow, cash holdings, and Tobin's Q; α_i is the firm fixed effect; $\varepsilon_{i,t}$ is the regression residual. The sample period is from year 2005 to year 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level.

[Table 8 about here]

Column (1) of Table 8 shows that during the financial crisis, wage growth dropped by almost 0.7 percentage points, about 20 percent of the average wage growth of 3.55% in year 2007 after controlling for various firm characteristics and firm fixed effects. A 0.7-percentage-point annual decrease is a significant concession from the employee perspective in collective agreement bargaining. The difficulty to reach such a modification in collective agreement bargaining was manifested in the strike that happened to Verizon in April 2016 when nearly 40,000 workers walked off the job after failing to reach a new labor agreement with the firm, making it the largest strike in the United States since Verizon workers last walked off the job in 2011. One of the main causes is that Verizon workers were not satisfied with the 6.5-percentage-point total pay raise Verizon had proposed for the new four-year contract. After 45 days of strike, workers finally accepted the proposed contract which offered a 10.9-percentage-point total pay raise over the next four years, about a 1-percentage-point annual increase compared to the firm's original wage growth proposal.

Wage payments constitute major claims on firms' income, and the impact of a 0.7-percentage-point annual decrease in wage growth could be substantial. Firms are not obligated to

disclose labor cost information, while some firms provide the information voluntarily. We use the labor cost information of firms in COMPUSTAT that disclosed the information in 2007 (about 24 percent of firms) to assess the importance of labor costs. We find that labor expenses, on average, are about 13 times net income for firms with a positive net income. A back-of-the-envelope calculation indicates that a 0.7-percentage-point cut in annual wage growth may raise the net income by nearly 6 percent annually assuming a 35% tax rate.[9] The impact of this wage cut can be even more significant if the cumulative effect is taken into account. Given the fact that the average duration of a contract is about four years, a 0.7 percentage annual decrease suggests that the cumulative wages cut would be about 3 percentage points throughout the duration of the contract, which would translate into an over 25 percent increase in net income in the final year of the contract.[10]

In summary, the results in Table 8 indicate that employees made significant concessions in the financial crisis period and that flexible-contract firms managed to cut down their labor costs substantially. Binding-contract firms, on the other hand, were locked in by their contracts signed before the financial crisis and lacked the flexibility to adjust their labor costs downward. Labor economics literature finds that firms in normal situations are typically hesitant to cut wages (Blinder and Choi, 1990; Campbell and Kamlani, 1997; Dickens et al., 2007). Our results show that when facing economic downturn, firms take advantage of contract renewal opportunities to adjust labor cost downward.

[9] The annual net income increase can be estimated as 0.7%*13*(1-35%) = 6%.

[10] The average annual wage growth workers and flexible-contract firms agreed to in year 2007 is 3.55%. The cumulative effect of the growth cut on the wage can be estimated as $(1+3.55\%)^4 - (1+3.55\%-0.7\%)^4 = 3.08\%$. The cumulative increase in net income can be estimated as 3.08%*13*(1-35%) = 26%

5.2 Employment

Another possible way for flexible-contract firms to adjust labor cost is through cutting the number of employees. We examine the impact of binding contracts on employment by estimating Equation (1) with the number of employees as the dependent variable. The result in Table 9 shows that the coefficient of the interaction term is insignificant with controls for related firm characteristics and fixed effects, suggesting that flexible-contract firms did not lay off more employees than binding-contract firms. It reflects the fact that in the 2008 crisis, many firms tried to keep their skilled and competent workforce and avoided or limited layoffs because of the high adjustment costs and the expectation that the economy might roar back soon.[11] This is also consistent with the literature which shows that in the presence of high labor adjustment costs associated with the labor search, selection, hiring, and training processes, firms have an incentive to minimize their labor turnover (Oi, 1962; Hamermesh and Pfann, 1996; Blatter, Muehlemann, and Schenker, 2012; Ghaly, Dang, and Stathopoulos, 2017). Overall, the finding shows that flexible-contract firms adjust their labor cost primarily through wage reduction.

[Table 9 about here]

6. The Real Effect of Rigid Labor Contracts

We have shown that rigid labor cost leads to a decline in financing activities during the financial crisis. In this section, we further examine its effect on firms' real activities. Specifically, we investigate the difference between binding-contract and flexible-contract firms in their employee performance and investment activities during the 2008 crisis.

[11] Firms tried to reduce the labor costs with measures less drastic than layoffs. For example, Dell extended unpaid holiday, Cisco decided to have a four-day, year-end shutdown, and Honda encouraged voluntary unpaid vacation. Source: https://www.nytimes.com/2008/12/22/business/22layoffs.html

6.1 Employee Performance

As discussed earlier, binding contacts could create both "operational leverage" and "insurance" effects. The results on the binding contracts' impact on financing policies are consistent with the operational leverage effect. In this section, we conduct further investigation and examine whether binding contracts could have potential insurance effect by examining their impact on employee performance.

The insurance effect of binding contracts predicts that the wage and employment insurance provided by binding contracts could boost the morale of workers and improve their job satisfaction, resulting in better employee performance in bad times (Akerlof, 1982; Akerlof, 1984; Akerlof and Yellen, 1990). Ouimet and Simintzi (2017) find that, for a sample of U.K. firms, profit per worker increases at binding-contract firms by 15 thousand pounds during a financial crisis relative to flexible-contract firms. We test the impact of binding contracts on employee performance by estimating Equation (1) and replacing the dependent variable with employee performance, which is measured by the ratio of sales over number of employees and the total factor productivity (TFP).[12]

[Table 10 about here]

The results are reported in Table 10. Results in Column (1) to Column (3) use sales over employees as the dependent variable, while results in Column (4) to Column (6) use TFP as the dependent variable. Column (1) (Column (4)) includes only the $Binding\text{-}Contract\ Firm * Crisis$ interaction term, Column (2) (Column (5)) adds the control variables, and Column (3) (Column (6)) includes also the year and firm fixed effects. In contrast to the findings of Ouimet

[12] We estimate TFP by following İmrohoroğlu and Tüzel (2014) and measure the TFP at the firm level.

and Simintzi (2017), our results show that workers at the binding-contract firms did not perform better than workers at their flexible-contract counterparts. The coefficient on the interaction term is not significantly different from zero by using either sales over employees or TFP as the dependent variable after controlling for firm characteristics and fixed effects. One possible reason why our findings differ from those in Ouimet and Simintzi (2017) is that the sample in Ouimet and Simintzi (2017) includes both public firms and private firms, while our sample only includes public firms. Wage and employment insurance is more likely to motivate employees to work harder in small, private firms during a financial crisis due to the high loyalty and commitment of small-business employees (Halbesleben and Tolbert, 2014).

6.2 Investments

If a binding labor contract during the financial crisis decreases a firm's financial activities, an obvious question is how that affects a firm's investment activities. To gauge the effect of labor cost rigidity on investment, we estimate Equation (1) by replacing the dependent variable with *Investment Ratio*$_{it}$, which is the total investment (i.e., the sum of capital, R&D and M&A expenditures) of firm *i* in period *t* normalized by the property, plant and equipment value in period *t-1*.[13] The results are reported in Table 11. Column (3) of Table 11 reports the regression result controlling for various firm characteristics and firm and year fixed effects. The coefficient on *Binding-Contract Firm*Crisis* is -0.125, significantly negative at the level of 5 percent. The result indicates that binding-contract firms reduced their investment spending by 12.5 percentage points more than that of flexible-contract firms during the crisis period. Given that the average investment ratio of the sample firm in 2007 is 54.7%, the negative effect of binding contracts on investment appears to be economically relevant. The results are consistent with the existing literature, which

[13] If the R&D value is missing in one year, we assume the value of R&D of that year to be zero.

documents that the inability to borrow externally constrains a firm's investment activities (Campello, Graham, and Harvey, 2010; Duchin, Ozbas, and Sensoy, 2010; Cingano, Manaresi, and Sette, 2016; Caggese, Cuñat, and Metzger, 2018).

[Table 11 about here]

7. Labor Cost Rigidity and Other Financing Activities

Our previous analyses focus on bond financing. In this section, we explore the effects of wage rigidity on bank loans and equity financing of firms during the 2008 financial crisis.

7.1 Bank Loans

To examine the difference in bank borrowing between binding-contract and flexible-contract firms, we estimate Equation (1) using the dependent variable *Loan Financing*, a dummy variable which equals to one if a firm took out a loan during the crisis and zero otherwise. Based on fixed-effect logistic models, results presented in Column (1) and (2) of Table 12 indicate that binding contracts have a significantly negative relation to loan financing. The coefficient of the *Binding-Contract Firm*Crisis* interaction term is -0.930, significant at the 1 percent level. The estimate using the linear probability model shows that binding contracts are associated with a 9.3-percentage-point decline in the likelihood of bank borrowing during the crisis. The effect is economically similar to that of bond financing (an 8.5-percentage-point decline). However, the results need to be interpreted with caution. Bank loans, which are relationship-based borrowing, depend on the financial health of banks (see, e.g., Gan, 2007). Banks were affected by the financial crisis to different extents. Chodorow-Reich (2014) showed that borrowers of weaker banks could not simply switch to healthier banks during the Lehman crisis. Firms which had pre-crisis relationships with less-healthy lenders were less likely to obtain a loan following the Lehman bankruptcy, and if they did borrow, they paid a higher interest rate compared to similar firms with healthier lenders.

As such, a caveat for the results on binding contract effects on bank loans is that they could be confounded by the financing condition of the bank that firms borrowed from during the crisis.

[Table 12 about here]

7.2 Equities

The effects of fixed labor contracts on equity pricing and financing could be ambiguous. On the one hand, operating cost-cutting is one of the most important measures for firms to cope with during a recession. Binding labor contracts that make firms more vulnerable in the financial turmoil would have a negative impact on equity value. On the other hand, different from creditors, who lend money to firms in exchange for a fixed return on their capital and are mainly concerned about the downside risk of firms, shareholders also enjoy the upside potential. Firms which cut costs faster and deeper than their competitors do not necessarily flourish after the crisis. Gulati, Nohria and Wohlgezogen (2010) find that compared with other firms, such firms actually have the lowest probability of pulling ahead of the competition when times get better. Binding labor contracts provide workers with job security and stable compensation, which can help firms to win the loyalty, commitment, and trust of their workers and allow them to recover from the crisis more quickly. Therefore, shareholders in binding-contract firms might benefit from their upside potential if they survive the crisis.

To examine the effect of wage rigidity on equity financing, we first test whether the shareholders of binding-contract firms reacted more negatively to the outburst of financial crisis than the shareholders of flexible-contract firms. We compute the abnormal return of the equities on September 15, 2008, the day on which Lehman Brothers filed for bankruptcy, by using both the Fama and French (1996) three-factor model and the Carhart (1997) four-factor model. We find that equities of binding-contract firms underperformed the equities of their flexible-contract

counterparts. Specifically, the average daily abnormal return of the binding-contract firm equities is -0.003 while the average daily abnormal return of the flexible-contract firm equities is 0.008 by using the Fama French three-factor model. The difference (-0.010) is significantly negative at the level of 1 percent. Using the Carhart four-factor model as the benchmark yields statistically and economically similar results. The results indicate that, from the equity holders' perspective, the negative impacts of binding contracts on equities dominate their positive impacts. The results are consistent with a growing body of literature, which shows that labor market frictions can make operating profits more sensitive to shocks and thus lead to a higher expected return demanded by shareholders (Donangelo, 2014; Favilukis and Lin, 2016; Donangelo, Gourio, Kehrig, and Palacios, 2018).

[Table 13 about here]

We next examine how binding labor contracts affect equity issuance of firms. Specifically, we regress net equity issuance, which is defined as the value of equity shares sold minus dividends and share repurchases, on *Binding-Contract Firm*Crisis* with controlling variables and fixed effects. The results presented in Table 13 show that binding-contract firms issue less equities than their flexible-contract counterparts during the financial crisis. Overall, we find that binding labor contracts have a significantly negative impact on equity financing, which is consistent with the notion that rigid labor costs make operating cash flows and profits more sensitive to the negative shocks, resulting in higher returns demanded by equity holders.

8. Conclusions

Utilizing the predetermined labor contract renewal dates and negative economic shock of the 2008 financial crisis as a unique setting, this paper investigates the differential impact of the financial crisis on the financing policies and real activities of two groups of otherwise similar firms that

differ in the timing of labor contract renewal. We find that, compared to flexible-contract firms where labor contracts expired and were renewed during the financial crisis, binding-contract firms with labor contracts that were not up for renewal during the crisis experienced a greater drop in bond prices and were less likely to issue new bonds during the financial crisis. Flexible-contract firms significantly reduced their wage growth rate when labor contracts were renewed in the crisis period, while binding-contract firms lacked such flexibility. Furthermore, binding-contract firms substantially reduced their expenditures on corporate investments. Our results provide new firm level evidence that wage rigidity could significantly impact a firm's financing policies and real activities in an economic downturn.

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Appendix A

Profitability: Earnings before interest and tax (EBIT)/total sales. Data source: COMPUSTAT

Size: ln(Total assets). Data source: COMPUSTAT

Liability Ratio: Total liability/total assets. Data source: COMPUSTAT

Cash Flow: (Net income + depreciation and amortization)/the lag of property, plant, and equipment. Data source: COMPUSTAT

Cash: Cash and short-term investments/total assets. Data source: COMPUSTAT

Tobin's Q: (Total assets + market capitalization - common equity - deferred taxes and investment tax credit)/total assets. Data source: COMPUSTAT

Soon-to-mature Debt Ratio: (Sum of long-term debt coming due in three years)/total asset. Data source: COMPUSTAT

Figure 1: Examples of binding-contract firms and flexible-contract firms

This figure gives examples of binding-contract firms and flexible-contract firms. Panel A demonstrates the contract renewal activity of a binding-contract firm, which did not renew any contract during financial crisis. Panel B demonstrates the contract renewal activity of a flexible-contract firm, which renewed its contract during financial crisis. Panel C demonstrates the contract renewal activity of a flexible-contract firm, which partially renewed its contracts during financial crisis.

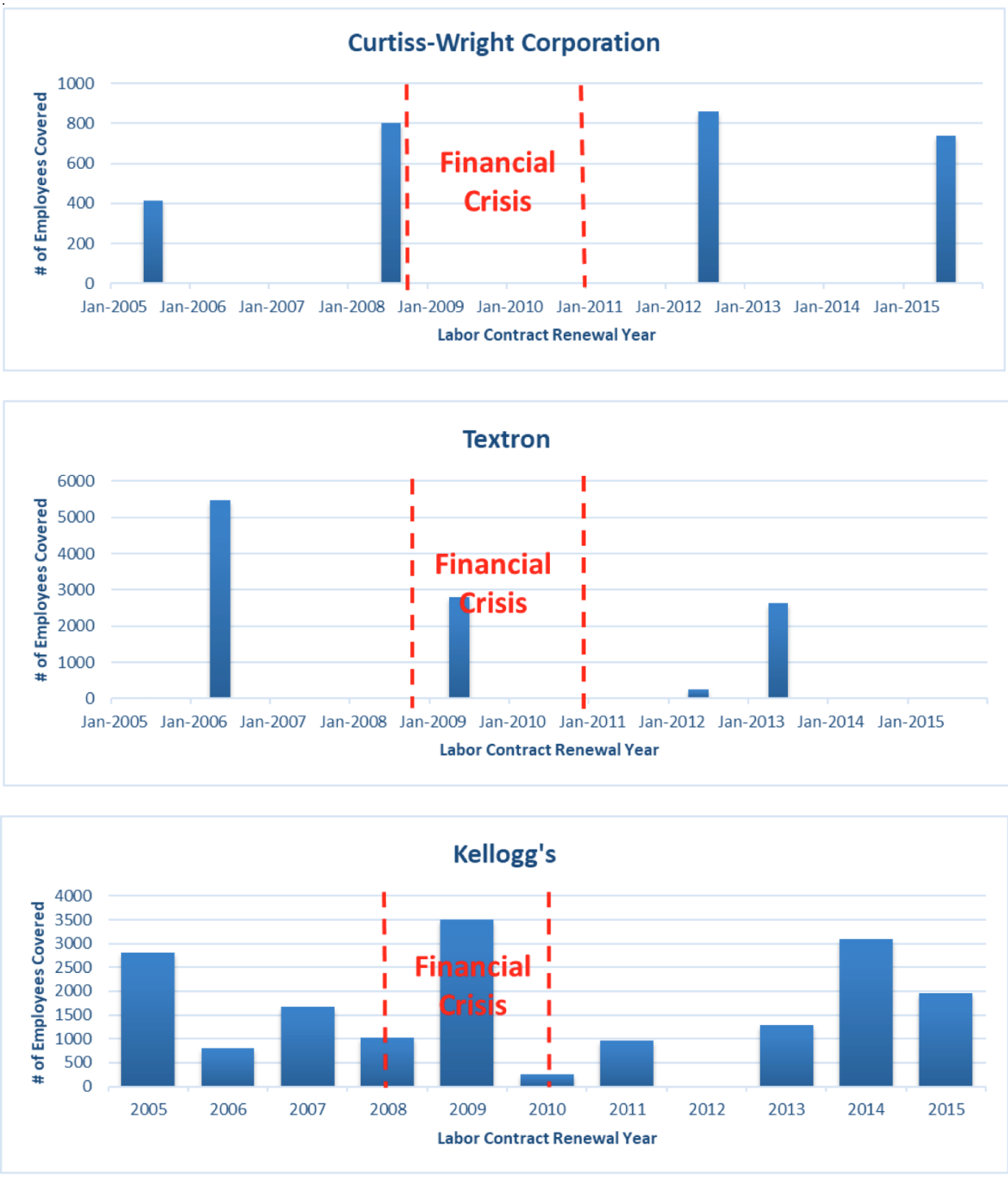

Figure 2: Wage Growth and Financial Crisis

This figure shows wage growth rate for flexible-contract firms during the financial crisis period. The solid (dotted) line re. Baa-Aaa s average (median) wage growth rate.

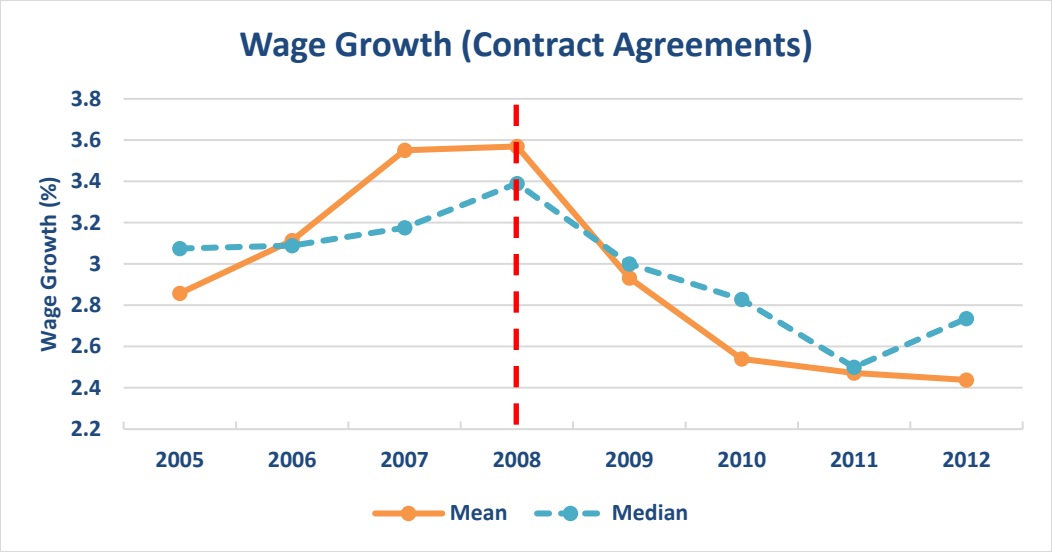

Table 1: Summary Statistics of Firm Characteristics

This table reports the summary statistics of firm financial characteristics and bond contract characteristics for binding-contract firms and flexible-contract firms in year 2007. Flexible-contract (biding-contract) firms are firms that had (had no) labor contracts up for renewal between September 15, 2008 and Dec 31, 2010. Panel A compares firm financial characteristics between the two groups. Panel B compares bond contract characteristics between the two groups. *Bond Ratio* is the ratio of total bond outstanding to total assets. *Original Maturity* (Years) is the issuing maturity of bonds. Remaining maturity is the remaining years to the mature year of bonds. *Due (2008, %), Due (2009, %), and Due (2010, 10%)* are defined as ratios of amount of bonds coming due in 2008, 2009, and 2010 to total assets for binding-contract firms and flexible-contract firms in 2007, respectively.

Panel A: Financial Characteristics Comparison (2007)

Group	Profitability	Total Asset	Liability Ratio	Cash Flow	Cash	Q
Binding Contract	0.113	12909.210	0.292	0.534	0.073	1.554
Flexible Contract	0.120	17788.540	0.289	0.516	0.066	1.659
Diff	-0.007	-4879.328	0.002	0.018	0.006	-0.075
T-statistic	-0.816	-0.897	0.129	0.244	0.750	-1.400

Panel B: Bond Characteristics Comparison (2007)

Group	Bond Ratio (%)	Original Maturity (Years)	Remaining Maturity (Years)	Due (08, %)	Due (09, %)	Due (10, %)
Binding Contract	0.284	14.784	7.626	0.013	0.020	0.012
Flexible Contract	0.259	15.703	8.143	0.023	0.019	0.013
Diff	0.025	-0.919	-0.518	-0.010	0.000	-0.002
T-statistic	0.632	-0.907	-0.757	-1.460	0.053	-0.285

Table 2: Summary Statistics of Firm Labor Contracts Before Financial Crisis

This table reports the summary statistics of labor contracts for both binding-contract firms and flexible-contract firms from year 2005 to year 2007. Flexible-contract (biding-contract) firms are firms that had (had no) labor contracts up for renewal between September 15, 2008 and Dec 31, 2010. *Wage Growth* is the average annual growth rate of wages employees and employers agreed to in a year. *Contract Duration* is the average length of labor contracts employees and employers agreed to in a year.

Panel A: Wage Growth (%)			
Group	2005	2006	2007
Binding Contract	2.898	2.861	2.708
Flexible Contract	2.941	2.976	3.035
Diff	-0.042	-0.115	-0.327
T-statistic	-0.233	-0.535	-1.476

Panel B: Contract Duration (Years)			
Group	2005	2006	2007
Binding Contract	4.155	4.362	4.504
Flexible Contract	4.313	4.286	4.176
Diff	-0.158	0.075	0.328
T-statistic	-0.540	0.231	0.996

Table 3: Bond CAR

This table analyzes the joint impact of financial crisis and labor rigidity on bond prices. *Bond CAR* is the cumulative abnormal return of bonds. The event month (month 0) is September 2008, the month in which Lehman Brothers filed for bankruptcy. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Group	CAR (-2, -2)	CAR (-2, -1)	CAR(-2, 0)	CAR(-2, 1)	CAR(-2, 2)	CAR(-2, 3)	CAR(-2, 4)	CAR(-2, 5)
Binding-Contract Firms	-0.002	-0.001	0.012**	0.004	0.003	-0.025	-0.032	-0.021
Flexible-Contract Firms	0.007***	0.008***	0.032***	0.029***	0.036***	0.038***	0.033***	0.036***
Diff.	-0.009**	-0.008**	-0.020***	-0.025*	-0.033*	-0.064**	-0.065***	-0.057**
T-statistic	-2.515	-2.052	-2.890	-1.739	-1.705	-2.585	-2.685	-2.214

Table 4: Labor Cost Rigidity and Bond Issuance

This table adopts both a fixed-effects logit model and a linear possibility model to analyze the joint impact of financial crisis and labor rigidity on bond issuance. The dependent variable is *Bond Issuance*, which equals one if firms issued a bond in a year and zero otherwise. *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	CLOGIT		OLS	
	(1)	(2)	(3)	(4)
Binding-Contract Firm*Crisis	-0.465*	-0.603**	-0.073**	-0.085**
	(0.280)	(0.308)	(0.032)	(0.035)
Profitability		0.170		-0.007
		(2.139)		(0.305)
Size		-0.404		-0.058
		(0.368)		(0.053)
Liability Ratio		-1.299		-0.166
		(1.243)		(0.175)
Cash Flow		0.470**		0.062**
		(0.201)		(0.030)
Cash		-3.876**		-0.467**
		(1.705)		(0.218)
Q		0.067		0.005
		(0.305)		(0.037)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	2,049	1,765	3,612	3,157
R-squared			0.496	0.508

Table 5: Refinancing Risk, Contract Flexibility, and Bond Issuance

This table adopts both a fixed-effects logit model and a linear possibility model to analyze the joint impact of financial crisis and labor rigidity on bond issuance. The dependent variable is *Bond Issuance*, which equals one if firms issued a bond in a year and zero otherwise. The sample firms are partitioned into two groups (high refinancing risk firms and low refinancing risk firms) based on the median soon-to-mature debt ratio in 2007. *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	CLOGIT		OLS	
	(1)	(2)	(3)	(4)
	High	Low	High	Low
Binding-Contract Firm*Crisis	-1.157**	0.004	-0.149***	-0.025
	(0.496)	(0.419)	(0.055)	(0.044)
Profitability	-0.309	0.943	-0.094	0.117
	(3.702)	(2.488)	(0.538)	(0.331)
Size	-0.038	-0.772*	-0.006	-0.099*
	(0.594)	(0.425)	(0.085)	(0.059)
Liability Ratio	-2.619	-0.727	-0.285	-0.063
	(1.859)	(1.907)	(0.225)	(0.275)
Cash Flow	0.921**	0.232	0.122**	0.034
	(0.393)	(0.243)	(0.048)	(0.034)
Cash	-5.100**	-3.063	-0.623*	-0.330
	(2.553)	(2.501)	(0.369)	(0.248)
Q	0.215	-0.050	0.025	-0.001
	(0.482)	(0.401)	(0.067)	(0.041)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	996	764	1,582	1,536
R-squared			0.513	0.489

Table 6: Labor Cost Rigidity and Bond Issuance

This table adopts both a fixed-effects logit model and a linear possibility model to analyze the joint impact of financial crisis and labor rigidity on bond issuance. The dependent variable is *Bond Issuance*, which equals one if firms issued a bond in a year and zero otherwise. *High-Rigidity (Low-Rigidity) Firms* are defined as those which renewed the contracts of fewer (more) employees than an average year between September 15, 2008 and December 31, 2010. *Labor-Contract Rigidity*Crisis* is an interaction of *Labor-Contract Rigidity*, which equals one for firms in the high-rigidity group and zero for firms in the low-rigidity group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	CLOGIT		OLS	
	(1)	(2)	(3)	(4)
Labor-Contract Rigidity*Crisis	-0.735***	-0.879***	-0.105***	-0.123***
	(0.260)	(0.288)	(0.037)	(0.040)
Profitability		-0.942		-0.124
		(2.761)		(0.337)
Size		-0.407		-0.063
		(0.408)		(0.055)
Liability Ratio		-2.267		-0.282
		(1.490)		(0.200)
Cash Flow		0.798***		0.096***
		(0.202)		(0.028)
Cash		-3.914**		-0.459*
		(1.825)		(0.236)
Q		0.092		0.011
		(0.343)		(0.041)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	1,788	1,562	3,082	2,717
R-squared			0.494	0.510

Table 7: Falsification Tests

This table reports the results of falsification tests by using Jan 1, 2004, Jan 1, 2005, and Jan 1, 2006 as placebo start day of financial crisis. It adopts both a fixed-effects logit model and a linear possibility model to analyze the joint impact of financial crisis and labor rigidity on bond issuance. The dependent variable is *Bond Issuance*, which equals one if firms issued a bond in a year and zero otherwise. *Binding-Contract Firm*Crisis Placebo* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis Placebo*, which equals one for the placebo crisis period, and zero for placebo non-crisis period. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Panel A: CLOGIT			
	(1)	(2)	(3)
	2004	2005	2006
Binding-Contract Firm*Crisis Placebo	-0.198	-0.092	-0.279
	(0.368)	(0.285)	(0.372)
Profitability	2.016	1.078	-1.088
	(2.565)	(2.143)	(3.301)
Size	0.207	0.159	-0.053
	(0.508)	(0.283)	(0.509)
Liability Ratio	1.535	-0.992	-5.974***
	(1.681)	(0.986)	(1.726)
Cash Flow	0.706	0.620**	0.804**
	(0.606)	(0.286)	(0.372)
Cash	-4.513	-3.381	-1.837
	(2.788)	(2.061)	(2.964)
Q	0.387	0.288	-0.179
	(0.502)	(0.333)	(0.574)
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	1,136	1,904	929

Panel B: OLS			
	(1)	(2)	(3)
	2004	2005	2006
Binding-Contract Firm*Crisis Placebo	-0.013	-0.001	-0.028
	(0.049)	(0.035)	(0.043)
Profitability	0.122	0.018	-0.106
	(0.425)	(0.305)	(0.419)
Size	0.002	0.017	0.008
	(0.075)	(0.041)	(0.065)
Liability Ratio	0.119	-0.132	-0.543***
	(0.203)	(0.126)	(0.195)
Cash Flow	0.082	0.075*	0.060
	(0.079)	(0.039)	(0.043)
Cash	-0.395	-0.384*	-0.245
	(0.259)	(0.214)	(0.290)
Q	0.033	0.026	-0.010
	(0.044)	(0.034)	(0.047)
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	2,396	3,595	2,265
R-squared	0.567	0.501	0.558

Table 8: Labor Cost Growth and Financial Crisis

This table adopts an OLS regression and analyzes the impact of financial crisis on wage growth of workers for the flexible-contract firms. The dependent variable is *Wage Growth*, which is defined as the average annual wage growth in percentage labor unions and firms agreed to in a year. Dummy variable *Crisis* equals one if the labor contract was signed after September 15, 2008, the day on which Lehman Brothers collapsed, and equals zero if the labor contract was signed before that day. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)
Crisis	-0.402**	-0.490***	-0.687***
	(0.155)	(0.162)	(0.258)
Profitability		0.488	2.176
		(1.609)	(6.248)
Size		0.079	1.829*
		(0.063)	(1.034)
Liability Ratio		-1.042	-4.703
		(0.762)	(4.965)
Cash Flow		-0.018	-0.175
		(0.357)	(1.209)
Cash		3.615	1.300
		(2.284)	(5.291)
Q		-0.029	-0.025
		(0.184)	(0.629)
Firm FE			YES
Observations	335	311	311
R-squared	0.021	0.080	0.623

Table 9: Labor Cost Rigidity and Employment

This table adopts an OLS regression and analyzes the impact of wage rigidity on employment of workers during the financial crisis. The dependent variable is number of employees. *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)
Binding-Contract Firm*Crisis	-18.337***	-3.134	0.168
	(3.000)	(2.050)	(0.786)
Profitability		-191.893***	4.033
		(29.418)	(4.815)
Size		20.589***	8.966***
		(1.948)	(1.401)
Liability Ratio		-24.219***	-1.539
		(7.699)	(3.090)
Cash Flow		3.981	0.088
		(3.167)	(0.413)
Cash		4.728	-4.223
		(15.722)	(3.617)
Q		14.997***	-0.066
		(4.185)	(0.699)
Firm FE			YES
Year FE			YES
Observations	3,039	2,686	2,686
R-squared	0.017	0.382	0.986

Table 10: Labor Cost Rigidity and Employee Performance

This table adopts an OLS regression and analyzes the impact of wage rigidity on performance of workers during the financial crisis. The dependent variable in Column (1) to Column (3) is the ratio of sales over number of employees while the dependent variable in Column (4) to Column (6) is the total factor productivity (TFP). *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	Sales/EMP (in 1000s)			TFP		
	(1)	(2)	(3)	(4)	(5)	(6)
Binding-Contract Firm*Crisis	-112.655**	-49.652	-14.168	-0.100***	-0.018	-0.022
	(44.194)	(34.720)	(15.960)	(0.031)	(0.020)	(0.022)
Profitability		-20.093	-12.857		1.291***	0.600**
		(389.570)	(106.704)		(0.146)	(0.276)
Size		121.816***	68.961***		0.078***	0.100***
		(23.892)	(20.225)		(0.007)	(0.031)
Liability Ratio		-357.977***	-21.283		0.068	-0.029
		(136.539)	(54.601)		(0.057)	(0.089)
Cash Flow		22.139	12.189		0.116***	0.042**
		(46.880)	(10.675)		(0.017)	(0.016)
Cash		-498.356**	-74.594		-0.060	0.042
		(250.877)	(61.666)		(0.101)	(0.132)
Q		-42.050	52.101***		0.071***	0.113***
		(38.453)	(17.634)		(0.018)	(0.025)
Firm FE			YES			YES
Year FE			YES			YES
Observations	3,024	2,680	2,680	2,152	1,952	1,952
R-squared	0.004	0.118	0.959	0.013	0.478	0.818

Table 11: Labor Cost Rigidity and Investment

This table adopts an OLS regression and analyzes the joint impact of financial crisis and labor rigidity on firm investment. The dependent variable is *Investment*, which is defined as the sum of capital, M&A, and R&D expenditures scaled by beginning of period Property, Plant and Equipment. *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)
Binding-Contract Firm*Crisis	-0.140***	-0.119***	-0.125**
	(0.033)	(0.031)	(0.060)
Profitability		-0.127	0.228
		(0.248)	(0.504)
Size		-0.009	-0.532***
		(0.010)	(0.106)
Liability Ratio		-0.061	-1.271***
		(0.102)	(0.362)
Cash Flow		0.367***	0.179***
		(0.054)	(0.060)
Cash		1.061***	2.192***
		(0.317)	(0.585)
Q		0.091**	0.187**
		(0.038)	(0.080)
Firm FE			YES
Year FE			YES
Observations	2,862	2,561	2,561
R-squared	0.005	0.147	0.478

Table 12: Labor Cost Rigidity and Bank Loan

This table adopts both a fixed-effects logit model and a linear possibility model to analyze the joint impact of financial crisis and labor rigidity on bank loan. The dependent variable is *Bank Loan*, which equals one if firms took out a loan in a year and zero otherwise. *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	CLOGIT		OLS	
	(1)	(2)	(3)	(4)
Binding-Contract Firm*Crisis	-0.811**	-0.930***	-0.083*	-0.093*
	(0.322)	(0.361)	(0.047)	(0.052)
ROA		2.479		0.285
		(2.455)		(0.383)
Size		-0.415		-0.073
		(0.375)		(0.066)
Liability Ratio		-1.083		-0.318
		(1.211)		(0.228)
Cash Flow		-0.054		-0.012
		(0.057)		(0.027)
Cash		4.057**		0.484*
		(1.912)		(0.291)
Q		-0.061		0.026
		(0.290)		(0.049)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	1,364	1,123	2,503	2,126
R-squared			0.471	0.485

Table 13: Labor Cost Rigidity and Stock Issuance

This table estimates an ordinary least squares regression to analyze the joint impact of financial crisis and labor rigidity on stock issuance. The dependent variable is *Stock Issuance*, which equals the amount of net equity issuance (the value of shares sold minus dividends and share repurchases). *Binding-Contract Firm*Crisis* is an interaction of *Binding-Contract Firm*, which equals one for firms in the binding-contract group and zero for firms in the flexible-contract group, and *Crisis* which equals one for year 2008, 2009, and 2010, and zero for year 2005, 2006, and 2007. The sample period begins in 2005 and ends in 2010. All control variables are lagged by one year. Standard errors are heteroskedastic-robust and clustered at the firm level and presented in parentheses. The symbols ***, **, and * denote significance at the 1, 5, and10 percent levels, respectively.

	(1)	(2)
Binding-Contract Firm*Crisis	-89.254*	-105.286**
	(47.640)	(50.635)
Profitability		-853.507**
		(385.340)
Size		-317.033***
		(93.249)
Liability Ratio		592.760***
		(194.182)
Cash Flow		10.782
		(32.462)
Cash		-508.273*
		(287.798)
Q		-88.776**
		(42.926)
Firm FE	YES	YES
Year FE	YES	YES
Observations	2,888	2,530
R-squared	0.812	0.828