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Contents

Preface

There are two essays in this dissertation.

In the first chapter, I first build a model to investigate firms' earnings management behavior and the bargaining process between firms and unions. The outcome for bargaining is specified by Nash Bargaining solutions and firms have incentives to report lower earnings after unionization to prevent unions from demanding high wages, pensions, and other benefits. In the same spirit as Stein (1989), in equilibrium, firms' earnings management incentive is anticipated and adjusted for by the union and the market. However, firms cannot commit not to do earnings management ex-ante. Empirically, I employ the data on union elections to verify predictions from the model. Compared with firms that just fail to pass the unionization with a small margin of votes around 50%, those who just pass engage in significantly less earnings management. For firms that barely pass the election, the pre-determined firm characteristics one year before unionization are not significantly different from those that just fail to pass. I do not find any evidence that unionized firms conduct significantly less earnings management before unionization. The main result that firms' earnings management is significantly lower for firms just above the cutoff is robust and not spurious. In summary, I document robust evidences on the causal effect of unionization on earnings management.

Regarding the second chapter, “Incentive Contracting with Multiple Directorships”, I focus on a feature of the outside director market, that is, a director can simultaneously work for several companies. I build a model to investigate the relationship between incentives (Pay-Performance Sensitivity) that are offered by different companies and the number of directorships an outside director holds. Theoretically, I find that the relationship between optimal incentives (Pay-Performance-Sensitivity) and the number of directorships is always positive, no matter efforts across directorships are substitutive or complementary.

Chapter 1

The Causal Effect of Unionization on Firms' Earnings Management: Evidence from the Regression Discontinuity Design

Abstract

This study explores the causal effect of unionization on firms' earnings management. An analytical model based on Nash bargaining and earnings management suggests muted incentives for income-increasing earnings management for unionized firms. By comparing firms that just pass unionization by a small number of votes to those that just barely lose elections, the regression discontinuity design (RDD) estimations suggest significantly lower earnings management for unionized firms. Further, this decrease is only significant in states without right-to-work legislation, where unions are more powerful. These findings are consistent with unionized firms' incentives to report lower earnings to prevent unions from demanding higher wages and benefits. Among unionized firms, I find no evidence that unions can undo the effect of lower reported earnings when negotiating on future pension and retirement benefits, and wages; i.e., firms reduce employee expenses to some extent by strategically conducting less earnings management.

Keywords: Unionization, Earnings management, Bargaining power, Wage and pension expenses

1. Introduction

This study examines whether unionization motivates companies to conduct less income-increasing (signed) earnings management and if so, whether less earnings management reduces employee expenses to some extent when companies negotiate with unions on future wages and benefits. Positive accounting theory (Watts and Zimmerman, 1978, 1980) suggests that the political costs arising from higher reported earnings may induce unionized firms to report lower earnings. However, the empirical literature has documented mixed results. Most papers do not find significant evidence for this claim (Liberty and Zimmerman, 1986; DeAngelo and DeAngelo, 1991; Osma et al. 2014; Gullinan and Bline, 2003). Liberty and Zimmerman (1986) cite low-power tests as one potential explanation for their findings of insignificant results. A notable exception to show significant evidence using US data is DeAngelo and DeAngelo (1991). However, using only 7 companies from the US steel industry in the 1980s makes the external validity questionable, and the measure they use is not accrual-based earnings management.

This study provides significant and robust evidence for the causal effect of unionization on firms' earnings management by conducting regression discontinuity design (RDD) around union elections. Specifically, I focus on subsamples of firms where the percentage of votes favoring unionization is near the cutoff of 50% to compare the earnings management behavior among unionized and non-unionized firms. The union election provides a powerful and appealing setting for examining the effects of unionization for several reasons. First, by focusing on subsamples near the cutoff, unionization is plausibly exogenous because a few more votes for unionization could

totally change the election results. Also, as detailed in section 5.1, firms and workers are unable to precisely manipulate the election outcomes. Second, after a union wins an election, the workers' bargaining power suddenly increases substantially. Thus, union election events offer a nice setting to explore the impact of possibly exogenous changes in union bargaining power. Finally, my paper focuses on the effect of newly organized unions instead of existing unions, which has an arguably larger impact since the union has not negotiated with the firm before—the lack of information and transparency may induce firms to change their earnings management behavior more substantially.

Moreover, this paper extends the existing literature by examining whether strategically lower earnings management after unionization leads to lower future expenses on employees' wages and benefits. Among unionized subsamples, those firms that conduct lower earnings management (report lower earnings) do incur fewer employee expenses.

I focus on earnings management behavior and employee expenses for several reasons. First, exploring earnings management is suitable for testing the political cost hypothesis in positive accounting theory. Secondly, regarding the effects of unionization, the impact on earnings management and employee expenses might be the most significant one. Thirdly, the effect of unionization on earnings management and employee expenses has some important social welfare and policy implications on union regulation. Lastly, whether firms change the financial reporting in response to unionization may shed some light on the implicit contracting value of accounting numbers. Different from debt contracts, or executive compensation contracts, the

negotiated workers' wages and benefits may *implicitly* depend on reported accounting numbers, even if it is not explicitly specified in employees' contracts[1].

Following the prior literature on union elections (e.g. Lee and Mas 2012; Bradley et al. 2016), I identify the events of union elections from 1977 to 2014, and merge these election events with data from Compustat. In the main analysis, I use the regression discontinuity design (RDD) approach to provide an estimation on the effect of unionization on a firm's future earning management, the change in the number of employees, and pension and retirement expenses. The final sample is restricted to US public firms and includes 2,318 union election events over the period 1977-2014. I document that, compared to firms that just fail to pass unionization, those that barely pass conduct significantly less earnings management after unionization (H1). I also find that the unionization effect is only significant in states without right-to-work legislation (H1a) where unions are more powerful. I conduct several robustness checks and find that the results continue to hold when I: (1) use different bandwidths, (2) control for different orders of local polynomial order functions, and (3) use different kernel functions. Moreover, I explore whether unions are "fooled" by reported earnings numbers, or if they are powerful enough to undo firms' strategic earnings management behavior. I find that both components of reported earnings[2], i.e. the unmanaged earnings and the earnings management part, have significant explanatory power for explaining future growths in pension and retirement expenses, and staff expenses. That said, I find no evidence that unions can fully undo the effect of firms' strategic earnings

[1] Blanchflower, Oswald, and Sanfey (1996) find that workers' wages are increasing in prior period's profits. However, I manually read some detailed collective bargaining agreements from the website of the Department of Labor (DOL), and did not find earnings is explicitly specified in employee contracts.

[2]

management, or firms can reduce employee expenses to some extent by strategically conducting lower earnings management.

My study contributes to the literature in the following aspects. First, I add to the mixed—and mostly insignificant—empirical findings on the effect of unionization on earnings management by providing evidence using a larger dataset in the US. Secondly, by exploiting union elections and focusing on subsamples with a share of votes for unionization near the 50% cutoff, I offer robust and significant evidence less susceptible to the endogeneity concern of unionization. Lastly, my research joins the underexplored literature on the implicit contracting value of accounting numbers in employee contracts.

In a related paper, Bova (2013) documents higher likelihood of missing analyst forecasts for unionized firms. However, my study complements and extends Bova (2013) in several aspects. First, in Bova (2013), the dependent variable is the probability of beating forecasts and he doesn't explicitly show lower earnings management[3]. My study offers a more direct test for lower reported earnings as missing forecasts could also be due to managing analysts' expectations or issuing more shares etc.. Secondly, utilizing the plausibly exogenous nature of unionization in an RDD setting better addresses the endogeneity concern of unionization. Thirdly, my paper extends to explore the effects on labor expenses, the number of employment, and whether unions can successfully undo firms' strategic earnings management. Lastly, by utilizing union

[3] Panel B of Table 5 shows that when unionized firms conduct negative earnings management, they are more likely to miss forecasts. However, this doesn't mean that unionized firms conduct lower earnings management, which is the focus of my paper. Bova (2013) focuses on the effects of earnings management while my study suggests earnings management as the consequences of unionization.

election data, I explore the effect of newly organized unions, which arguably to have larger effects.[4]

The rest of the article is organized as follows. Section 2 reviews prior research while Section 3 discusses the empirical setting and develops hypotheses. Sample and research design is provided in Section 4 and the results are presented in Section 5. Section 6 concludes. An analytical model is provided in Appendix A.

2. Prior Research

It is theoretically appealing that firms have incentives to report lower earnings after unionization and before wage renegotiation. Positive accounting theory highlights that "political costs are the costs labor unions impose through increased demands generated by large reported profits" (Watts and Zimmerman, 1978). However, the empirical results in the prior literature are mixed, and most research does not find evidence that unionization drives lower reported earnings or significantly affects other accounting choices (e.g., Cullinan and Bline 2003; Cullinan and Knoblett, 1994; Liberty and Zimmerman, 1986; Osma et al. 2014). Liberty and Zimmerman (1986) propose low-power tests as one explanation for the findings. In contrast, DeAngelo and DeAngelo (1991) provide weak evidence of managing earnings during negotiations. However, the sample of seven US steel firms in the 1980s substantially limits external validity. Recently, Mora and Sabater (2008) find evidences of lower earnings in Spanish companies and argue that the political cost hypothesis is only suitable to the "open shop

[4] This could also explain why some previous studies exploring earnings management after wage renegotiation fails to find significant evidence (Liberty and Zimmerman 1986; Garcia Osma, Mora, and Sabater 2014, etc.).

system" in continental Europe, but not for the US or Canada with "closed shop system" while my study provides significant and robust results using the US data.

Some issues likely contribute to the mixed and mostly insignificant results. First, the sample sizes in the previous research are usually small, ranging from seven firms to a few hundreds of observations (e.g. Cullinan and Knobett,1994; DeAngelo and DeAngelo, 1991; Osma, Mora, and Sabater, 2014), which lowers the power of the tests. Secondly, the prior papers usually focus on firms' earnings management in existing unions, however, this effect may be more pronounced among newly organized unions since it may be easier for firms to fool unions by reporting lower earnings due to the lack of transparency and information. Also, the results are less reliable and convincing when the endogeneity of unionization is not well addressed. Lastly, research utilizing industry-level union strength data may not be precise enough to yield significant results. In this study, I provide significant and robust new evidence by utilizing firm-level union election data of larger sample sizes and utilize a RDD approach. In addition to financial reporting, I also provide evidence of the effect of unionization on the number of employees, pension and retirement expenses, and employee expenses.

3. Empirical Setting and Hypotheses

3.1 Unions and the Empirical Setting of Union Elections

Workers are indispensable stakeholders of a firm and human capital is becoming more and more important in the modern economy. Thus, workers also play key roles in allocating profits. In particular, unions are representatives of the workers, with activity centering on collective bargaining over benefits, wages, and working conditions, and on

representing their members in disputes with management over contract violations. Higher reported earnings may induce the union to demand higher wages and benefits. If the workers are not satisfied, the union may initiate a strike.

Before the union election, when some workers decide to organize a union, they need to petition the NLRB to hold a presentation election and at least 30% of the workforce needs to sign the petition to be considered eligible. Once the NLRB determines the appropriate bargaining unit, it holds an election at the worksite and workers vote on whether they are willing to be represented by the union or not. If the percentage of votes favoring unionization is greater than 50%, the vote leads to unionization. Otherwise, the outcome is non-unionization.

This paper is not the first to use the union election as a setting in which workers' bargaining power increases. Utilizing the locally exogenous variation in union formation, recent papers have investigated union elections to test the effect of unionization on some issues such as stock return (Lee and Mas, 2012), innovation (Bradley et al. 2016), loan pricing (Qiu and Shen, 2017), debt structure (Qiu, 2017), product quality (Kini et al. 2018), the relation between the cost of labor and bankruptcy (Campbell et al. 2017), and the relation between cost asymmetry and dividend payouts (He et al. 2018). These studies suggest that newly formed unions do have significant effects on firms' overall policies, even though the election is held at the plant level. My paper adds to this line of research by showing that union elections do affect earnings management, pension and retirement expenses, and employee expenses.

3.2 Hypotheses Development

As the political cost hypothesis in positive accounting theory suggests, firms may have incentives to report lower earnings when facing strong unions to avoid demands for high wages and benefits.

In the Appendix, I develop an analytical model based on earnings management[5] and Nash Bargaining to explore the effect of unionization on firms' strategic financial reporting and workers' welfare (including wages and benefits). In the model, managers and workers split the surplus from working relationship according to their relative bargaining power. When deciding the amount of earnings management, the firm is trading off the benefit of higher stock price in the capital market from higher reported earnings and the cost of being asked higher wages and employee benefits by workers. After unionization, workers' bargaining power increases substantially and they get a higher proportion of the profits. Thus, the cost of reporting high earnings is larger, leading to lower signed[6] earnings management. This is stated in the following hypothesis:

H1: After unionization, a union's bargaining power increases due to the collective nature in the negotiation process, and thus, the firm conducts less earnings management.

[5] In the simplified model, firms' earnings management amount is anticipated and completely adjusted by other market participants. However, the results are robust when extended to models where earnings management can only be partially adjusted due to noises (Fischer and Verrecchia, 2000; Dye and Sridhar, 2004)

[6] By "signed", I mean the proxy for earnings management is the residuals from discretionary accrual models, instead of the absolute value of residuals. Thus, higher earning management means higher reported earnings.

To test this hypothesis, I focus on subsample of firms with the percentage of votes for unionization near the cutoff of 0.5 using RDD methodology. More specifically, I compare the earnings management behavior in the year following union elections for firms that just pass unionization to those that just fail to. I also conduct a battery of robustness checks using different bandwidths, different kernel functions etc..

For cross-sectional analysis, the above effect should be more pronounced when unions are more powerful. In states with Right-to-Work Law (RTW), unions cannot force workers to join unions and employees with unions are not required to pay dues to receive the benefits of collective bargaining. Thus, in RTW states, unions have significantly lower bargaining power. So, I propose the following hypotheses for subsample analyses:

H1a: After unionization, firms change earnings management behavior more substantially for subsamples of elections in states without right-to-work law where unions are more powerful.

Then, a natural question is whether firms' strategical earnings management behavior after unionization has some real consequences? More specifically, after firms strategically conduct less earnings management, do unions have enough information and power to undo the effect of lower reported earnings when negotiating with firms on wages and benefits? If unions are able to completely undo the effect of strategic

earnings management, then regarding the two parts of reported earnings[7], only the "unmanaged" earnings, but not the earnings management, has power in explaining future growth in pension and retirement expenses, and employee expenses. In reality, it is more likely that unions are not able to completely undo earnings management due to the facts that: (1) firms may also have significant bargaining power as they can threat to close the plant or factory; (2) it might be difficult for unions to pin down the exact amount of earnings management. Thus, I propose the following hypothesis:

H2: Both components of earnings—unmanaged earnings and earnings management—have some explanatory power in explaining the growth in future pension and retirement expenses, and employee expenses.

Regarding the effect of unionization on workers' welfare, workers' pension and retirement expenses should increase with workers' bargaining power because they would get a larger proportion of the firm's profits in the bargaining process. Thus, the third hypothesis is:

H3: After unionization, the union's bargaining power increases, and thus, the firm incurs more pension and retirement expenses.

[7] The unmanaged earnings is the difference between reported earnings and earnings management, where earnings management is computed using performance-matched discretionary accrual models (Francis et al. 2005).

4. Sample and Research Design

4.1 Sample

I collect data on union election results from the NLRB (National Labor Relations Board) website and from Thomas Holmers' website for the period from 1977 to 2014. The data contains the firm name, location, a two-digit industry code, the date of election, the number of voters for and against unionization, the number of eligible voters, and the outcome of the election.

The key variables are the number of votes for and against unionization. In addition, the financial data in Compustat was obtained from Wharton Research Data Services (WRDS). I start with a total of 66,069 union election events, including those for both public and private firms. Following Dinardo and Lee (2004), I drop union elections with fewer than 20 eligible voters and then manually merge the union election data with the financial data from Compustat using company's name. I also check manually to make sure the matching is accurate. The final sample consists of 2,318 union elections for publicly-listed US companies. The panels A, B, and C in Table 1 reports the summary statistics separately for full, unionized, and non-unionized samples. Continuous variables are winsorized at the 1 percent and 99 percent levels to mitigate the extreme observations' influences. Out of the 2318 union elections, 768 lead to unionization. The average vote shares for unionization are 0.439, 0.664, and 0.327 for the full, unionized and non-unionized samples, respectively. The mean number of earnings management (EM) for the full, unionized, and non-unionized samples are 0.0621, 0.0607, and 0.0628, respectively. Unionized firms do conduct less earnings management in the year following union elections. Panel D shows the union election

distribution by industry. We can see that construction and manufacturing are industries with the most elections.

4.2 Main Variable Definitions

Vote share (vote shares for unionization) is the percentage of votes for unionization divided by total number of votes. Then I create an indicator variable, union (unionization), which is equal to one if the vote shares for unionization is greater than 50% and zero otherwise. Of the 2318 union election events, 768 of them leads to unionization while 1550 fail to unionize. To measure the accruals-based earnings management, I use the performance-matched modified Jones model following Francis et al. (2005). First, scaled total accruals are regressed on changes in the difference between scaled revenue and scaled receivables, scaled PPE (gross property plant and equipment), and ROA. The fitted value is the nondiscretionary part of accruals. Then, the proxy for earnings management, or discretionary accrual, is the difference between total and nondiscretionary accruals.

4.3 Research Design

To explore the effects of unionization, I employ the regression discontinuity design (RDD) approach that relies on "locally" exogenous variations in unionization generated by these elections that pass or fail by a small number of votes. This approach effectively compares outcome variables for firms that just pass to those that do not pass by a small margin (e.g.,52% vs. 48%). More specifically, the following local linear RDD equation is estimated with different intervals (bandwidths) for robustness checks,

$$EM_{i,t+1} = \beta_0 + \beta_1 Union_{i,t} + \beta_2 Union_{i,t} * (\text{vote share} - 0.5) + \beta_3 (\text{vote share} - 0.5) \text{ other controls} + \epsilon_{i,t} \quad (1)$$

where $EM_{i,t+1}$ is the amount of earnings management in the year following union election. In addition to local linear RDD, I also conduct local quadratic RDD regression by including quadratic terms. To explore the real economic effect of unionization, other dependent variables, such as the growth rate of the number of employees, pension and retirement expenses, or staff expenses are also explored. Vote_share is the percentage of votes for unionization and $Union_{i,t}$ is a dummy variable which takes a value of 1 if the union election leads to unionization and 0 otherwise. Either same or different weights may be assigned to different observations depending on their distances to the cutoff, i.e., the weight $w_i = K(\frac{vote_{share} - 0.5}{h})$ where K(.) is a kernel function. In different specifications, the kernel function could be either rectangular, which gives the same weight to all observations within the bandwidth, or triangular kernel (WLS), which gives more weight to observations near the cutoff. Our focus and interest is on the economic and statistical significance of the coefficients on the $union$ (*unionization*) dummy.

To explore whether unions are able to undo firms' strategic earnings management behavior, the following regressions would be run:

$$Expenses_{i,t+k} = \beta_0 + \beta_1 Unmanaged\ Earnings_{i,t+1} + \beta_2 EM_{i,t+1} + \beta_3 NI_{it} + fixed\ effects + \epsilon_{i,t} \quad (2)$$

where $Expenses_{i,t+k}$ is either pension and retirement expenses or staff expenses at year t+k, $EM_{i,t+1}$ is the amount of earnings management at year t+1, and the year of election is t. NI is the scaled earnings at year t.

5. Results

5.1 Validity tests for RDD identifying assumptions

An important identifying assumption in regression discontinuity design is that employers and workers are not able to perfectly manipulate the outcome of the elections (the percentage of votes for unionization) near the cutoff of 50%. Even with some manipulation, so long as it is not precise, there is some randomness across the cutoff and unionization may still be exogenous to some extent.

The first falsification test explores whether the number of observations just below the cutoff is significantly different from that above the cutoff. If firms (workers) are able to perfectly manipulate the outcome, the number of observations just below the cutoff should be significantly higher (lower). Figure 1 shows that the densities just above and below 50% are similar. Following Cattaneo, Janson, and Ma (2017)[8], a formal manipulation test cannot reject the null hypothesis of no perfect manipulation near the cutoff (t-statistics is -0.3999 and p-value is 0.6893), which mitigates the concern of perfect manipulation to some extent.

Another key assumption is that unionized firms and their non-unionized counterparts should not display systematic differences in terms of observable predetermined characteristics. Table 2 shows that, one year prior to the elections, ROA, Q, research and development, cash holding, tangibility, and market-to-book are not significantly different among firms just below and above the threshold.

[8] The idea of this test is the same as McCrary (2008), which is to compare the densities below and above the cutoff, although the implementation is different.

5.2 Main Regression Discontinuity Design Results

The main RDD test is to explore the earnings management behavior shortly after elections. Figure 2a plots earnings management against the percentage of shares in favor of unionization and documents a sharp discontinuity near the 50% cutoff. The earnings management for firms that barely pass the elections to unionize is significantly lower than their non-unionized counterparts. In Figures 2b and 2c, I use 0.45, and 0.55 as placebo cutoffs. Indeed, no sharp discontinuities are documented.

To offer a more precise placebo test, I randomly draw a placebo cutoff from the uniform interval [0.25,0.75] for 1,000 times, conduct RDD regressions for each cutoff and plot the histogram for 1000 z-statistics and the coefficients of unionization to compare those with that using the true cutoff of 0.5. The results are reported in Figures 3 and 4. The 1,000 z-statistics and coefficients are centered around 0. That said, using placebo cutoffs for unionization, there is on average no effect of lower earnings management for unionized firms. However, the z-statistics and the coefficient using the true cutoff of 50% are -2.01 and -0.05, respectively. This test mitigates the concern that the main RDD results are spurious.

For the main analyses, Table 3 reports results using both local linear and local quadratic[9] regressions in RDD by focusing on a small margin around the cutoff. After controlling for size, ROA and leverage, firms that barely pass the vote for unionization conduct significantly less earnings management (report relatively lower earnings) after unionization than firms that just fail to unionize. The coefficient of unionization is

[9] On page 41-42 of Cattaneo, Idrobo and Titiunik (2018), they suggest that, "in practice, the recommended choices of local polynomial order is p=1 (local linear) or p=2 (local quadratic)" as p=0 exhibits some undesirable theoretical feature and higher-order polynomials tend to overfit the data.

always negatively significant. For example, in column 1 of panel A, the coefficient on unionization is -0.050. (z-statistic is -2.01). I conduct local quadratic RDD in columns 1 and 3 and local linear RDD in columns 2 and 4. The results are also robust using different bandwidths in panels B and C, and using different kernel functions (uniform and triangular) in panels A, B and C.

5.3 Do firms conduct less earnings management before the union elections?

Ex-ante, do unionized firms anticipate the election results and strategically conduct less earnings management before unionization? To test this hypothesis, I regress firms' earnings management one or two years before unionization on the ex-post unionization dummy using local linear and local quadratic RDD. Table 4 suggests that on average, unionized firms do start doing less earnings management one year before unionization, compared to their non-unionized counterparts. The coefficients are -0.043, and -0.036 and z-statistics are -1.67 ($p<0.1$) and -1.74 ($p<0.1$), respectively. However, there is no evidence of less earnings management for unionized firms two years before unionization. This may be due to the fact that, two years before unionization, firms still do not have much information that union elections would be held in the future.

5.4 Placebo tests

Formal placebo tests are performed to ensure that the relation between earnings management and unionization are not spurious. I explore whether the results disappears when picking other winning thresholds than 50%. Table 5 shows that, when the placebo cutoff is 0.63, 0.35, 0.47 or 0.53, unionized firms do not conduct significant less

earnings management following elections in both local linear and local quadratic RDD regressions.

5.5 Cross-sectional tests

To strengthen the story, I also conduct the following cross-sectional tests. Different states passed the right-to-work (RTW) law in different years. In states with RTW, unions cannot force workers to join unions and employees with unions are not required to pay dues to receive the benefits of collective bargaining. Thus, in RTW states, unions have significantly lower bargaining power. When deciding the amount of earnings management, firms trade off the benefits from lower earnings to avoid higher wage demands from unions and the costs from lower stock price. Thus, unionized firms may have attenuated incentives to report lower earnings in RTW states. Table 6 shows that the coefficient on unionization for firms in RTW states has a much smaller economic magnitude (-0.042 vs. -0.060, and -0.056 vs. -0.077). Moreover, the results in RTW states are statistically insignificant while those in states with RTW are significant. This is consistent with the hypothesis that incentives to report lower earnings are weaker when unions have lower bargaining power.

5.6 Can unions undo firms' strategic earnings management?

Next, I explore whether firms are successful in conduct less earnings management to avoid instituting higher wages and better benefits demanded by union workers. That said, are unions powerful enough to undo the effect of less earnings management when negotiating wages and benefits? I first regress the growth rate in pension and retirement

expenses (XPR) and staff expenses (XLR) from year t to year t+2, on two components of earnings, the unmanaged earnings (non-discretionary) and the amount of earnings management at year t+1. The results are reported in panel A of Table 7. If the unions are powerful enough to completely undo this effect, then only the unmanaged earnings—but not the earnings management—can explain the growths in wage and benefits. However, I find that both components have significant explanatory power. In column 1, for pension and retirement expenses, the coefficients for unmanaged earnings and earnings management are 2.471 and 2.375, respectively (t-statistics are 2.92 and 2.75). The same pattern is documented for staff expenses (XLR) in column 2 (coefficients are 2.858 and 2.626 with t-statistics of 2.46 and 2.25). In column 3 and column 4, if I control for the reported earnings, which is the sum of unmanaged earnings and earnings management, then the coefficients on earnings management is not significant anymore, which means that the two coefficients on unmanaged earnings and earnings management in columns 1 and 2 are not significantly different from each other. In panel B, the growth rates of pension and retirement expenses, and staff expenses three years after unionization still positively correlate with both unmanaged earnings and earnings management. In panel C, after four years, the result is only significant for growth rate in pension and retirement expense, but not for staff expenses. In panel D, after five years, both are not significant. This may suggest that, the first initial contract may be renewed four or five years after unionization.

5.7 Effect of Unionization on Pension and Retirement Expenses and the Number of Employees

In addition to the effect on a firm's financial reporting, does unionization lead to real economic effects, e.g. does it affect workers' pension and retirement expenses and the number of employees?

Bronfenbrenner (2009) studies a representative sample of hundreds of NLRB election and finds that within two years after unions win the elections, more than one-third have not reached an initial collective bargaining agreement with the firms. The collective bargaining agreements in the website of Department of Labor (DOL) show that once an initial contract has been reached, it usually last for three to five years.

In this study, I explore the effect of unionization on the growth rate of pension and retirement expenses and the number of employees from two to five years after unionization. In unreported results, the effect two, three, four years after unionization are insignificant. In table 8, I find that the growth rate on pension and retirement expenses five years after unionization are significantly higher for unionized firms using RDD, compared to their nonunionized counterparts. In columns 1 and 2 of Table 8, the growth rate on pension and retirement expenses from year t to year t+5, or the log of the ratio of pension and retirement expenses in year t+5 divided by the one in year t, is significantly higher for unionized firms than for their non-unionized counterparts (coefficient on union dummy is 0.430 and 0.458 using uniform and triangular kernel functions, two-sided $p<0.05$). To mitigate the concern that this difference may be due to the change in the total number of employees, the results for the per-capita expenses are presented in columns 3 and 4, and the results are robust (coefficients are 0.458 and

0.469 respectively, both two-sided $p<0.05$). These findings may be consistent with the above evidence that it usually take a few years after unionization for the majority of firms to reach the initial contracts and the initial contracts usually last for three to five years.

The results on the effects of unionization on the number of employees are presented in Table 9. In columns 1 and 2, the dependent variable is the number of total employees five years following elections, while in columns 3 and 4, the dependent variable is growth rate, or more specifically, the log of the ratio of the number of employees in year t+5 divided by the number in year t. Firms that just pass the election do not have significantly more or less workers from firms that just fail to (two-side p is always greater than 0.10) in all columns. I also explore the effect of unionization on the number of employees 1 through 4 years after elections, but still do not find significant differences among unionized versus non-unionized firms. This is consistent with the findings in DiNardo and Lee (2004).

Overall, these results indicate that unionized firms do incur more expenses on workers' pensions and retirement benefits than their non-unionized counterparts long after unionization, while the short run effect is insignificant. However, the number of employees, or the grow rates in the number of employees are not significantly different between unionized and non-unionized firms over both short and long horizons.

6. Conclusion

In this study, I provide new, significant, and robust causal evidence of unionization on firms' financial reporting and real economic outcomes, utilizing a larger sample size

firm-level data on union elections and regression discontinuity design methodology. I find that, compared to non-unionized firms, unionized firms conduce less earnings management, incur more pension and retirement expenses, but do not have significantly more or fewer employees after unionization. Moreover, the effect on earnings management is only significant among elections in states without right-to-work laws where unions are more powerful. Overall, these results are consistent with firms conducting less earnings management in response to more powerful unions. Moreover, I also explore the real consequence of lower reported earnings and whether unions are able to undo firms' strategic earnings management behavior after unionization when negotiating benefits and wages. Both components of reported earnings, the unmanaged earnings and earnings management, have significant power in explaining future growths in pension and retirement expenses, and staff expenses. Overall, I do not find evidence that unions can completely undo firms' strategic earnings management.

References

Aobdia, D., and Cheng, L. (2018). Unionization, product market competition, and strategic disclosure. *Journal of Accounting and Economics*, 65(2-3), 331-357.

Bova, F. 2013. Labor unions and management's incentive to signal a negative outlook. *Contemporary Accounting Research*, 30(1), 14-41.

Bova, F., Y. Dou, and O. K. Hope. 2015. Employee ownership and firm disclosure. Contemporary Accounting Research, 32(2), 639-673.

Bronfenbrenner, K. (2009). No holds barred: The intensification of employer opposition to organizing.

Budd, J. W. (2004). Non-wage forms of compensation. Journal of Labor Research, 25(4), 597-622.

Budd, J. W. (2007) "The Effect of Unions on Employee Benefits and Non-Wage Compensation: Monopoly Power, Collective Voice, and Facilitation," in James T. Bennett and Bruce E. Kaufman, eds., What Do Unions Do? A Twenty-Year Perspective (New Brunswick, NJ: Transaction Publishers), pp. 160-192.

Blanchflower, D. G., A. J. Oswald, and P. Sanfey. 1996. Wages, profits, and rent-sharing. *The Quarterly Journal of Economics*, 111(1), 227-251.

Bradley, D., I. Kim, and X. Tian. 2016. Do unions affect innovation? *Management Science*, 63(7), 2251-2271.

Brown, Judy A. 2000. Labor perspectives on accounting and industrial relations: A historical

and comparative review, *Labor Studies Journal* 25, 40-75.

Campello, M., J. Gao, J. Qiu, and Y. Zhang. 2017. Bankruptcy and the cost of organized labor: Evidence from union elections. *The Review of Financial Studies*, 31(3), 980-1013.

Cattaneo, M. D., Idrobo, N., and Titiunik, R. (2018). A Practical Introduction to Regression Discontinuity Designs. *Working Manuscript. January 15th ,2018*

Cattaneo, M. D., M. Jansson, and X. Ma. (2017). Simple Local Polynomial Density Estimators. *working paper*, University of Michigan .

Chen, H. J., M. Kacperczyk, and H. Ortiz-Molina. 2011. Labor unions, operating flexibility, and the cost of equity. *Journal of Financial and Quantitative Analysis*, 46(1), 25-58.

Cheng, L. 2016. Organized labor and debt contracting: Firm-level evidence from collective bargaining. *The Accounting Review*, 92(3), 57-85.

Chung, R., B. B. H. Lee, W. J. Lee, and B. C. Sohn. 2015. Do managers withhold good news from labor unions? *Management Science*, 62(1), 46-68.

Chyz, J. A., W. S. C. Leung, O. Z. Li, and O. M. Rui. 2013. Labor unions and tax aggressiveness. *Journal of Financial Economics*, 108(3), 675-698.

Connolly, R. A., B. T. Hirsch, and M. Hirschey. 1986. Union rent seeking, intangible capital, and market value of the firm. *The Review of Economics and Statistics*, 567-577.

Cullinan, C. P., and D. M. Bline. 2003. The effects of labour on accounting choice in Canada. *Accounting Perspectives*, 2(2), 135-151.

Cullinan, C. P., and J. A. Knoblett. 1994. Unionization and accounting policy choices: An empirical examination. *Journal of Accounting and Public Policy*, 13(1), 49-78.

DeAngelo, H., and L. DeAngelo. 1991. Union negotiations and corporate policy: A study of labor concessions in the domestic steel industry during the 1980s. *Journal of financial Economics*, 30(1), 3-43.

Dechow, P. M., A. P. Hutton, J. H. Kim, and R. G. Sloan. 2012. Detecting earnings management: A new approach. *Journal of Accounting Research*, 50(2), 275-334.

Dechow, P. M., R. G. Sloan, and A. P. Sweeney. 1995. Detecting earnings management. *Accounting Review*, 193-225.

Dichev, I. D., and D. J. Skinner. 2002. Large–sample evidence on the debt covenant hypothesis. *Journal of Accounting Research*, 40(4), 1091-1123.

Dou, Y., Khan, M., and Zou, Y. (2016). Labor unemployment insurance and earnings management. *Journal of Accounting and Economics*, 61(1), 166-184.

DiNardo, J., and Lee, D. S. (2004). Economic impacts of new unionization on private sector employers: 1984–2001. *The Quarterly Journal of Economics*, 119(4), 1383-1441.

Hsieh, H. Y. S., B. Jung, and H. Yi. 2017. The Impact of Non-Financial Stakeholders on Accounting Conservatism: The Case of Labor Unions. *Seoul Journal of Business*, 23(1).

Fischer, P. E., and R. E. Verrecchia. 2000. Reporting bias. *The Accounting Review*, 75(2), 229-245.

Francis, J., R. LaFond, P. Olsson, and K. Schipper. 2005. The market pricing of accruals quality. *Journal of Accounting And Economics*, 39(2), 295-327.

Frandsen, B. R. (2012). Why unions still matter: The effects of unionization on the distribution of employee earnings. *Manuscript. Cambridge, MA: MIT.*

Freeman, R. B. (1985). Unions, pensions, and union pension funds. In Pensions, labor, and individual choice (pp. 89-122). *University of Chicago Press*.

García Osma, B., A. Mora, and A. M. Sabater. 2015. Strategic accounting choice around firm-level labor negotiations. *Journal of Accounting, Auditing and Finance*, 30(2), 246-277.

Hamm, S. J., B. Jung, and W. J. Lee. 2013. Labor unions and income smoothing. *Contemporary Accounting Research*.

He, J., X. Tian, H. Yang, and L. Zuo. 2018. Asymmetric Cost Behavior and Dividend Policy, Working Paper.

Hilary, G. 2006. Organized labor and information asymmetry in the financial markets. *Review of Accounting Studies*, 11(4), 525-548.

Imbens, Guido and Thomas Lemieux, 2008, Regression discontinuity designs: A guide to practice, *Journal of Econometrics* 142, 615-635.

Klasa, S., W. F. Maxwell, and H. Ortiz-Molina. 2009. The strategic use of corporate cash holdings in collective bargaining with labor unions. *Journal of Financial Economics*, 92(3), 421-442.

Kothari, S. P., A. J. Leone, and C. E. Wasley. 2005. Performance matched discretionary accrual measures. *Journal of Accounting And Economics*, 39(1), 163-197.

Lee, D. S., and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, 48(2), 281-355.

Lee, D. S., and A. Mas. 2012. Long-run impacts of unions on firms: New evidence from financial markets, 1961–1999. *The Quarterly Journal of Economics*, 127(1), 333-378.

Leung, W. S. C., O. Z. Li, and O. M. Rui. 2009. Labor union and accounting conservatism. Working Paper.

Liberty, S. E., and J. L. Zimmerman. 1986. Labor union contract negotiations and accounting choices. *Accounting Review*, 692-712.

Matsa, D. A. 2010. Capital structure as a strategic variable: Evidence from collective bargaining. *The Journal of Finance*, 65(3), 1197-1232.

Mautz, R. D. Jr. and F. M. Richardson. Fall 1992. Employer financial information and wage bargaining: Issues and evidence. *Labor Studies Journal* 17(3):35-52.

Mora, A., and A. Sabater. 2008. Evidence of income-decreasing earnings management before labour negotiations within the firms. *Investigaciones Económicas*, 32(2).

Qiu, Y. 2017. Debt structure as a strategic bargaining tool, Working Paper, Temple University.

Qiu, Y., and T. Shen. 2017. Organized labor and loan pricing: A regression discontinuity design analysis. *Journal of Corporate Finance*, 43, 407-428.

Roberts, M. R., and Whited, T. M. (2013). Endogeneity in empirical corporate finance1. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier.

Sloan, R. G. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *Accounting Review*, 289-315.

Stein, J. C. 1989. Efficient capital markets, inefficient firms: A model of myopic corporate behavior. *The Quarterly Journal of Economics*, 104(4), 655-669.

Waterhouse, J., M. Gibbins, and A. J. Richardson. 1993. Strategic financial disclosure: Evidence from labor negotiations. *Contemporary Accounting Research*, 9(2), 526-550.

Watts, R. L., and J. L. Zimmerman. 1978. Towards a positive theory of the determination of accounting standards. *Accounting Review*, 112-134.

Appendix

Appendix A: A model on earnings management and Nash Bargaining

In this appendix, I develop an analytical model to motivate some hypotheses tested in the paper. This model is built on signal jamming (Stein, 1989) and earnings management models (Fischer and Verrecchian, 2000; Dye and Sri, 2004). The players in the game include a union, a manager, and a continuum of investors in the stock market. I assume either that there is no agency problem between the manager and the firm or that the agency problem can be solved via contracting. Thus the firm and the manager can be used interchangeably. The union represents workers and its goal is to maximize workers welfare w, including workers' wages and pension and retirement expenses; imprecisely, we can just call w wages.

There are two periods. In the first period, firms' earnings, r, is publicly reported to all market participants. Reported earnings, r, equals true earnings e_0 plus the earnings management. The manager can choose the amount of earnings management b at a cost of $C(b) = cb^2/2$. The earnings are specified as:

$\tilde{e}_0 = \tilde{v} + \tilde{n}_0$ and $\tilde{e}_1 = \alpha * \tilde{v} + \tilde{n}_1$ where $\tilde{n}_0$ and $\tilde{n}_1$ are independent random noises in period 0 and 1's earnings. Ex-ante, the market's common belief is that: $\tilde{v} \sim N(\mu_v, \sigma_v^2)$, $\widetilde{n_0} \sim N(0, \sigma_{n_0}^2)$ and $\widetilde{n_1} \sim N(0, \sigma_{n_1}^2)$.

The timeline of the game is summarized as follows. First, firms' true earnings in the first period, or period zero, is realized. The manger knows precisely the true earnings while other players do not. Secondly, the manager announces earnings, which is the true earnings plus the amount of earnings management. Thirdly, given the first period's reported earnings, the firm bargains with the union on the next periods' fixed

wages, w. After that, the investors in the capital market trade the stocks and set the stock price equal to future ex-wage profits minus wage payment. Finally, the firm's second period earnings is realized and investors consume the cash flows received from company's liquidation.

I focus on the rational expectation equilibrium. In the same spirit as the signal jamming literature, companies conduct earnings management, while the union and investors are rational and sophisticated when forecasting and undoing the amount of earnings management. In equilibrium, the amount of earnings management is fully adjusted and undone. Similar to Fisher and Verrecchia (2000) and Dye and Sridhar (2004), I also extend the model to the case where the amount of earnings management can only be partially adjusted by other market participants after introducing some noise, but the results of the model do not change. There is a Nash Bargaining between the firm and the workers. The workers' wage w is chosen to maximize the total Nash surplus in the negotiation process,

$$[\mathrm{w} - \mathrm{w_a}]^{\beta} * [\mathrm{E}(\widetilde{e_1}|\mathrm{r}) - \mathrm{w} - \mathrm{d_0}]^{\beta} \qquad (1)$$

where without loss of generality, the workers and the firm's outside options $\mathrm{w_a}$ and $\mathrm{d_0}$ are both normalized to zero. The first order condition gives rise to the equilibrium wage:

$$\mathrm{w}^* = \beta * \mathrm{E}(\widetilde{e_1}|\mathrm{r}) \qquad (2)$$

The stock price after period zero's earnings report r, is equal to investors' rational expectation about next period's earnings before expenses on workers' expenses, $\tilde{\mathrm{e}}_1$, minus wage paid to workers, w, i.e.,

$$\mathrm{p} = \mathrm{E}(\widetilde{e_1}|\mathrm{r}) - w^* \qquad (3)$$

By choosing earnings management, b, the manager's objective function is to maximize shareholders' interests, equaling stock price after the earnings announcement, p, minus earnings management cost, i.e.

$$U = p - \frac{cb^2}{2} \tag{4}$$

$$E(\tilde{e_1}|r) = \alpha E((\tilde{v}|r) = \alpha * \frac{[r-b(e)]*\sigma_v^2}{\sigma_v^2+\sigma_{n_0}^2} + \alpha * \frac{\mu_v*\sigma_{n_0}^2}{\sigma_v^2+\sigma_{n_0}^2} \tag{5}$$

After plugging other formula into equation (3) and taking first order condition, we get the optimal amount of earnings management chosen by the manager,

$$b^* = \frac{(1-\beta)\alpha}{c} * \frac{\sigma_v^2}{\sigma_v^2+\sigma_{n_0}^2} \tag{6}$$

From equation (6), we can reach the following hypotheses:

(Hypothesis H1) After unionization, the union's bargaining power β increases, so the manager would do less (positive) earnings management. Or, mathematically, $\frac{\partial b^*}{\partial \beta} < 0$.

(Hypothesis H2) If a firm's earnings management across periods are more correlated with each other (α is larger), then the magnitude of the unionization effect is larger, i.e., $|\frac{\partial b^*}{\partial \beta}|$ is larger if α increases.

Next, we explore the workers' welfare before and after unionization. After plugging the expressions of equilibrium earnings management into equation 6) and the other formula into equation (2), and taking derivative on workers' welfare, w, with respect to union's bargaining power, β, we get:

$$\frac{\partial w^*}{\partial \beta} = \alpha \left[\frac{[r-b(e)]*\sigma_v^2}{\sigma_v^2+\sigma_{n_0}^2} + \frac{\mu_v*\sigma_{n_0}^2}{\sigma_v^2+\sigma_{n_0}^2}\right] + \alpha * \beta \frac{\sigma_v^2}{\sigma_v^2+\sigma_{n_0}^2} * \frac{\alpha}{c} * \frac{\sigma_v^2}{\sigma_v^2+\sigma_{n_0}^2} \tag{7}$$

This is stated in the following hypothesis:

(H3, workers' welfare) After unionization, as the union's bargaining power increases, the equilibrium negotiated welfare per worker, including wage and pension and retirement expenses, increases as well.

Actually, union bargaining power has two effects on the worker welfare. The direct effect is that, after unionization, the union is more powerful and thus able to extract more rents from the firm's profits in collective bargaining. Additionally, the indirect effect states that, when a union is more powerful, the manager will conduct less earnings management to "hide" some profits from the union and workers. Less earnings management incurs less inefficiency since in the long-run, accruals would reverse and the costs spent on earnings management is merely a waste of resources. Therefore, firms' profits would be higher on average after unionization.

Some caveats are in order, however. First, this improvement in workers' welfare only applies to workers who keep their jobs both before and after unionization. In reality, some workers may be laid off after unionization. Thus, some workers are worse off. The current model does not take into account the change in the number of employees. Additionally, even if workers' payments from the firm are higher, in reality, there are some costs of unionization, which the current model ignores. Finally, for welfare analyses for the whole society, we also need to consider the negotiation costs, including the cost of the strike, if any.

Appendix B: Variable Definitions

Variable	Description
CASH_HOLDING	CHE divided by AT (book value of total assets) at the end of year t.
ELIGIBLE_TO_EMP	The ratio of the number of eligible votes in the election divided by the total number of employees.
EM	The performance-matched abnormal accruals using modified Jones Model following Francis et al. (2005).
EM_LEAD1	Earnings management in year t+1
EMP	the number of total employees in the company in year t;
LEVERAGE	Book value of long-term debt in year t divided by book value of total assets (at) in year t.
MTB	(PRCC_F*CSHO+DLTT+DLC+PSTKL-TXDITC)/AT, all measured at the end of year t.
NI_AT	the ratio of net income in year t divided by total assets in year t.
NI_AT_LEAD1	the ratio of net income in year t+1 divided by total assets in year t+1.
Q	(at-ceq+abs(prcc_f))*csho, all measured at the end of year t.
RATIO_XLR_LEADk	Log of the ratio of staff expenses in year t+k divided by that in year t, where k=2,3,4,5.
RATIO_XPR_LEADk	Log of the ratio of pension and retirement expenses in year t+k divided by that in year t, where k=2,3,4,5.
R&D	XRD in year t divided by SALE in year t.
ROA	Operating income before depreciation in year t divided by book value of total assets at the end of year t.
RTW	An indicator variable which equals 1 if the union is held in states which right-to-work law and 0 otherwise.
SIZE	Log of total assets in year t.
TANGIBILITY	The ratio of PPENT to AT (total asset) in year t.
Union/Unionization	An indicator variable equal to 1 if the union is formed (vote shares for unionization is greater than 50%).
Vote Share	Number of votes for the most voted union divided by total number of votes.
XLR	Staff expenses in year t.
XPR	Expenses for pension and retirement in year t.

Figure 1
Histogram of the Percentage of Votes Favoring Unionization

Note: This figure displays a histogram of the percentage of votes for the unionization. The y-axis is the frequency, or equivalently, the number of observations, while the x-axis is the percentage of votes for unionization.

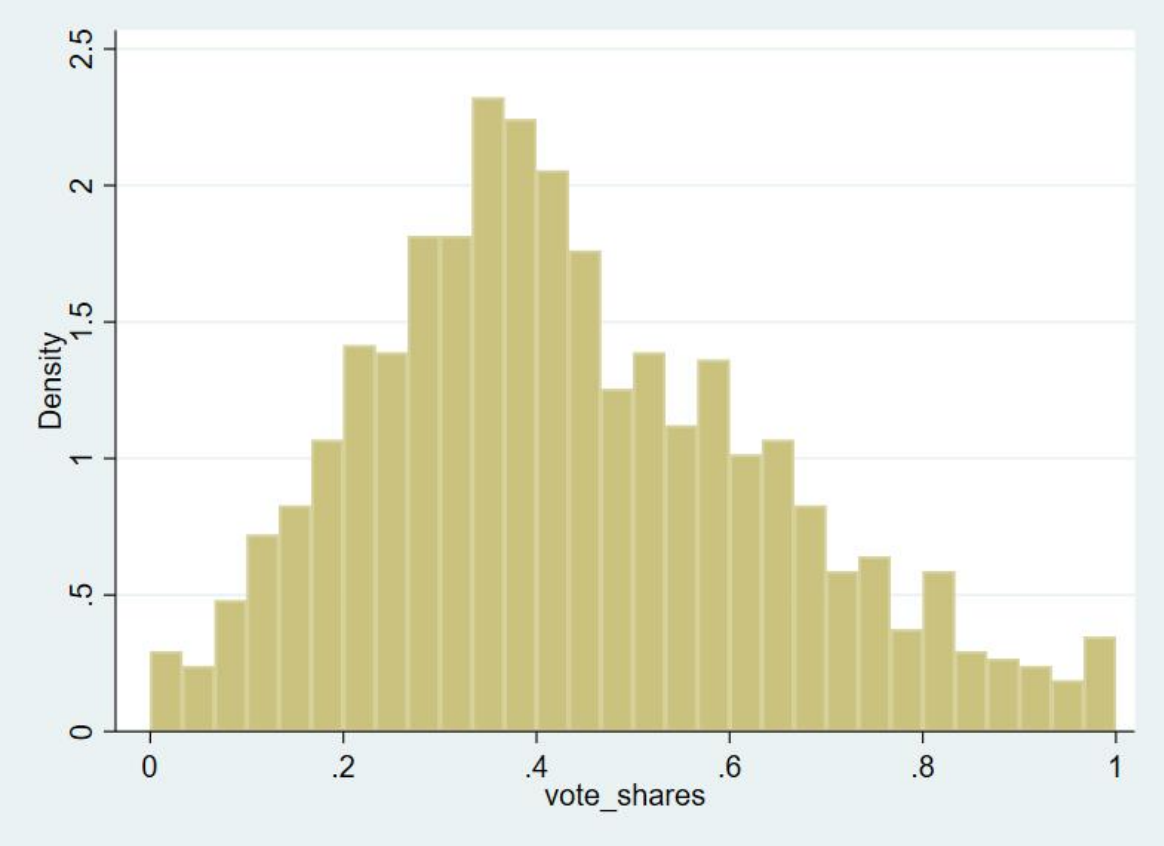


Figure 2

Graphical Display of EM against Vote Shares near the Cutoff of 0.5, 0.45 and 0.55

Note: The following figures represent the RDD plots to show the relation between earnings management and the votes in favor of a union. The y-axis is earning management one year after while the x-axis is the percentage of votes favoring unionization. The plot points depict the average earnings management outcomes in each of the 40 equally-spaced bins. The different polynomial functions up to the order of 4 are used on the left and right of the cutoff. The cutoffs in the following graphs are 0.5, 0.45, and 0.55.

Figure 2a Cutoff of 0.5

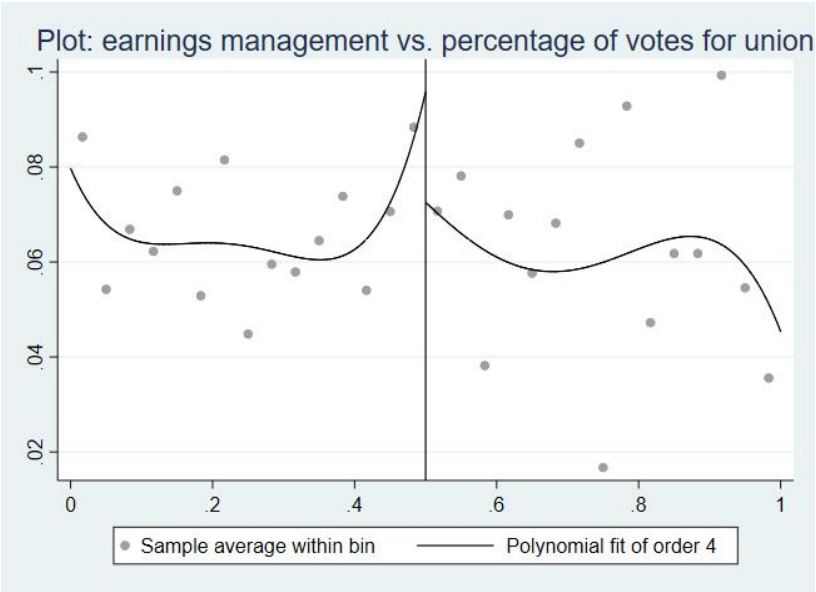


Figure 2b Placebo Cutoff of 0.45

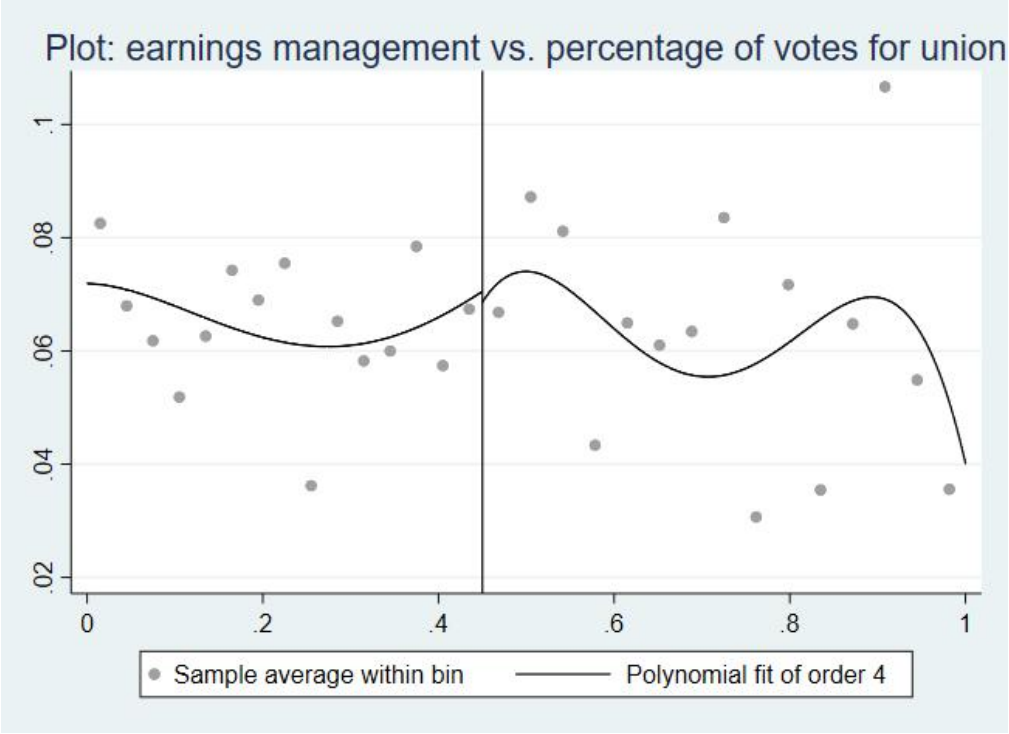


Figure 2c Placebo Cutoff of 0.55

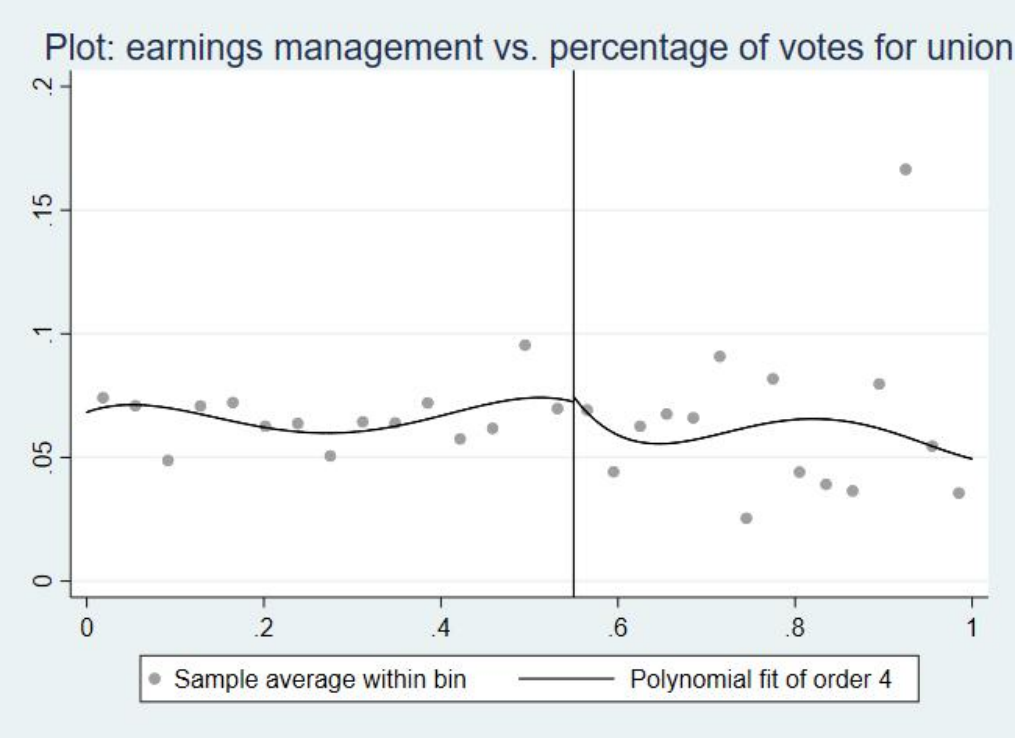


Figure 3
Histogram for z-statistics for 1,000 Random Draws from Pseudo Cutoffs

Note: This figure presents the histogram of z-statistics for the union dummy in the RDD local quadratic regressions for 1000 randomly selected pseudo cutoffs from uniform distribution [0.25,0.75]. The red line denotes the z-statistic for union dummy under the true cutoff of 0.50.

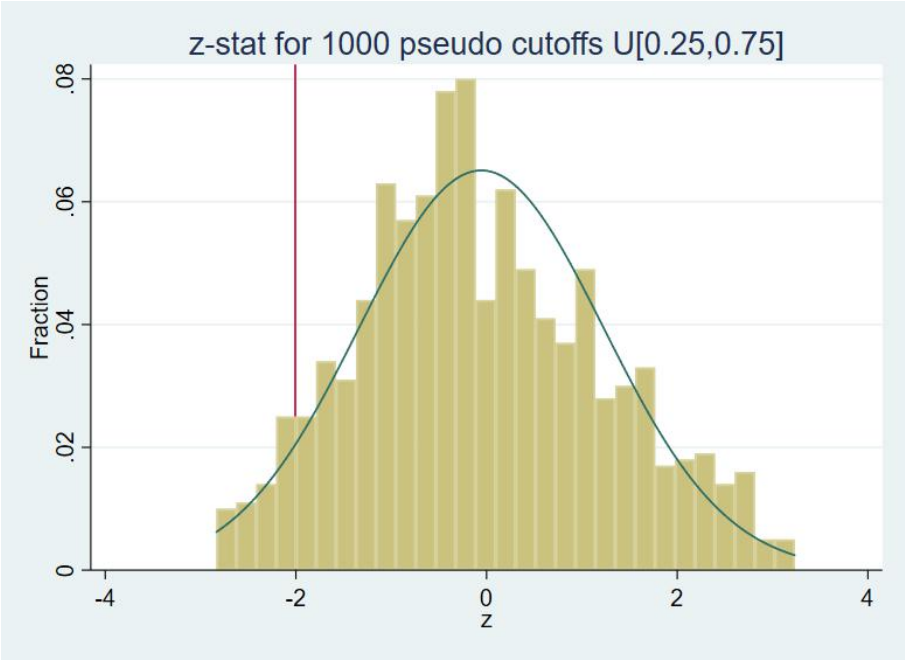


Figure 4
Histogram for Coefficients of Unionization for 1,000 Random Draws from Pseudo Cutoffs

Note: This figure presents the histogram of coefficients for the union dummy in the RDD regressions for 1000 randomly selected pseudo cutoffs from uniform distribution [0.25,0.75]. The red line denotes the coefficient for union dummy under the true cutoff of 0.50.

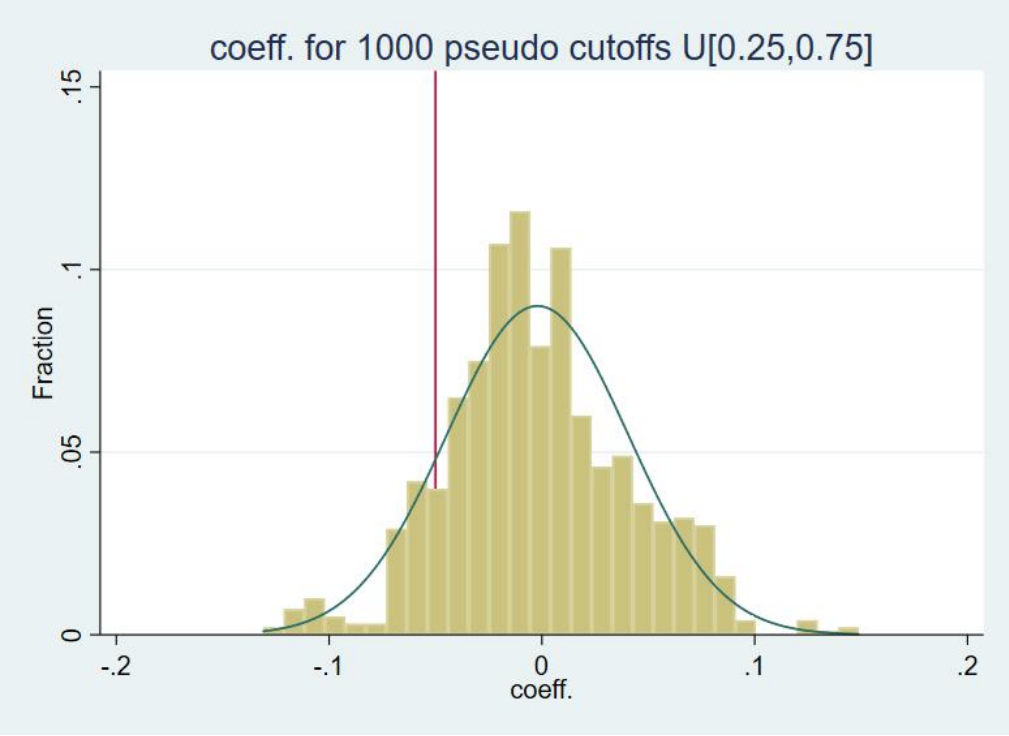


Table 1
Descriptive Statistics for Variables

Note: This table reports summary statistics for the main variables used in the regression analysis. The full sample consists of 2318 union elections over the period 1977-2014, among which 768 successfully pass unionization while 1550 fail to pass. Panels A, B, and C report the summary statistics for the full sample, unionized sample, and non-unionized sample separately. Variable definitions are provided in Appendix B. Panel D reports the industry distribution of elections.

Panel A: Summary statistics for full Sample (2318 union elections)

Variable	N	Mean	Median	Std. Dev
EM_LEAD1	2150	0.0621	0.0470	0.174
XPR	1990	28.15	4.902	65.64
XLR	593	1367	483.0	2441
EMP	2287	20.99	8.00	29.16
RTW	2318	0.295	0.00	0.456
Vote Share	2318	0.439	0.419	0.197
Unionization	2318	0.331	0.00	0.471
ROA	2318	0.0500	0.0560	0.0680
SIZE	2318	6.293	6.378	2.011
LEVERAGE	2314	0.284	0.261	0.173
RATIO_XPR_LEAD2	1650	0.0790	0.115	0.708
RATIO_XPR_LEAD3	1513	0.104	0.144	0.761
RATIO_XPR_LEAD4	1403	0.116	0.157	0.901
RATIO_XPR_LEAD5	1314	0.126	0.155	1.047
RATIO_XLR_LEAD2	488	0.131	0.130	0.177
RATIO_XLR_LEAD3	440	0.179	0.168	0.228
RATIO_XLR_LEAD4	409	0.209	0.217	0.286
RATIO_XLR_LEAD5	381	0.250	0.258	0.315

Panel B: Summary statistics for unionized sample (768 union elections)

Variable	N	Mean	Median	Std. Dev
EM_LEAD1	708	0.0607	0.0460	0.145
XPR	653	32.55	4.750	72.38
XLR	196	1626	535.7	2734
EMP	756	21.17	7.600	30.08
RTW	768	0.275	0	0.447
Vote Share	768	0.664	0.635	0.124
Unionization	768	1	1	0
ROA	768	0.0450	0.0500	0.0720
SIZE	768	6.238	6.261	2.071
LEVERAGE	768	0.300	0.276	0.184
RATIO_XPR_LEAD2	550	0.0990	0.106	0.622
RATIO_XPR_LEAD3	512	0.0720	0.106	0.762
RATIO_XPR_LEAD4	468	0.106	0.138	0.882
RATIO_XPR_LEAD5	430	0.108	0.117	1.021
RATIO_XLR_LEAD2	164	0.133	0.133	0.180
RATIO_XLR_LEAD3	149	0.198	0.178	0.234
RATIO_XLR_LEAD4	136	0.205	0.204	0.329
RATIO_XLR_LEAD5	124	0.258	0.259	0.347

Panel C: Summary statistics for non-unionized sample (1550 union elections)

Variable	N	Mean	Median	Std. Dev
EM_LEAD1	1442	0.0628	0.0470	0.186
XPR	1337	26.00	4.903	62
XLR	397	1239	445.5	2276
EMP	1531	20.90	8.217	28.70
RTW	1550	0.305	0	0.460
Vote Share	1550	0.327	0.340	0.113
Unionization	1550	0	0	0
ROA	1550	0.0520	0.0580	0.0650
SIZE	1550	6.321	6.447	1.980
LEVERAGE	1546	0.277	0.257	0.167
RATIO_XPR_LEAD2	1100	0.0680	0.120	0.748
RATIO_XPR_LEAD3	1001	0.120	0.154	0.760
RATIO_XPR_LEAD4	935	0.121	0.180	0.910
RATIO_XPR_LEAD5	884	0.134	0.185	1.060
RATIO_XLR_LEAD2	324	0.130	0.128	0.176
RATIO_XLR_LEAD3	291	0.170	0.163	0.225
RATIO_XLR_LEAD4	273	0.211	0.220	0.263
RATIO_XLR_LEAD5	257	0.246	0.252	0.298

Panel D: Industry Distribution of Elections

1-Digit SIC	Industry Name	Frequency	Percentage
1	Mining	54	2.33%
2	Construction	716	30.89%
3	Manufacturing	808	34.86%
4	Transportation, Communication, Electric, Gas and Sanitary Service	299	12.90%
5	Whole and Retail Trade	302	13.03%
6	Finance, Insurance and Real Estate	10	0.43%
7	Services	70	3.02%
8	Health Services	39	1.68%
9	Public Administration	20	0.86%

Table 2
Predetermined Firm Characteristics

Panel A: Local Linear RDD

	ROA_LAG1	Q_LAG1	R&D_LAG1	CASH_HOLDING_LAG1	TANGIBILITY_LAG1	MTB_LAG1
Coeff.	-0.002	2537.929	0.005	-0.002	0.004	-0.126
z-	(-0.14)	(0.97)	(0.78)	(-0.08)	(0.06)	(-0.32)
Obs.	562	493	314	562	562	493

Panel B: Local Quadratic RDD

	ROA_LAG1	Q_LAG1	R&D_LAG1	CASH_HOLDING_LAG1	TANGIBILITY_LAG1	MTB_LAG1
Coeff.	0.013	3384.663	-0.004	0.001	0.010	0.066
z-	(0.79)	(1.11)	(-0.46)	(0.03)	(0.10)	(0.14)
Obs.	562	493	314	562	562	493

Note: This table shows the results for the null hypothesis of no systematic differences in firm characteristics one year before the election between firms that barely elect to unionize and firms that just failed to. The triangular kernel and optimal bandwidth is used. Different polynomial functions up to the orders of 2 are employed. The coefficients for RDD estimation are bias-corrected to remove the misspecification error in RDD[10]. *Obs* is the number of effective observations within the bandwidth, instead of the total number of observations.

10 To mitigate the effect of misspecification error arising from the fact that the local polynomial approach is a nonparametric approximation as on page 62-64 of Cattaneo, Idrobo, and Titiunik (2018), the bias-corrected coefficients (estimators) are used in all RDD regressions.

Table 3
Main Results: Does Unionization Lead to Lower Earnings Management Ex-Post?

Panel A: Local Linear and Quadratic RDD

	(1)	(2)	(3)	(4)
Unionization	-0.050**	-0.058**	-0.059**	-0.065**
z-statistic	(-2.01)	(-2.33)	(-2.22)	(-2.34)
Effective Obs.	1143	569	899	380
Opt. Bandwidth	0.165	0.079	0.126	0.055
Kernel	triangular	triangular	uniform	uniform
Polynomial order p	2	1	2	1

Panel B: Robustness using Different Bandwidths (Triangular Kernel)

	(1)	(2)	(3)	(4)	(5)	(6)
Unionization	-0.050**	-0.097**	-0.080***	-0.059***	-0.046**	-0.032*
z	(-2.01)	(-2.37)	(-2.64)	(-2.72)	(-2.34)	(-1.75)
Effective Obs.	1143	595	886	1414	1623	1786
Bandwidth	Opt.	0.5 *Opt.	0.75*opt	1.25*opt	1.5*opt	1.75*opt
Kernel	triangular	triangular	triangular	triangular	triangular	triangular
p	2	2	2	2	2	2

Panel C: Robustness using Different Bandwidths (Uniform Kernel)

	(1)	(2)	(3)	(4)	(5)	(6)
Union	-0.059**	-0.093**	-0.075**	-0.082***	-0.044**	-0.035*
z	(-2.22)	(-2.10)	(-2.28)	(-3.52)	(-2.08)	(-1.80)
Effective Obs.	899	437	680	1108	1309	1495
Bandwidth	Opt.	0.5 *Opt.	0.75*opt	1.25*opt	1.5*opt	1.75*opt
Kernel	Uniform	Uniform	Uniform	Uniform	Uniform	Uniform
p	2	2	2	2	2	2

Note: This table reports the earnings management one year after election. The dependent variables are earnings management. In all Panels, I control for Q, SIZE, and ROA. The optimal bandwidths and rectangular kernel functions are used in local linear regressions in both panels. The coefficients estimation are bias-corrected to remove the misspecification error in RDD. ***.**. and * represent significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Earnings Management One Year and Two Years before the Elections using RDD

	EM_LAG1	EM_LAG2	EM_LAG1	EM_LAG2
Union	-0.043*	0.002	-0.036*	-0.023
z	(-1.67)	(0.05)	(-1.74)	(-1.20)
Polynomial Order	2	2	1	1
Effective N	1182	978	863	1044

Note: This table reports earnings management one (first and third column) or two (second and fourth column) years before the elections. The optimal bandwidths and triangular kernel functions are used in local linear regressions in both panels. The coefficients for RDD estimation are bias-corrected to remove the misspecification error in RDD. ***.**. And * means significance at 1%, 5% and 10% levels, respectively.

Table 5
Placebo Tests using Pseudo Cutoffs other than 50%

Panel A: Local Linear RDD

	(1)	(2)	(3)	(4)
Pseudo cutoff	0.65	0.35	0.47	0.53
Union	0.004	0.009	0.020	-0.014
z	(0.16)	(0.55)	(1.14)	(-0.67)

Panel B: Local Quadratic RDD

	(1)	(2)	(3)	(4)
Pseudo cutoff	0.65	0.35	0.47	0.53
Union	0.002	0.003	-0.009	-0.007
z	(0.04)	(0.12)	(-0.36)	(-0.29)

Note: This table reports the earnings management one year after the election using pseudo cutoffs other than 0.5. The optimal bandwidths and Triangular kernel functions are used in local linear and quadratic regressions. The coefficients for RDD estimation are bias-corrected to remove the misspecification error in RDD. ***.**. and * means significance at 1%, 5%, and 10% levels, respectively.

Table 6
Cross-Sectional Test: Right-to-Work Law vs. without Right-to-Work Law

	(1)	(2)	(3)	(4)
	RTW	without RTW	RTW	without RTW
Union	-0.042	-0.060*	-0.056	-0.077**
z-statistic	(-0.82)	(-1.70)	(-1.10)	(-1.99)
Effective Obs.	39 1	629	192	242
Total Obs.	634	1516	634	1516
Kernel	triangular	triangular	triangular	triangular
Polynomial p	2	2	1	1
Opt. BDW	0.184	0.196	0.088	0.052

Note: This table reports the earnings management after elections in states with and without RTW. The columns 1 and 3 show the results on subsamples in states with RTW while columns 2 and 4 are for those without RTW. The linear and quadratic linear RDD approach is employed with optimal bandwidths. The coefficients for RDD estimation are bias-corrected with cubic correction term to remove the misspecification error in RDD. ***.**. and * means significance at 1%, 5%, and 10% levels, respectively.

Table 7
Can Unions Undo Firms' Strategic Earnings Management?

Panel A: Expenses Growth Rate in Two Years after Unionization

	(1)	(2)	(3)	(4)
Dependent Variable	RATIO_XPR_LEAD2	RATIO_XLR_LEAD2	RATIO_XPR_LEAD2	RATIO_XLR_LEAD2
Unmanaged Earnings_t+1	2.471***	2.858**		
	(2.92)	(2.46)		
EM_t+1	2.375***	2.626**	-0.096	-0.232
	(2.75)	(2.25)	(-0.39)	(-1.06)
Reported Earnings_t+1			2.471***	2.858**
			(2.92)	(2.46)
NI	-0.079	-0.575	-0.079	-0.575
	(-0.14)	(-0.86)	(-0.14)	(-0.86)
Constant	0.181	-0.326	0.181	-0.326
	(1.30)	(-1.02)	(1.30)	(-1.02)
FEs	Industry+Year	Industry+Year	Industry+Year	Industry+Year
Std. Error cluster by	Industry	Industry	Industry	Industry
Adj. R-Square	0.143	0.433	0.143	0.433
N	523	158	523	158

Panel B: Expenses Growth Rate in Three Years after Unionization

	(1)	(2)	(3)	(4)
Dependent Variable	RATIO_XPR_LEAD3	RATIO_XLR_LEAD3	RATIO_XPR_LEAD3	RATIO_XLR_LEAD3
Unmanaged Earnings_t+1	2.465**	2.951***		
	(2.01)	(3.55)		
EM_t+1	2.760**	2.453***	0.295	-0.499***
	(2.16)	(3.00)	(0.93)	(-2.86)
Reported Earnings_t+1			2.465**	2.951***
			(2.01)	(3.55)
NI	0.852	-0.525	0.852	-0.525
	(0.91)	(-0.67)	(0.91)	(-0.67)
Constant	0.112	0.245*	0.112	0.245*
	(0.50)	(1.82)	(0.50)	(1.82)
FEs	Industry+Year	Industry+Year	Industry+Year	Industry+Year
Std. Error cluster by	Industry	Industry	Industry	Industry
Adj. R-Square	0.200	0.547	0.200	0.547
N	487	143	487	143

Panel C: Four Years after Unionization

	(1)	(2)	(3)	(4)
Dependent Variable	RATIO_XPR_LEAD4	RATIO_XLR_LEAD4	RATIO_XPR_LEAD4	RATIO_XLR_LEAD4
Unmanaged Earnings_t+1	3.507**	1.724		
	(2.34)	(1.44)		
EM_t+1	3.854**	1.06	0.346	-0.664
	-2.35	-0.81	-0.87	(-1.50)
Reported Earnings_t+1			3.507**	1.724
			(2.34)	(1.44)
NI	-0.123	0.727	-0.123	0.727
	(-0.09)	(0.39)	(-0.09)	(0.39)
Constant	0.002	0.482**	0.002	0.482**
	(0.01)	(2.44)	(0.01)	(2.44)
FEs	Industry+Year	Industry+Year	Industry+Year	Industry+Year
Std. Error cluster by	Industry	Industry	Industry	Industry
Adj. R-Square	0.295	0.605	0.295	0.605
N	447	130	447	130

Panel D: Five Years after Unionization

	(1)	(2)	(3)	(4)
Dependent Variable	RATIO_XPR_LEAD5	RATIO_XLR_LEAD5	RATIO_XPR_LEAD5	RATIO_XLR_LEAD5
Unmanaged Earnings_t+1	0.571	1.210		
	(0.20)	(0.93)		
EM_t+1	1.29	1.021	0.719	-0.189
	(0.44)	(0.66)	(1.52)	(-0.39)
Reported Earnings_t+1			0.571	1.210
			(0.20)	(0.93)
NI	1.326	1.900	1.326	1.900
	(0.71)	(0.78)	(0.71)	(0.78)
Constant	0.095	0.740***	0.095	0.740***
	(0.20)	(3.29)	(0.20)	(3.29)
FEs	Industry+Year	Industry+Year	Industry+Year	Industry+Year
Std. Error cluster by	Industry	Industry	Industry	Industry
Adj. R-Square	0.276	0.682	0.276	0.682
N	415	119	415	119

Note: This table reports the results for the OLS regressions of growth in expenses in year t+2, t+3, t+4, t+5 (pension and retirement expenses, and staff expenses) on two components of earnings, the non-discretionary part of earnings and earnings management in year t+1. RATIO_XPR_LEAD2 is the log of ratio of total pension and retirement expenses in year t+k (k=2,3,4,5) divided by that in year t+1. RATIO_XLR_LEADk is the log of the ratio of total staff expenses in year t+k divided by that in year t+1. NI_AT is the net income in year t, scaled by total asset. Value of t-statistics are in parentheses. ***.**. and * means significance at 1%, 5%, and 10% levels, respectively.

Table 8
Effects of Unionization on Future Pension and Retirement Expenses

	RATIO_XPR_5	RATIO_XPR_5	RATIO_(XPR/EMP)_5	RATIO_(XPR/EMP)_5
Union	0.430**	0.458**	0.461**	0.469**
z-statistics	(2.14)	(2.34)	(2.30)	(2.37)
Total Obs.	1310	1310	1296	1296
Effective Obs.	492	585	451	539
Opt. Bandwidth	0.107	0.126	0.096	0.116
Kernel	uniform	triangular	uniform	triangular
Polynomial p	1	1	1	1

Note: This table reports the effects of unionization on the growth of pension and retirement expenses (XPR) five years after unionization. RATIO_XPR is log of the total pension and retirement expenses in year t+5 divided by the one in year t where t is the election year. Similarly, RATIO_(XPR/EMP) is the log of the average pension and retirement expenses per employee (XPR/EMP) in year t+5 divided by the one in year t. The local linear RDD approach is employed with optimal bandwidths. The coefficients for RDD estimation are bias-corrected to remove the misspecification error in RDD. ***.**. and * means significance at 1%, 5%, and 10% levels, respectively.

Table 9 The Effect on the Number of Employees

	EMP_LEAD5	EMP_LEAD5	RATIO_EMP_LEAD5	RATIO_EMP_LEAD5
coeff. on Union	-0.951	1.273	0.02	0.025
z-statistics	(-0.25)	-0.38	-0.31	-0.41
Total Obs.	1746	1746	1731	1731
Kernel	uniform	triangular	uniform	triangular
Polynomial order	1	1	1	1

Note: This table reports the effect of unionization on the total number of employees. EMP_LEAD5 is the total number of employees in year t+5 where t is the election year. RATIO_EMP_LEAD5 is the log of the ratio of total number of employees in year t+1 divided by the number in year t where t is the election year. The local linear RDD approach is employed with optimal bandwidths and covariates of size, ROA and leverage. The coefficients for RDD estimation are bias-corrected to remove the misspecification error in RDD. ***.**. and * means significance at 1%, 5%, and 10% levels, respectively.

Chapter 2 Incentive Contracting with Multiple Directorships

Abstract

A unique feature of the outside director market is that a director usually simultaneously works for several companies. In this paper, based on the linear-exponential-neutral (LEN) framework, I find that the relationship between optimal incentives (pay-performance sensitivity) and the number of directorships is always positive, no matter efforts across directorships are substitutive or complementary.

1 Introduction

A feature of the independent director market is multiple directorships. According to the database of Riskmetrics, more than half of all independent directors hold multiple directorships. Because each director has limited time and energy, overboarding may destroy shareholder value and be detrimental to corporate governance. The maximum number of directorships an independent director is allowed to hold in China is five. In India, the maximum number is ten. From a sample from 708 public companies in 2010 in the US, the *"Hewitt Analysis of outside director compensation*" report shows that the maximum number of directorships is 11. Even though there is no regulation in the US on the maximum number of directorships an independent director is allowed to hold, there

is a policy debate on the issue of overboarding (Papadopoulos, 2019). In the Sarbanes-Oxley era, the breakdown in corporate governance caused many scandals, which some have attributed to independent directors who did not have enough time to fulfill their oversight responsibility. As stated in Papadopoulos (2019), "the idea that directors should not serve on too many boards has been a key consideration for investors for many years. The main concern for investors and companies focuses on the ability of directors to fulfill their responsibilities given the significant time commitment associated with each directorship". However, another key element that is mentioned less in this debate is the synergy, or the complementarity, across different companies the same director serves on. For example, if a director serves on the boards of two companies in the same industry simultaneously, the more effort he invests in one company, the more familiar he will be with the industry, and thus his marginal cost of effort for the other company will be lower.

Academically, there have been many studies on corporate executives (Becht, Bolton and Roell, 2003; Masulis, 2020). However, the market for outside directors[1] is relatively underexplored (Adams and Weisbach, 2010). Unlike corporate executives, outside directors usually serve on multiple companies' boards simultaneously. In this paper, I theoretically investigate the relationship between the optimal incentives that different companies offer for the same outside director and the number of directorships. The research questions explored in this paper are: (1) do more directorships relate to stronger or more muted incentives? and (2) what is the optimal number of boards for an outside director to serve on and what are the determinants of this number? These questions are interesting and important because they shed light on the interaction between incentives different

[1]In this paper, I do not differentiate between outside directors and independent directors. My focus is on investigating directors with multiple directorships. Thus, the model is applicable to both outside directors and independent directors as long as they hold multiple directorships.

companies offer. In addition, investigating these issues deepens our understanding of the trade-off between risk sharing and incentive provision. Lastly, the answers to these questions may yield policy implications.

Based on a sample from 708 public companies representing four major industries in 2010 in the US, the *"Hewitt Analysis of outside director compensation"* report shows that the compensation for outside directors comprises three parts: (1) annual retainer, which is a fixed payment; (2) performance pay, which is the compensation that companies grant directors in the form of their own company's equities (e.g. stocks and stock options); and (3) payments based on attending board committee meetings. However, the third part is becoming much less common in the past decade and is now negligible. More specifically, the average annual retainer is \$67,624 while the average economic value for non-retainer equity is \$68,767. Obviously, performance pay makes up a large part of the total compensation and is crucial in aligning the interests of outside directors and shareholders. Thus, in the theoretical model, I assume that the outside directors receive both fixed and performance-based payments. Another piece of institutional background is the prevalence of multiple directorships in the outside director market. According to the ISS (formerly RiskMetrics) database, more than half of the outside directors serve on multiple boards.

In the model, multiple companies compete for a director's efforts[2]. An outside director can determine the number of boards he or she will serve on before they negotiate with N companies on the incentive contracts. The companies specify pay-performance sensitivity while the director determines the fixed salary. Next, the director chooses efforts for each company. In the end, the output for each company is realized, and the companies make payments to the outside director.

When the number of directorships is exogenously given, when exploring

[2]In this paper, based on the Linear-Exponential-Normal framework, it is assumed that the director's efforts improve a company's output.

the relationship between the number of directorships N and incentives (or Pay-Performance-Sensitivity), there are two effects, namely the competition effect and the task-interaction effect. The competition effect suggests that, as the number of directorships increases, more companies are competing for the same director's effect, and thus companies would offer greater incentives, leading to a positive relationship between the number of directorships and incentives. The task-interaction effect depends on whether efforts are complementary or substitutive across tasks. When efforts are substitutive, with more directorships, it becomes more costly to induce the director to work hard, leading to a negative relationship between the number of directorships and incentives; however, when efforts are complementary, with more directorships, it is less costly to induce the director to work hard, leading to a positive relationship between the number of directorships and the incentives. The model suggests that: (1) when efforts are complementary, the association between incentives and the number of directorships is positive since both competition and task-interaction effects are positive; (2) when efforts are substitutive, the relationship is still positive because the competition effect dominates the task-interaction effect. In summary, the relationship between incentives and the number of directorships is always positive. Then, I turn to the issue of how the optimal number of directorships is determined endogenously and the optimal incentives. I conduct some comparative static analyses numerically as the closed-form solutions are not available. The numerical analyses show at least in some parameter region, with substitutive efforts, the outside director with greater ability (the parameter c in the cost function is smaller) serves on more boards; the less risk-averse director also serves on more boards; the riskier these firms are, the fewer directorships the outside director holds, and the optimal number of directorships decreases with the degree of substitution p. Moreover, after endogenizing the optimal

number of directorships N, with substitutive efforts, companies provide more muted incentives for more risk-averse directors; the optimal incentive decreases with the companies' riskiness; directors with greater ability (smaller c) are offered stronger incentives; and the optimal incentive increases with the degree of substitution p.

This paper is related to several strands of literature.

First, a strand of literature empirically investigates busy boards and its effect on firm value. Generally, the results are quite mixed. Ferris, Jagannathan and Pritchard (2003) find no evidence that directors with multiple directorships shirk their responsibilities to serve on board committees, or that they are associated with more securities fraud litigation. These findings are consistent with Fama and Jensen (1983)'s reputation hypothesis. However, Fich and Shivdasani (2006) argue that corporate governance is weak in companies with busy boards, which are defined as firms where the majority of outside directors hold three or more directorships. They find that companies with busy boards have lower sensitivity of CEO turnover to financial performance, and these firms are less profitable. Further, the departure of busy directors is associated with positive abnormal returns. Field, Lowry and Mkrtchyan (2013) propose the bright side of busy directors that they are more experienced and efficient at offering advice, which is crucial for new IPO firms. Therefore, busy boards are associated with higher firm value for IPO firms. Papers in this strand of literature focus on the relationship between busy boards and firm value. The number of directorships is taken as given. My paper focuses more on the relationship between pay performance sensitivity and the number of directorships.

This paper is associated with the literature on common agency as well. Bernheim and Whinston (1986) show that a non-cooperative menu auction among the principals has an efficient equilibrium. There have been some applications.

For example, Grossman and Helpman (1994) apply the model to the setting of tariffs lobbying, and Dixit (1996) applies it to producer taxes and subsidies. This line of literature on common agency focuses on whether the efficient outcome can be achieved. However, my paper is more focused on the relationship between incentives and the number of principals, and their determinants, which are not explored in the existing literature.

In addition, this paper is related to the literature on multi-tasking but with some key differences. Holmstrom and Milgrom (1991) extend the principal-agent framework to the multi-task setting. In their model, the principal either has several different tasks or a single task with multiple dimensions. In this paper, however, the distinguishing feature of the outside director market is that there are many principals (companies) who compete with each other for a director's efforts. Thus, the choice of incentive schemes for a director is a non-cooperative activity. However, in Holmstrom and Milgrom (1991), there is a single principal and his purpose is to maximize the "total profits" from multiple tasks, which is similar to the case where multiple principals cooperate. In reality, cooperation among principals is often unlikely. This may be due to the lack of communication or the fact that the gains to deviate from collusion are greater than the costs.

Last but not the least, this paper also builds on the accounting literature the LEN (Linear-Exponential-Neutral) framework. According to Lambert (2001), which reviews agency theory and its applications to accounting issues, the model in this paper belongs to the class of multi-action models using the LEN framework (e.g., Bushman and Indjejikian, 1993, Feltham and Xie, 1994, Hemmer, 1995, and Rajan and Reichelstein, 2004). In particular, it is related to the optimal number of partnerships (Huddart and Liang, 2005 and Liang, Rajan, and Ray 2008). Huddart and Liang (2005) investigate optimal partner-

ship size, profit shares and inventive payments when every partner performs the same tasks, and find out that either smaller or larger partnerships dominates medium-size partnerships. Liang, Rajan, and Ray (2008) explore the optimal team size and monitoring in organizations and show that the presence of complementarities between team size and monitoring, and between worker talent and managerial monitoring ability. The distinguishing feature of this paper from the accounting literature is that, multiple principals offer incentive contracts simultaneously to compete for the same agent's costly efforts, and thus, the interplay between principals plays a key role and the externality one principal imposes on others needs to be taken into account.

The rest of the paper is organized as follows. The model is presented in Section 2. Section 3 concludes the paper. Section 4 lists the limitations of the model. The Appendix contains all the proofs.

2 The Model

2.1 Benchmark Model

In the benchmark model, an outside director works for N companies simultaneously. Within the LEN (Linear-Exponential-Normal) framework, we assume the outside director's effort can improve the companies' output. However, effort is unobservable and payments can only be based on the actual output, which equals the effort plus a random noise, i.e., $y_i = m_i + \epsilon_i$ where $\epsilon_i \sim N(0, \sigma_i^2)$ and ϵ_i is independently and identically distributed across i, $i \in \{1, 2, ...N\}$. For simplicity, I assume $\sigma_i^2 = \sigma^2$ for all i in the benchmark model and consider the case of different variances in the extension. The outside director is risk-averse with exponential utility and the risk-averse coefficient is γ. Therefore, his utility max-

imization problem is equivalent to maximizing the certainty equivalence $CE = E[\sum(b_i y_i + k_i)] - \frac{1}{2}\gamma Var[\sum(b_i y_i + k_i)] - C(m_1, m_2 ... m_N)$ where the cost function is specified as $C(m_1, m_2 ... m_N) = c[m_1^2 + m_2^2 + ... m_N^2 + p(\sum_{i \neq j, i<j} m_i m_j)]$. When $p \geq 2$, the substitution among efforts is so strong that the outside director exerts all effort on a single company, which is unrealistic[3]. Thus, I assume $p < 2$ in the following analysis. Here, the parameter p can be negative, which means that there is complementarity (synergy) among the effort spent in different companies. However, when p is negative, I assume it is not too negative that the total cost $C(m_1, m_2 ... m_N)$ is negative, which means $p \geq \frac{-2}{N(N-1)}$.Generally, the parameter p in the cost function is meant to capture the degree of substitution and complementarity among the effort spent on different companies. On one hand, a director has limited time and energy, and he works for several companies simultaneously. If he exerts more effort m_i in firm i, his marginal cost for firm j, $\frac{\partial C}{\partial m_j}$, is higher, which is the case when effort is substitutive. On the other hand, there could also be synergy among effort spent on different companies. For example, if an outside director works for several companies in the same industry. He is more familiar with the industry, if he exerts more effort at firm i, his marginal cost for firm j, $\frac{\partial C}{\partial m_j}$, can be lower. Aside from the assumption that the director is risk-averse, the shareholders of the companies can hold a diversified portfolio, and thus it is assumed that the companies are risk-neutral and their objectives are to maximize expected profits.

In the beginning of the game, the outside director can choose the number of directorships N, which then becomes common knowledge. N is exogenously given in the benchmark model. The compensation scheme for outside directors is modeled as a fixed payment k_i plus some share of the company's output $b_i y_i$. Similar to the literature on CEO compensation, I call b_i Pay-Performance

[3]That means the outside director signs contracts with N companies, but only spends effort in one company.

Sensitivity (PPS). In this model, the outside director has bargains with the N companies. The companies pick incentives b_i ($i \in 1, 2, ...N$) and the director chooses fixed payment k_i and efforts to spend in each company m_i subject to the director's incentive-compatibility (IC) constraint and the companies' individual rationality (IR) constraint that company's profit is greater than or equal to the outside option. The justification for this assumption is that, in reality, there is not enough supply of directors. The director has more bargaining power and can set the fixed salary to extract the surplus. The outside options for all the N companies are assumed to be $\bar{u}$. For simplicity, the outside option is normalized to be zero in the following analyses.

To summarize, the timeline of the model is as follows:

- At t=0, the director chooses the number of companies (N) that he will serve, and this information is common knowledge afterwards.
- At t=1, in the negotiation, the N companies pick incentives $\{b_i\}_{i=1}^N$to the director, and the director sets the fixed salary $\{k_i\}_{i=1}^N$.
- At t=2, the director decides whether to accept the contracts or not, and if he accepts, he chooses effort for each company, i.e. $\{m_i\}_{i=1}^N$. These efforts are unobservable.
- At t=3, given efforts $\{m_i\}_{i=1}^N$, the outputs of the N companies $\{y_i\}_{i=1}^N$ are realized, and the payments to the director $\{k_i + b_i y_i\}_{i=1}^N$are made to the director.

To solve the game, the backward induction approach is employed and the solution concept is SPNE (Subgame-Perfect Nash Equilibrium). At t=2, given

the choice of N and the incentive contracts $\{b, k_i\}_{i=1}^N$, the director chooses efforts $\{m_i\}_{i=1}^N$to maximize his utility. The following Lemma gives the optimal effort the director exerts as a best response to the incentive contracts.

Lemma 1. *Given the number of directorships, N and incentive contracts* $(\{b_i\}_{i=1}^N)$ *offered by companies, the outside director chooses efforts* $\{m_i\}_{i=1}^N$*to maximize his utility, and the optimal efforts are* $m_i^* = \frac{1}{c(2-p)(2-p+pN)}[(2-2p+pN)b_i - p(\sum_{j\neq i} b_j)]$ *for all* $i = 1, 2...N$.

Proof. Please see the Appendix.

□

This result is intuitive. If firm i offers stronger incentives, the director will exert more effort for firm i. If p is positive, the efforts are substitutive. The lower incentives other companies offer, the more efforts the director will exert on firm i. If p is negative, the efforts are complementary, so the stronger the incentives firm j offers, the more effort the director exerts for firm i. If the effort is less costly (the parameter c is smaller), the levels of effort for all companies are higher.

Then, given the outside director's optimal choice of effort, the optimal linear contract is summarized in the following proposition.

Proposition 2. *The optimal contract offered by each company is*

$b_i^* = \frac{(2-2p+pN)}{(2-2p+pN)+(2-p)(2-p+pN)cr\sigma^2}$ $\forall i = 1, 2...N$, *and the corresponding fixed payments* $k_i = (1-b_i)\frac{b_i^*}{c}\frac{1}{(2-p+pN)} - \bar{u}$. *For the solution to exist, the restriction on parameter should be such that* $\frac{-2}{N(N-1)} \leq p < \frac{2}{(N-1)}$ *and the outside option*

should not be too large, $\bar{u} \leq (1 - b_i^*)\frac{b_i^*}{c}\frac{1}{(2-p+pN)}$. *Since we normalize the outside option* $\bar{u}$ *to be zero, the restriction on outside option holds.*

Proof. Please see the Appendix.

□

The interior solution only exists if the value function is still positive, so the outside option can not be too big. For simplicity, the outside option is normalized to be zero in the following analyses. Since homogeneous companies are assumed, incentive contracts for all companies are the same.

2.2 Comparative Static Analysis when the Number of Directorships N is treated as Exogenous

From the above proposition in subsection 2.1, we know that incentive (PPS) b_i^* depends on the riskiness of companies σ^2, the coefficient of risk-aversion of the director γ, the cost of efforts c (or equivalently, the ability of the director), the number of directorships N, and the parameter p. In this subsection, some comparative static analyses are conducted.

First, the following proposition summarizes the comparative static analyses of incentive (PPS, b_i^*), with respect to parameters c, γ , p, and σ^2.

Proposition 3. *The comparative static analyses suggest that* $\frac{\partial b_i^*}{\partial c} < 0$; $\frac{\partial b_i^*}{\partial \gamma} < 0$; $\frac{\partial b_i^*}{\partial \sigma^2} < 0$. With regard to $\frac{\partial b_i^*}{\partial p}$, the results show that $\frac{\partial b_i^*}{\partial p} > 0$ when $p > 0$ and $\frac{\partial b_i^*}{\partial p} < 0$ when $p < 0$.

Proof. Please see the Appendix.

□

The standard tradeoff between risk-sharing and incentive provision still applies here. Companies provide lower incentives for more risk-averse directors since it is more costly to expose them to risk. The issue of risk-sharing is more important for riskier companies, leading to lower incentives in equilibrium. If a director has greater ability (i.e. the coefficient c in the cost function is smaller), the director's efforts are more valuable, and thus, companies offer stronger incentives to induce the director to work hard. Regarding the comparative static analyses on p, when $p > 0$, $\frac{\partial b_i^*}{\partial p} > 0$ suggests that when efforts become more substitutive, the optimal incentive is greater because companies face fiercer competition. On the other hand, when $p < 0$, $\frac{\partial b_i^*}{\partial p} < 0$ suggests that when efforts become more complementary ($p < 0$ and p becomes more negative), the optimal incentive is greater due to companies' strategic behavior. Specifically, company i would like to offer greater incentive, attracting more effort for firm i and reducing the marginal cost for other companies, which in turn induces them to offer greater incentives and attract more efforts for other firms. This is beneficial to firm i itself due to reduced marginal cost. This phenomenon is similar to the concept of strategic complements in industrial organization (Bulow, Geanakoplos, and Klemperer, 1985; Fudenberg, and Tirole, 1989).

Next, I summarize the relationship between incentives and the number of directorships N in the following proposition.

Proposition 4. *The marginal effect of the number of directorships N on the optimal incentive b_i^* is positive, i.e. $\frac{\partial b_i^*}{\partial N} > 0$.*

Proof. Please see the Appendix.

□

In the case the number of directorships is exogenously given, when exploring the relationship between the number of directorships N and incentives (or Pay-Performance-Sensitivity), there are two effects, namely the competition effect and the task-interaction effect. The competition effect suggests that, as the number of directorships increases, more companies compete for the same director's effect, and thus companies will offer greater incentives, leading to a positive relationship between the number of directorships and incentives. The task-interaction effect depends on whether efforts are complementary or substitutive across tasks. When efforts are substitutive, with more directorships, it becomes more costly to induce the director to work hard, leading to a negative relationship between the number of directorships and incentives; however, when efforts are complementary, with more directorships, it is less costly to induce the director to work hard, leading to a positive relationship between the number of directorships and the incentives. The model suggests that: (1) When efforts are complementary, the association between incentives and the number of directorships is positive, since both competition and task-interaction effects are positive; (2) When efforts are substitutive, the relationship is still positive because the competition effect dominates the task-interaction effect.

In summary, when the number of directorships is exogenous, regardless of if efforts are substitutive or complementary, the relationship between the number of directorships and incentive is always positive, i.e., with more companies, companies offer greater incentives.

2.3 Special case: $p = 0$

After solving the model, it is interesting to consider a special case and compare the result to those from other classical models. The following corollary provides the result when $p = 0$.

Corollary 5. *When $p = 0$, the optimal contract is $b_i^*(p = 0) = \frac{1}{1+2cr\gamma\sigma}$, which is the same as the result from the one-principal-one-agent Linear-Exponential-Neutral (LEN) framework.*

Proof. Plugging in $p = 0$ into the expression for b_i^* gives us $b_i^*(p = 0) = \frac{1}{1+2c\gamma\sigma^2}$.

□

When $p = 0$, this model is equivalent to the one-principal-one-agent Linear-Exponential-Neutral (LEN) framework. The intuition for the equivalence is straightforward. Unlike the one-principal-one-agent framework, there are multiple principals and they compete with each other for a director's efforts. The interaction occurs through the non-separability in the cost function, and depending on whether p is positive or negative, if the director exerts more efforts for company i, the marginal cost for efforts in other companies may increase or decrease. When $p = 0$, the efforts are neither substitutive nor complementary, and thus there is no interaction between contracts offered by different companies. So, the result restores to the one-principal-one-agent framework.

2.4 How is the optimal number of directorships determined

After solving the optimal contracts given the director's choice of the number of companies to work for N, I turn to the outside director's optimal decision of this number in the beginning of the game. The following proposition implicitly specifies the optimal number of directorships the outside director chooses and its determinants.

Proposition 6. *The optimal number of directorships N is determined by the director to maximize the following objective function:*

$Payoff = N\frac{1}{c(2-p+pN)}(b_i^* - \frac{b_i^{*2}}{2}) - N\frac{1}{2}\gamma\sigma^2 b_i^{*2}$ *where* $b_i^* = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$.

Proof. Please see the Appendix.

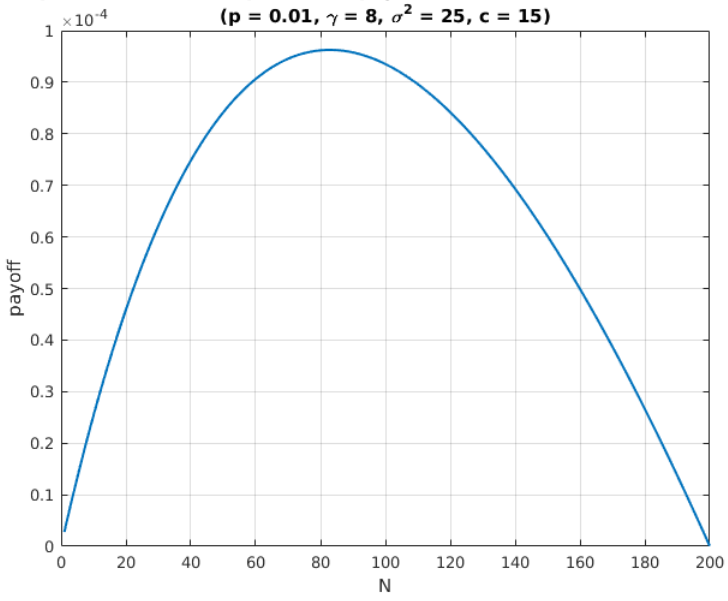
□

In the above proposition, the companies' outside options are normalized to zero. The director decides the optimal number of directorships, N, to maximize his payoff. As the function $Payoff(.)$ is complicated and it is impossible to get a closed-form solution from the first order condition. I turn to conduct some numerical analyses on the optimal number of directorships N.

When $p < 0$, efforts are complementary. The more directorships the director holds, the "equivalent" cost is lower, and thus, the director would like to hold as many directorships as possible, and the optimal number of directorship is determined by the boundary condition in proposition 2. This case is less interesting. Thus, in the following numerical analysis, I only focus on the cases with substitutive efforts. When $p > 0$, efforts are substitutive. From the following graph 1, the payoff first increases and then decreases with the number of directorships. The number of directorships which generates the highest payoff for

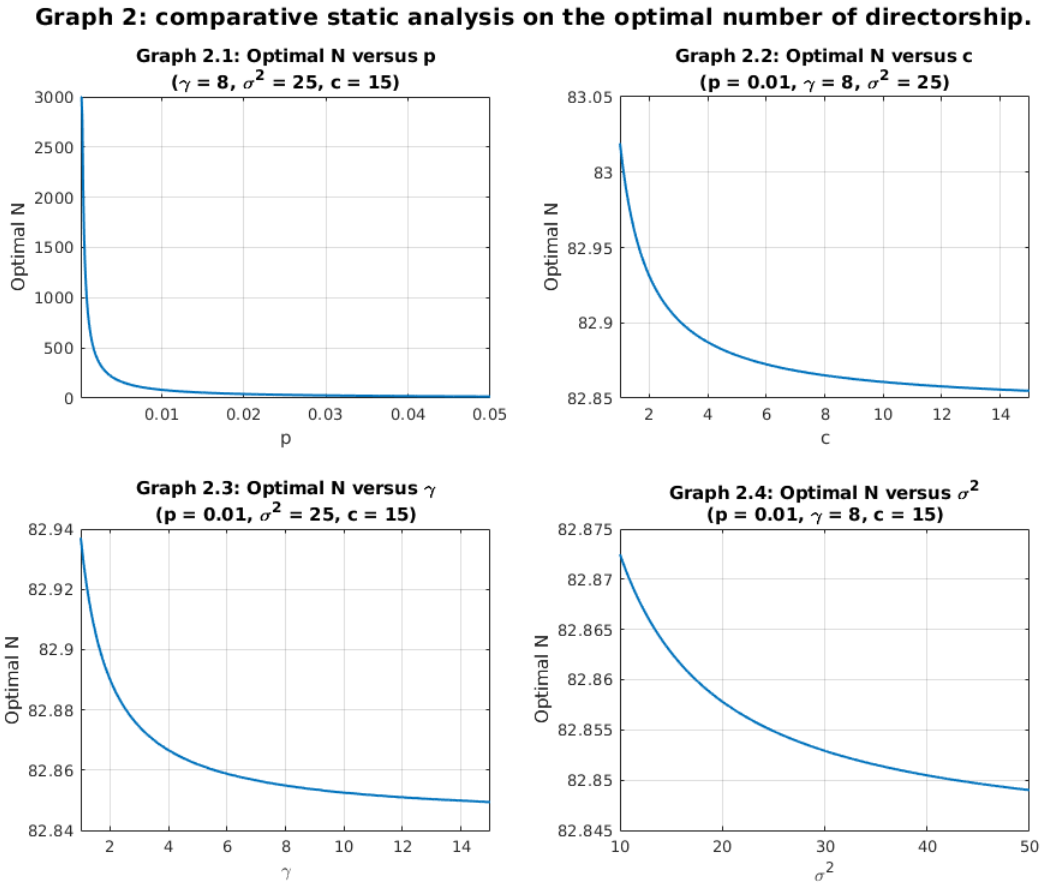
the director is denoted as the optimal number of directorships. I also try other parameter values and find similar patterns. However, as we are not able to get a closed-form solution, this conclusion may not hold with some parameter values.

Graph 1: the relationship between payoff and the number of directorships.



2.5 Comparative static analyses on the optimal number of directorships and the optimal incentives

Using numerical analyses, some comparative static analyses on the optimal number of directorships with respect to parameter are available.



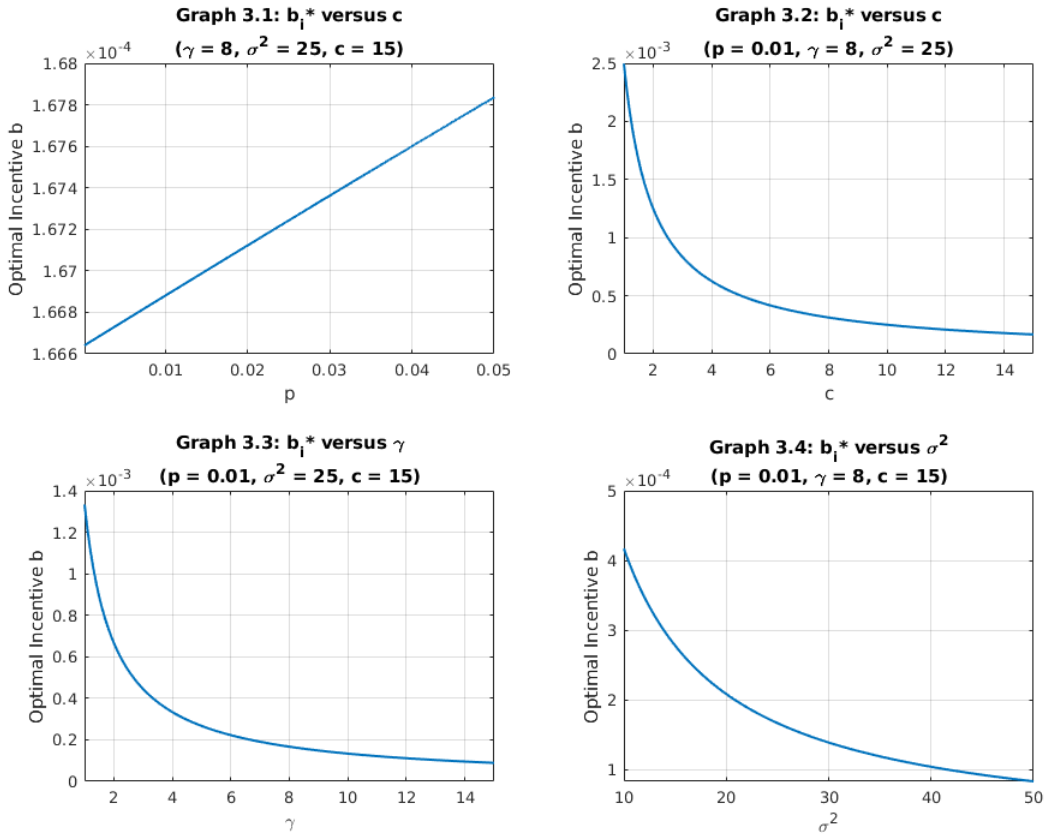
First, in graph 2.1, the relationship between the optimal number of directorships and p is negative. Intuitively, when efforts become more substitutive, serving more boards will increase the "equivalent" cost of efforts, and thus, the

director serves on few boards.

Secondly, in graphs 2.2, 2.3, and 2.4, the relationship between the optimal number of directorships and c (the cost of effort), γ, σ^2 is negative. Intuitively, the outside director with greater ability (the parameter c in the cost function is smaller) serves on more boards; the less risk-averse director also serves on more boards; the riskier these firms are, the smaller number of directorships the outside director holds, i.e. $\frac{\partial N^*}{\partial c} < 0$, $\frac{\partial N^*}{\partial \gamma} < 0$, and $\frac{\partial N^*}{\partial \sigma^2} < 0$. Again, there is a caveat that these results may not hold with other parameter values.

After determining the optimal number of directorships, using numerical analyses, we can recalculate the comparative static analyses for the optimal incentive b_i^* at the optimal number of directorships N^*.

Graph 3: comparative static analysis on the optimal incentive b_i*, after endogenizing N.



From the graph 3.1, when $p > 0$, the optimal incentive (pay-performance-sensitivity) b_i^* is increasing with the degree of substitution. Intuitively, the optimal incentive is greater because companies face fiercer competition.

From graphs 3.2, 3.3 and 3.4, even after endogenizing the optimal number of directorships, we find that the standard tradeoff between risk-sharing and incentive provision still applies. Companies provide lower incentives for more risk-averse directors since it is more costly to expose them to risk. The issue of risk-sharing is more important for riskier companies, leading to lower incentives. Directors with greater ability are offered stronger incentives. Of course, these results may not hold with other parameter values.

2.6 Comparison between the common agency setting and multi-task model

The distinguishing feature of the benchmark model from the multi-task model is that in the benchmark model, N companies offer contracts to compete for a director's efforts and they do not take into account the negative externality they impose on other companies. However, in the (one principal, one agent) multi-task model, the principal takes into account this externality and offer contracts for the multiple tasks as a whole, which is the case where N companies cooperate in the benchmark model. In this subsection, I derive the optimal contract in the multi-task setting and compare it to the benchmark model. The following proposition gives the optimal contracts under the multi-task setting.

Proposition 7. *Under the multi-task (MT) setting, the optimal contract is* $b^*_{i,MT} = \frac{(2-p+pN)}{c\gamma\sigma^2(2-p+pN)^2+2(1-p+pN)}$. *Moreover, when* $p > 0, b^*_{i,MT} < b^*_{i,CA}$ *,and when* $p < 0, b^*_{i,MT} > b^*_{i,CA}$ *where* $b^*_{i,CA}$ *is the optimal incentive in the benchmark model of common agency.*

Proof. Please see the Appendix.

□

Compared to the common agency setting, in the multi-task model, there is only one principal and he hires the director to perform tasks for all the N companies. Thus, he takes into account the externality one company exerts on other firms when offering incentives. When $p > 0$, efforts are substitutive, and there is negative externality when a company increases the bonus rate b_i. After taking this negative externality into account, the equilibrium incentives in the multi-task model would be more muted than that under the common agency setting. On the contrary, when $p < 0$, efforts are complementary, and there is positive externality when a company increases the bonus rate b_i. The only principal in the multi-task setting takes this positive externality into account, and thus, the equilibrium incentives under the multi-task model would be greater than that under the common agency setting.

3 Limitations of the model

There are some limitations that need to be highlighted. First, in reality, there is no performance metric such as the firms' outputs in the model, which only depends on directors' efforts plus some noise. Typically, directors' compensation, such as stocks, options, or warrants, is based on stock price which depends on many other factors and only indirectly depends on the director. In the model, we assume away other factors.

Second, in the model, we assume that the error terms ϵ_i are independently and identically distributed across companies. Due to the macroeconomic and industry effects, it is more realistic to assume that the error terms across companies are correlated.

Thirdly, the director is assumed to have all the bargaining power and can

extract all rents from the companies. A more realistic assumption is to assume that both the director and the N companies have some bargaining power and they allocate the rents from the relationships via the mechanism of bargaining.

Moreover, we assume the efforts in all N companies are either complementary or substitutive to each other and we ignore the case where some are complementary while others are substitutive. It may be more reasonable to assume some are complementary while others are substitutive.

Next, the model is only static in the sense that it does not consider dynamic issues such as reputation effect. In reality, on top of companies' incentives, the reputation concerns may also drive directors to word hard. The litigation risk is another issue that affects the directors' effort allocation decision.

In addition, in the comparative static analyses on the optimal number of directorships, a closed-form solution is not available. This is a weakness of the paper, and the numerical results may not hold with other parameter values.

Finally, the assumption of a linear contract may not hold in reality. For example, if directors' compensation consists of options, then the contract is not linear globally. Also, the bonus rate may be different across different regions.

4 Conclusion

Outside directors are crucial to a company's corporate governance. An interesting phenomenon in the outside director market is that an outside director simultaneously works for multiple firms. Then, what is the relationship between the number of directorships and the incentives these companies offer? The answer from this paper is that, when the number of directorships is exogenous,

the relationship between the number of directorships N and incentives (Pay-Performance Sensitivity) is always positive, i.e. with more directorships, the companies would offer greater incentives. More specifically, the model suggests that: (1) When efforts are complementary, the association between incentives and the number of directorships is positive since both competition and multi-task effects are positive; and (2) When efforts are substitutive, the overall relationship is still positive because the competition effect dominates the multi-task effect.

Secondly, what is the optimal number of directorships an outside director chooses and what are the determinants of this number? After conducting comparative static analyses on the optimal number of directorships with respect to the parameters numerically, the results show that, at least with some parameter values, with substitutive efforts, the outside director with greater ability (the parameter c is smaller) serves on more boards; the less risk-averse director serves on more boards; the riskier these firms are, the smaller number of directorships the outside director holds; and when efforts across companies are more substitutive, the outside director serves on fewer boards. In the end, some numerical comparative static analyses on the optimal incentive after endogenizing N are conducted. After endogenizing, with substitutive efforts, companies provide more muted incentives for more risk-averse directors; the optimal incentive decreases with the companies' riskiness; directors with greater ability (smaller c) are offered stronger incentives; and the optimal incentive increases with the degree of substitution p.

In the future work, it may be interesting to structurally back out parameters from the model, in particular, the parameter on whether efforts are complementary or substitutive and the magnitude p.

Appendix

Proof of Lemma 1.

Given incentive contracts $\{k_i, b_i\}_{i=1}^N$, the outside director will choose $\{m_i\}_{i=1}^N$to maximize the Certainty Equivalent.

Thus, the optimization problem becomes:

Max $U_d = CE = \sum_{i=1}^N [(b_i E(y_i|m_i) - \frac{1}{2}\gamma b\sigma^2] - c(m_1^2 + m_2^2 + ... + m_N^2 + p\sum_{i=1}^N \sum_{j<i} m_i m_j)$

s.t $m_i \geq 0$ for all i. (Non-negativity constraint).

We know that $E(y_i|m_i) = E(m_i + e_i|m_i) = m_i$

From the First Order Condition, $\frac{\partial U_d}{\partial m_i} = b_i - c[(2-p)m_i + p\sum_{j=1}^N m_j] = 0$, $\forall i = 1, 2...N$.

Summing up all the N First Order Conditions results in:

$\sum_{i=1}^N b_i - c[(2-p)(\sum_{i=1}^N m_i) + pN(\sum_{i=1}^N m_i)] = 0$

$\implies \sum_{i=1}^N m_i = \frac{\sum_{i=1}^N b_i}{c(2-p+pN)}$

Plugging in the above equation into the First Order Condition, we can get

$m_i^* = \frac{1}{c(2-p)(2-p+pN)}[(2-2p+pN)b_i - p(\sum_{j\neq i} b_j)]$, $\forall i = 1, 2...N$.

Proof of Proposition 2.

Given the outside director's best response function $m_i(.)$, company i will choose the contract $\{b_i\}$to maximize $E\pi_i$. The optimization problem is as follows:

Max $E\pi_i = (1-b_i)Ey_i - k_i = m_i - k_i - b_i m_i$

s.t. (IC for directors) $m_i^* = \frac{1}{c(2-p)(2-p+pN)}[(2-2p+pN)b_i - p(\sum_{j\neq i} b_j)] > 0$

The first order condition with respect to b_i gives:

$b_i^* = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$,

Then, we can plug in the solution for b_i^*into the expression for $m_i^*$to get:

$m_i^* = \frac{b_i^*}{c}\frac{1}{(2-p+pN)} = \frac{1}{c(2-p+pN)} * \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$.

Also, the director picks k_i so that the firm's profit is equal to the outside option.

(IR for firm i) $m_i - b_i m_i - k_i = 0$ (for simplicity, assuming that $\bar{u}_i = \bar{u} = 0$ $\forall i = 1, 2...N$)

From the above IR constraint for firm i, we can get

$k_i = (1-b_i)m_i - \bar{u} = (1-b_i^*)\frac{b_i^*}{c}\frac{1}{(2-p+pN)} - \bar{u}$ where $b_i^* = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$. Due to the constraint that the cost $C(m_1, m_2, ...m_N) \geq 0$, we need to assume $p \geq \frac{-2}{N(N-1)}$. For the solution to exist for the optimization problem,

we need to assume $p < \frac{2}{(N-1)}$ and the outside option is not too large. In summary, the parameter restriction is that $\frac{-2}{N(N-1)} \leq p < \frac{2}{(N-1)}$ and the outside option $\bar{u} \leq (1-b_i^*)\frac{b_i^*}{c}\frac{1}{(2-p+pN)}$.

Q.E.D.

Proof of Proposition 3.

Simple calculations imply: $\frac{\partial b_i^*}{\partial c} < 0$; $\frac{\partial b_i^*}{\partial \gamma} < 0$; $\frac{\partial b_i^*}{\partial \sigma^2} < 0$;

Next, we want to determine the sign of $\frac{\partial b_i^*}{\partial p}$.

From $b_i^* = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$,we know $(\frac{1}{b_i^*}-1)\frac{1}{c\gamma\sigma^2} = (1+\frac{p}{2-2p+pN})(2-p)$

Then we have, $\frac{\partial[(\frac{1}{b_i^*}-1)\frac{1}{c\gamma\sigma^2}]}{\partial p} = -(1+\frac{p}{2-2p+pN}) + (2-p)\frac{2-2p+pN-(N-2)p}{(2-2p+pN)^2} = \frac{2(2-p)-(2-p+pN)(2-2p+pN)}{(2-2p+pN)^2}$;

So, $\frac{\partial[(\frac{1}{b_i^*}-1)\frac{1}{c\gamma\sigma^2}]}{\partial p} < 0$ when $p > 0$ and $\frac{\partial[(\frac{1}{b_i^*}-1)\frac{1}{c\gamma\sigma^2}]}{\partial p} > 0$ when $p < 0$.

Thus, $\frac{\partial b_i^*}{\partial p} > 0$ when $p > 0$ and $\frac{\partial b_i^*}{\partial p} < 0$ when $p < 0$.

Q.E.D.

Proof of Proposition 4.

Define $t = c\gamma\sigma^2$.

First, $\frac{1}{b_i} = 1 + \frac{t(2-p)(2-p+pN)}{(2-2p+pN)}$

$(\frac{1}{b_i}-1)\frac{1}{t(2-p)} = \frac{2-p+pN}{2-2p+pN} = 1 + \frac{p}{2-2p+pN} = 1 + \frac{1}{\frac{2}{p}-2+N}$

it is obvious that $\frac{\partial b_i}{\partial N} > 0$.

Q.E.D.

Proof of Proposition 6.

We know that, the director's utility equals all payments from the N companies minus the cost of efforts and minus the risk premium, i.e. $E\pi_d = N(b_i m_i + k_i) - N\frac{1}{2}\gamma\sigma^2 b_i^2 - C(m_1, ...m_N)$.

After plugging in the expressions , we get

$Payoff = N\frac{1}{c(2-p+pN)}(b-\frac{b^2}{2}) - N\frac{t}{c}b^2$ where $b = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$.

As before, the companies' outside options are normalized to zero.

Q.E.D.

Proof of Proposition 7.

We know $m_i = \frac{1}{c(2-p)(2-p+pN)}[(2-2p+pN)b_i - p(\sum_{j\neq i} b_j)]$, $\forall i = 1, 2...N$

Thus, $\frac{\partial m_i}{\partial b_i} = \frac{(2-2p+pN)}{c(2-p)(2-p+pN)}$ and $\frac{\partial m_i}{\partial b_j} = \frac{-p}{c(2-p)(2-p+pN)}$ for $j \neq i$

In the multi-task model, the total profit for the principal who hires the director to perform N tasks is:

$TP = \sum_{i=1}^{N}[m_i - \frac{1}{2}\gamma b_i^2\sigma^2 - cm_i(m_i + p\sum_{j\neq i} m_j)] = (\sum_{i=1}^{N} m_i) - \frac{1}{2}\gamma\sigma^2(\sum_{i=1}^{N} b_i^2) - (1-p)c(\sum_{i=1}^{N} m_i^2) - pc(\sum_{i=1}^{N} m_i)^2$

The First-Order-Condition gives:$\forall i = 1, 2...N$

$\frac{\partial TP}{\partial b_i} = \frac{\partial m_i}{\partial b_i} + (N-1)\frac{\partial m_i}{\partial b_j} - \gamma\sigma^2 b_i - 2(1-p)c[m_i\frac{\partial m_i}{\partial b_i} + (N-1)m_j\frac{\partial m_j}{\partial b_i}] - 2pc(\sum_{i=1}^{N} m_i)[m_i\frac{\partial m_i}{\partial b_i} + (N-1)m_j\frac{\partial m_j}{\partial b_i}] = 0$.

In equilibrium, $m_i^* = \frac{1}{c(2-p+pN)}b_i^*$,$\forall i = 1, 2...N$.

Then using N equations, we can solve for:

$b_{i,MT}^* = \frac{(2-p+pN)}{c\gamma\sigma^2(2-p+pN)^2+2(1-p+pN)}$ $\forall i = 1, 2...N$ where the subscript MT stands for multi-task.

We recall that the optimal incentive under common agency in the benchmark model is:

$b_{i,CA}^* = \frac{(2-2p+pN)}{(2-p+pN)(2-p)c\gamma\sigma^2+(2-2p+pN)}$.

Next, we want to show that when $p > 0$,$b_{i,MT}^* < b_{i,CA}^*$,and when $p < 0$,$b_{i,MT}^* > b_{i,CA}^*$.

Define $t = c\gamma\sigma^2 > 0$,when $p > 0$, we need to show:

$b_{i,MT}^* = \frac{(2-p+pN)}{t(2-p+pN)^2+2(1-p+pN)} < \frac{(2-2p+pN)}{t(2-p+pN)(2-p)+(2-2p+pN)}$

Because, the denominator is always positive, so it is equivalent to show:

$(2-p+pN)^2(2-p)t + (2-p+pN)(2-2p+pN) < (2-p+pN)^2(2-p+pN)t + 2(1-p+pN)(2-2p+pN)$

which can be reduce to,

$-pN(2-p+pN)^2t-p(N-1)<0.$

We know that $t=c\gamma\sigma^2>0$,so when $p>0$, the above inequality holds obviously.

Following the same way, we can show that when $p<0, b^*_{i,MT}>b^*_{i,CA}$.

References

Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey. Journal of Economic Literature, 48(1), 58-107.

Aggarwal, R. K., Evans, M. E., and Nanda, D. (2012). Nonprofit boards: Size, performance and managerial incentives. Journal of Accounting and Economics, 53(1), 466-487.

Andres, C., Bongard, I., and Lehmann, M. (2013). Is busy really busy? Board governance revisited. Journal of Business Finance and Accounting, 40(9-10), 1221-1246.

Becht, M., Bolton, P., and Röell, A. (2003). Corporate governance and control. In Handbook of the Economics of Finance (Vol. 1, pp. 1-109). Elsevier.

Bergemann, D., and Välimäki, J. (2003). Dynamic common agency. Journal of Economic Theory, 111(1), 23-48.

Bernheim, B. D., and Whinston, M. D. (1986). Common agency. Econometrica: Journal of the Econometric Society, 923-942.

Bulow, J. I., Geanakoplos, J. D., and Klemperer, P. D. (1985). Multimarket oligopoly: Strategic substitutes and complements. Journal of Political Economy, 93(3), 488-511.

Bushman, R. M., and Indjejikian, R. J. (1993). Accounting income, stock price, and managerial compensation. Journal of Accounting and Economics, 16(1-3), 3-23.

Cashman, G. D., Gillan, S. L., and Jun, C. (2012). Going overboard? On busy directors and firm value. Journal of Banking and Finance, 36(12), 3248-3259.

Di Pietra, R., Grambovas, C. A., Raonic, I., and Riccaboni, A. (2008). The effects of board size and 'busy'directors on the market value of Italian companies. Journal of Management and Governance, 12(1), 73-91.

Dixit, A. (1996). Special-interest lobbying and endogenous commodity taxation. Eastern Economic Journal, 22(4), 375-388.

Dixit, A., Grossman, G. M., and Helpman, E. (1997). Common agency and coordination: General theory and application to government policy making. Journal of Political Economy, 105(4), 752-769.

Feltham, G. A., and Xie, J. (1994). Performance measure congruity and diversity in multi-task principal/agent relations. Accounting Review, 429-453.

Fich, E. M., and Shivdasani, A. (2006). Are busy boards effective monitors?. The Journal of finance, 61(2), 689-724.

Field, L., Lowry, M., and Mkrtchyan, A. (2013). Are busy boards detrimental?. Journal of Financial Economics, 109(1), 63-82.

Fudenberg, D., and Tirole, J. (1989). Noncooperative game theory for industrial organization: an introduction and overview. Handbook of industrial Organization, 1, 259-327.

Gibbons, M., and Murphy, K. (1990). K.. Executivesial incentives and the horizon problem. Journal of Accounting and Economics, 14.

Gibbons, R., and Murphy, K. J. (1992). Optimal incentive contracts in the presence of career concerns: Theory and evidence. Journal of political Economy, 100(3), 468-505.

Grossman, G. M., and Helpman, E. (1994). Protection for sale. The American Economic Review, 84(4), 833-850.

Hemmer, T. (1995). On the interrelation between production technology, job design, and incentives. Journal of Accounting and Economics, 19(2-3), 209-245.

Hermalin, B. E., and Weisbach, M. S. (1988). The determinants of board composition. The RAND Journal of Economics, 589-606.

Hermalin, Benjamin E., and Michael S. Weisbach. Hermalin, B. E., and Weisbach, M. S. (1991). The effects of board composition and direct incentives on firm performance. Financial management, 101-112.

Hermalin, B. E., and Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. American Economic Review, 96-118.

Hermalin, B. E., and Weisbach, M. S. (2003). Boards of directors as an endogenously determined institution: A survey of the economic literature. Economic Policy Review, 9(1).

Hölmstrom, B. (1979). Moral hazard and observability. The Bell journal of economics, 74-91.

Holmstrom, B. (1982). Moral hazard in teams. The Bell Journal of Economics, 324-340.

Holmstrom, B., and Milgrom, P. (1991). Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. Journal of Law, Economics, and Organization, 24-52.

Huddart, S., and Liang, P. J. (2005). Profit sharing and monitoring in partnerships. Journal of Accounting and Economics, 40(1-3), 153-187.

Jiraporn, P., Davidson, W. N., DaDalt, P., and Ning, Y. (2009). Too busy to show up? An analysis of directors' absences. The Quarterly Review of Economics and Finance, 49(3), 1159-1171.

Jiraporn, P., Singh, M., and Lee, C. I. (2009). Ineffective corporate governance: Director busyness and board committee memberships. Journal of Banking and Finance, 33(5), 819-828.

Jullien, B. (2000). Participation constraints in adverse selection models. Journal of Economic Theory, 93(1), 1-47.

Levit, D., and Malenko, N. (2015). The labor market for directors and externalities in corporate governance. The Journal of Finance.

Liang, P. J., Rajan, M. V., and Ray, K. (2008). Optimal team size and monitoring in organizations. The Accounting Review, 83(3), 789-822.

Martimort, D. (1996). Exclusive dealing, common agency, and multiprincipals incentive theory. The RAND Journal of Economics, 1-31.

Martimort, D., and Stole, L. (2002). The revelation and delegation principles in common agency games. Econometrica, 70(4), 1659-1673.

Masulis, R. W. (2020). A survey of recent evidence on boards of directors and CEO incentives. Asia-Pacific Journal of Financial Studies.

Masulis, R. W., and Mobbs, S. (2014). Independent director incentives: Where do talented directors spend their limited time and energy? Journal of Financial Economics, 111(2), 406-429.

Masulis, Ronald W. and Mobbs, Shawn, (2015). Independent director reputation incentives: Major board decisions and corporate outcomes, Working Paper

Matveyev, E.(2013). How do firms and directors choose each other? Evidence from a two-sided matching model of the director labor market. Working Paper, University of Alberta

Milgrom, P. R. (1988). Employment contracts, influence activities, and efficient organization design. The Journal of Political Economy, 42-60.

Peters, M. (2001). Common agency and the revelation principle. Econometrica, 1349-1372.

Papadopoulos, K. (2019) Director overboarding: global trends, definitions, and impact. Harvard Law School Forum on Corporeate Governance

Rajan, M. V., and Reichelstein, S. (2004). A perspective on" Asymmetric information, incentives and intrafirm resource allocation". Management Science, 1615-1623.