Contracting, Bargaining, and Profit Sharing

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Abstract

In this paper, we consider a setting with formal and relationship contracting between a principal and an agent, subject to interim-renegotiation. Specifically, we assume that Nash bargaining occurs after wages are agreed upon, which allows the agent to potentially hold up the principal. We show that, in this setting, the principal can sometimes benefit from engaging in relational contracting, rather than formal contracting, in order to limit the share of the surplus claimed by the agent. We then test the predictions of our model using a matched employer-retirement plan dataset, where we interpret discretionary profit-sharing plans in terms of relational contracting and employee stock ownership plans in terms of formal contracting. Our primary finding is that the use of discretionary profit-sharing plans are associated with lower efficiency, but with higher profits for firms that discount the future relatively heavily.

Keywords: relational contract, retirement plans, profit sharing, ESOP

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1 Introduction

Tying worker compensation to output or surplus is one of the cornerstones of incentive contracting theories in economics. According to Kruse et al. (2010), almost half of the U.S. workforce participate in so-called "shared capitalism", where worker compensation is in some way tied to firm-level (or less often unit-level) performance. The common idea is that the various forms of shared capitalism extend the fruits of firm performance to a broader base of workers, raising worker productivity and in turn firm profits. From an agency standpoint, this phenomenon can be understood as providing incentives in situations where individual outputs are difficult to measure and monitoring work effort is also costly. In such cases, the employer can offer a compensation package that would align the employer's and the worker's incentives by tying worker compensation to firm's profits or asset values.

The ways in which firms try to align workers' incentives have varied across time and place. For instance, beginning in the early 1980s, due to a series of government regulations and tax incentives, the U.S. private sector pension structure shifted away from the traditional defined benefit to defined contribution plans (such as 401(k) type plans) in which employees are allowed to make contributions.[1] In recent times more and more employers have started making direct contributions to their employee's retirement accounts that are tied to the firm's profits or asset values, often in one of the two following ways.

First, a "profit sharing plan" refers to a retirement plan to which the employer can make *discretionary* contributions. That is, both whether and how much to contribute to the profit sharing plan are subject to the employer's full discretion, which may in turn depend on the company's financial performance in that year (hence, the name profit sharing).[2] Unlike a 401(k)

[1]Pensions were often based on a formula dependent on years of employment and final/peak salary; hence, being caught shirking would lead to a forfeiture of this deferred form of compensation. As Lazear (1979, 1981) showed, such backloading of earnings can achieve incentive alignment by essentially posting a bond early in the worker's career. In the defined contribution plans, however, firms provide a fixed (or maximum) percentage matching, and the matched contributions are often immediately vested, so being caught shirking does not lead to a forfeiture of significant deferred compensation. Hence, we do not focus on any fixed benefits such as annuity, health and other fringe benefits, because the contracting principles are based on the agency model. Paying a fixed benefit over the salary is, however, similar to paying a higher (efficiency) wage, which can be captured in our model.

[2]To be more precise, profit sharing can be in the form of cash bonus that is added to the employee's paychecks

plan, the profit sharing plan can only accept contributions from the employer and it does not allow employees to make contributions. A number of scholars have extensively studied the adoption of profit sharing plans in the U.S. at least since 1980s, and have shown that the profit sharing plans are linked to worker behavior that increases labor productivity, firm profits and employment stability (see, e.g., Kruse, 1993).

Second, some employers make contributions to employee retirement accounts in the form of company stock, which is known as Employee Stock Ownership Plan (ESOP). The mechanism through which employee stock ownership motivates employees to work harder is often quite similar to that of profit sharing plans (see, e.g., Blasi, 1987).[3] ESOP distinguishes itself from profit-sharing plans in that the benefits (i.e., dividend stream or asset value) from owning the company stock cannot be taken away in the future from the employees once the stock awards vest. That is, a portion of the company stock is granted (which need not be based on firm profits), and the employee benefit from their stock units if the stock price were to increase (e.g., they can sell their stock subject to vesting requirement).

As alluded to above, the difference we focus on between profit sharing plans and ESOP relates to discretion. For ESOP, once stock is granted to the employee, this effectively provides pay for performance pay for the periods that follow. If the firm performs well, including due the employee's effort, the employee benefits due to the stock increasing in value (and the opposite will occur if the firm performs badly). The firm cannot deny or forfeit this benefit from employees after the stock is granted. For profit sharing, the link between firm performance and employee compensation is different, where performance pay consists of transferring a benefit to the work following good performance. However, there may often be little obligation to actually transfer this promised benefit once the employee exerts effort, i.e. profit sharing involves firm ex post discretion. Another reason to link ESOP to limited discretion is that the amount of

or to the retirement accounts for which the employee does not pay income tax until after retirement. We do not distinguish these two (cash or deferred) for our purpose, because our model does not focus on tax considerations and it also has an infinite rather than finite horizon.

[3]There are some additional issues with stock ownership grants. For instance, ESOP may see a nonoptimizing behavior of the workers in terms of the portfolio theory (e.g., Benartzi and Thaler, 2001). However, we abstract from this issue because our model focuses on the firm's incentive provisions, and firms often provide means for diversification closer to the retirement age.

compensation specific employees receive under such plans may be formula-based, for example related to employee seniority.[4] This is in contrast to profit sharing plans, or even stock bonus plans, where employer discretion plays a larger role.

We develop an agency model, where the employer tries to motivate the employee to exert effort through performance pay, and consider both formal contracting (where the payment promised must be granted, subject to the agreed-upon performance) and relational contracting (where the employer has the discretion to renege on the promised payment). A novel feature of our framework is that we consider interim-renegotiation. Instead of the employee simply making a take-it-or-leave-it offer to the employer, we assume that the two parties bargain in each period immediately prior to the employee exerting effort.

Given the discretionary nature of payments under relational contracting, these payments must be self-sustaining, in the sense of satisfying a dynamic enforcement constraint. As is standard in models of relational contracting, this constraint limits the strength of possible performance pay that the employee can credibly promise to the employee. This constraint would typically hurt the employer, by making it more difficult for her to motivate the employee. However, in our setting, there is an additional effect at play: the fact that the employer cannot commit to strong performance pay can also increase her bargaining power vis-a-vis the agent during interim renegotiation. This additional effect means that the employer may actually earn a higher payoff under relational contracting then under formal contracting, in particular in situations where her initial bargaining power is weak.

Making the link between relational contracting and profits sharing plans, and between formal contracting and ESOP, our theoretical analysis describes the parameter space for which the employer will prefer one plan to the other, and also when the preferred/chosen plan will lead to an efficient level of effort. We then test the predictions of our model using a matched firm-retirement plan dataset among publicly trading companies. As will be further described in Section 4, the firm-level financial data come from Compustat, and the benefits plan characteristics come from the mandatory Form 5500 filing under the provision of the Employee Retirement Income

[4] See https://www.nceo.org/articles/comprehensive-overview-employee-ownership/page/2

Security Act (ERISA). Consistent with our model predictions, preliminary results from our cross-sectional analysis suggest that public firms adopting ESOPs are on average associated with a higher discount factor (proxied by a lower probability of bankruptcy), lower profit (proxied by earnings before interest and taxes) per employee, and a higher level of productive efficiency (proxied by the distance from production frontiers) than those adopting profit sharing plans.

While the question of why firms provide different types of pensions has appeared in the literature, to our knowledge, the focus on firm discretion in providing retirement benefits has received relatively little attention. For instance, Dorsey (1987) examines the firm's choice of defined benefit plans, as opposed to defined contribution plans, using the same data source (Form 5500 filings) and finds that larger, unionized firms are more likely to provide defined benefit plans. In contrast, our theory and analysis focuses on two primary forms of defined contribution plans.

Our analytic framework does not encompass alternative treatments of why firms offer these retirement plans. For instance, Employee Stock Ownership Plan (ESOP) has been often associated with tax savings and hostile takeover defense (e.g., Beatty, 1995; Rauh, 2006). While in no way implying that these other incentives unimportant, our paper sheds light on this subject from a contracting perspective, focusing on the role of discretion vs. commitment. Moreover, we note that there are a few variants of the retirement plans that our model cannot address. For instance, since our theory focuses on plans in which employers make defined contributions, we include ESOPs that work through 401(k) plans; however, we do not consider Employee Stock Purchase Plan (ESPP), because in ESPP, employees voluntarily purchase company stock (often at a discount).[5]

This paper is also related to the stream of literature on how contracting models help us to better understand real-world incentive mechanisms. Our focus on retirement plans in our empirical setting is a natural extension of the observation that for most rank and file employees (or the labor force collectively) retirement benefits constitute the largest deferred compensation

[5]Babenko and Sen (2014) find that the majority of employees in large public U.S. firms do not participate in ESPPs, leaving some money on the table; Bhagat et al. (1985) argue that ESPPs are offered to better align managerial and shareholder interests. Thus, the incentivizing effects of ESPP seem to be somewhat limited to managerial positions and also by the voluntary nature of plan participation.

element. While the literature on shared capitalism and its effects is large and extensive, the agency models have not received much attention in the above mentioned scholarly works. In particular, we focus on the hitherto neglected feature that both the decision to contribute to a profit-sharing plan and the amount of such contributions are at the employer's discretion, which contrasts to the commitment nature of employee stock ownership.

While the canonical relational contracting model uses a discretionary 'bonus' to be paid in each period (e.g., Bull, 1987; Baker et al., 1994; Levin, 2003; Kvaløy and Olsen, 2009; Malcomson, 2012, to name a few), little fundamental difference between cash (or period) bonus and deferred compensation may exist as an incentive mechanism. In particular, while annuity plans are disappearing, profit-related, deferred retirement plans seem to play a larger role in motivating rank and file employees. By focusing on retirement plans, we hope to add to the growing literature that documents empirical evidence on relational contracting in a variety of settings (e.g., Gil, 2013; Gil and Marion, 2013; Calzolari et al., 2015; Macchiavello and Morjaria, 2015; DeVaro et al., 2018).

The rest of this paper is organized as follows. Section 2 lays out the model, and Section 3 analyzes it under formal and relational contracting. Section 4 discusses the dataset, and Section 5 contains the empirical tests of the model's predictions. Section 6 concludes.

2 Model

The setting we consider involves bargaining, for example where representatives of the employees and the employer meet to discuss how to divide the firm's surplus. For convenience, we refer to the labor force as the worker, as if they are a single entity, thereby abstracting away from any potential free riding problem among employees. One might argue that the incentivizing effect of compensation that is tied to the firm-level profits is then heavily diluted because firm profits depends on the entire workforce. However, the literature on broad-based incentive plans often found that the incentive schemes do raise firm performance despite the apparent threat/concerns of free riding (e.g., Knez and Simester, 2001).[6]

Given that our goal is to explain the institutional choice of how to share surplus as a type of contracting, abstracting from the free riding problem among employees should not be critical to our theory. That is, both discretionary profit sharing and employee stock ownership can suffer free riding, but our purpose is to compare the two using a contracting framework.

Specifically, we consider a principal and an agent, who play a game with an infinite time horizon where time is discrete and indexed by $t = 0, 1, 2, \ldots$. A novel element in our model is that within each period we consider an interim Nash bargaining stage after the worker accepts the job but before production begins, meaning that the worker can hold up the employer.[7]

We will consider both formal and relational contracting, as described in more detail below. Under either contractual form, at the beginning of period $t = 0, 1, 2, \ldots$, the principal hires the agent at least for that period and pays a base salary V_t. If the agent accepts the job offer, the principal and the agent bargain over the current period benefits, B_t, and the next period salary, V_{t+1}. Specifically, they agree on an effort level e_t that the agent should exert, a benefit B_t the agent should receive conditional on exerting that effort, and a salary V_{t+1} that the agent should receive conditional on the employment relationship continuing to period t+1.

Total surplus in a period where the agent exerts effort level e_t is $y(e_t) - c(e_t)$, where $y(e_t)$ is the production output and $c(e_t)$ is the cost of effort to the agent. Since the relationship between effort and output is deterministic, we can equivalently view the principal and agent as bargaining over what output to produce, rather than what effort to exert. For tractability, we will assume $y(e) = e$ and $c(e) = e^2$, which allows us to obtain explicit solutions.[8]

Both players are risk neutral, and we assume limited liability, in the sense that $V_t \geq 0$ and

[6]Theoretically, the lessening of free riding can be explained by employees monitoring one another as in Kandel and Lazear (1992). Kim and Vikander (2015) also demonstrate conditions under which team-based incentives can be preferred despite a free riding problem.

[7]Renegotiation is plausible in at-will employment relationship. Stole and Zwiebel (1996) considers a similar contracting environment wherein workers and firms can renegotiate wages at any time before production takes place, so the workers earn ex-post rents because the firm cannot immediately hire new employees from the labor market.

[8]Otherwise, it would suffice to assume that the agent's output is $y(0) = 0$ and y is strictly increasing and concave; and similarly the agent's cost is $c(0) = 0$ and c is strictly increasing and convex. Additionally, $\lim_{e\to 0} c'(e) < \lim_{e\to 0} y'(e)$ and $\lim_{e\to\infty} c'(e_t) > \lim_{e\to\infty} y'(e)$.

$B_t \geq 0$. We denote the principal's payoff from the period-t bargaining as $\pi_t = y(e_t) - B_t - \delta V_{t+1}$, and the agent's as $u_t = B_t + \delta V_{t+1} - c(e_t)$, where $\delta \in (0, 1)$ is the common discount factor. The players agree on π_t and u_t through weighted Nash bargaining. Thus, the outcome of bargaining is a set of values e_t, B_t and V_{t+1} that maximize the weighted Nash product $\pi_t^\alpha u_t^{1-\alpha}$, subject to the constraints, $\pi_t \geq 0$ and $u_t \geq 0$, and such that B_t and V_{t+1} can implement effort e_t for the given contractual form.[9]

Production then takes place after the bargaining closes. The agent chooses an effort level $e_t \in [0, \infty)$, and the principal observes that the worker has produced output $y(e_t)$, which accrues to the principal. Under formal contracting, the principal is obliged to pay the agreed-upon benefit B_t if the agent has exerted the agreed-upon effort e_t. However, if the agent does not exert the agreed-upon effort, the principal is not obliged to pay B_t, and can also immediately terminate the employment relationship without paying V_{t+1}. Under relational contracting, the only difference is that the principal is not obliged to pay the benefit B_t even if the agent exerts the agreed-upon effort.

We look for a stationary, subgame perfect Nash equilibrium that implements the values of e_t, B_t and V_{t+1} that are agreed upon in the interim bargaining stage. Players punish each other with a grim trigger strategy (which is never executed in equilibrium) if anyone deviates from the equilibrium path. For instance, suppose there is a period in which the principal does not pay the base salary or reneges on the benefits that were promised, or the agent does not exert the required effort. In those cases, either player may immediately terminate the relationship, so that both receive a payoff of zero from their outside options in all subsequent periods.

Given that failure in period t to exert the agreed-upon effort immediately leads to termination, causing the agent to forgo both the period-t bonus and period-t+1 base salary, it follows that both B_t and V_{t+1} effectively constitute performance pay for period-t. That is, what matters for the agent's incentives in period t is the total effective compensation promised, valued at $B_t + \delta V_{t+1}$, rather than the relative level of benefit vs base salary. As such, in our setting, we

[9]Thus, the players bargain over how to split the surplus produced, through the period-t benefit B_t and the period-t+1 salary V_{t+1}s (discounted from the perspective of period-t), which can be transferred prior to the next bargaining session in period $t + 1$.

can assume without loss of generality that $V_{t+1} = 0$, so that all incentives are promised through the benefit B_t.

For much of the analysis, whether contracting is formal or relational can be viewed as an exogenous feature of the contracting environment. However, motivated in part by our empirical application, we will also consider what the principal would prefer to choose, between formal and relational contracting, given her profits under each contracting form. We will assume throughout out analysis that the contracting environment (formal vs relational) does not change over time, consistent with the observation in the data where such changes are at best infrequent. This may be because it is too costly to change this institutional feature and also the benefit contracts might be written in a way that it must be applied in all subsequent periods. This assumption means that the contracting environment cannot be bargained over, even if it interpreted as an initial choice by the principal.

3 Theoretical Prediction

First, consider formal contracting, where a benefit B_t must be paid at the end of the period conditional on the agent exerting an effort level e_t. The principal and agent bargain over the set of possible contracts (e_t, B_t) that maximizes the Nash product,

$$(y(e_t) - B_t)^{\alpha}(B_t - c(e_t))^{1-\alpha}. \tag{1}$$

Formally, the agreed upon contract must satisfy the following constraint,

$$c(e_t) - B_t \leq \sum_{i=1}^{\infty} \delta^i (B_{t+i} - c(e_{t+i})), \tag{2}$$

as the agent's future gains from continuing the relationship must exceed the cost of exerting effort less the benefit in that period. However, in our setting this constraint says nothing more than the agent should prefer the agreed-upon contract to her outside option, $B_t - c(e_t) \geq 0$.

Taking the first-order condition with respect to the benefit implies $B_t = \alpha c(e) + (1 - \alpha)y(e)$.

That is, the parties agree on the benefit that gives a share α of the surplus to the principal, $\pi = \alpha(y(e) - c(e))$, and a share $1 - \alpha$ of the surplus to the agent, $u = (1 - \alpha)(y(e) - c(e))$. Moreover, taking the first-order condition with respect to effort implies that the parties agree on the efficient effort level e, in order to maximize total surplus $y(e) - c(e)$. Given our functional form assumptions, $y(e) = e$ and $c(e) = e^2$, this implies benefit $B^f = (2 - \alpha)/4$ and effort $e^f = 1/2$, with resulting profits of $\pi^f = \alpha/4$, where the superscript f stands for 'formal'.[10]

Second, consider relational contracting, where the principal offers a benefit B_t to be paid at the end of the period conditional on effort level e_t, but has discretion whether or not to actually pay the benefit. The principal and agent bargain over the set of possible contracts (e_t, B_t) that maximizes the weighted Nash, as before given by (1), but now subject to the principal's dynamic enforcement constraint:

$$B_t \leq \sum_{i=1}^{\infty} \delta^i (y(e_{t+i}) - B_{t+i}), \tag{3}$$

That is, the principal's future gains from continuing the relationship must exceed the size of the benefit that was promised. Given a stationary contract, i.e. with e_t and B_t independent of t, condition (3) is equivalent to

$$B \leq \delta y(e), \tag{4}$$

so the agreed-upon benefit cannot exceed a fraction δ of the agreed-upon output (i.e. the output generated by the agreed-upon effort).

We now derive the benefit B^r and effort level e^r that the parties will agree on under relational contracting, where the superscript r stands for 'relational'. We are interested in how this benefit and effort level compare to those under formal contracting, and what this implies for the principal's profits.

[10]The interpretation of the benefit B can be in terms of a promised cash bonus, conditional on the agreed upon effort level, but it can also be in terms of equity. For instance, the benefit can consist of a cash bonus of $c(e^f)$, to directly cover the agent's cost of effort, plus a fraction $1 - \alpha$ ownership share (equity) of the firm's surplus. This would also lead the agent to choose the effort level e^f that maximizes surplus, $y(e) - c(e)$.

Proposition 1. *Consider relational contracting. If* $\delta \geq 1 - \alpha/2$*, then the parties agree on* $e^r = e^f = 1/2$ *and* $B^r = B^f = (2-\alpha)/4$*, with resulting profits* $\pi^r = \pi^f = \alpha/4$*. If* $\delta < 1 - \alpha/2$*, then the principal and agent instead agree on* $e^r = \delta/(2-\alpha) < e^f$ *and* $B^r = \delta^2/(2-\alpha) < B^f$*, with resulting profits* $\pi^r = (1-\delta)\delta/(2-\alpha)$*. Moreover, we have* $\pi^r > \pi^f$ *if* $\delta \in (\alpha/2, 1-\alpha/2)$ *but* $\pi^r < \pi^f$ *if* $\delta < \alpha/2$*.*

To understand this result, the only difference between relational and formal contracting in our setting lies in the dynamic enforcement constraint, (4), which limits the size of the bonus the principal can credibly promise to pay. An increase in the discount factor, δ, loosens this constraint. Thus, if the discount factor exceeds a threshold value, then this constraint will not bind at the bonus and effort level that maximize the weighted Nash product. The parties will therefore agree on the same outcome as under formal contracting. That is, they agree that the agent should exert the efficient effort level, and receive a fraction $1 - \alpha$ of the resulting surplus, in order to maximize (1).

If the discount factor is too low, then the outcome under formal contracting is not feasible under relational contracting, because the principal's promise to pay benefit B^f given effort level e^f is simply not credible. The parties instead agree on a lower benefit level, one that gives the agent a smaller fraction of the generated surplus, i.e. below $1 - \alpha$, but one that the principal has an incentive to pay. Thus, the principal's credibility problems under relational contracting effectively increase her bargaining power, allowing her to claim a larger share of surplus than under formal contracting.

However, the parties will not just agree on a lower benefit, they will also agree on a lower effort level. Intuitively, the agent directly bears the cost of exerting effort, and an agreement that specifies the efficient effort level e^f but a low bonus will not give him a high enough payoff to maximize the weighted Nash product. Instead, the parties agree on an inefficiently low effort level, alongside a benefit that is just low enough to make the principal's promise to pay credible. This benefit is even lower than what the principal would have been able to pay, had the parties agreed on the efficient effort level e^f under relational contracting. Nonetheless, the agreement to reduce effort below e^f still benefits the agent, and result in a higher value of the weighted

Nash product, because it allows the agent to save on effort costs.[11]

As such, when comparing profits under relational contracting to those under formal contracting, there are two effects at play. The first effect limits the size of the maximum possible bonus, which effectively increases the principal's bargaining power and the share of surplus she can claim at any given effort level. This first effect, seen in isolation, pushes up the principal's profits. The second effect leads the parties to agree on efficiently low effort, which can be seen as a way to compensate the agent for the principal's inability to promise a high bonus. This second effect, seen in isolation, pushes down the principal's profits.

The second effect dominates when δ is small, since the principal's credibility problems under relational contracting are then so severe, that they result in very low effort. Total surplus is then so low that the principal ends up with lower profits than under formal contracting, despite capturing a larger share of surplus. In contrast, when δ is at an intermediate level, the first effect dominates, so that the principal ends up with higher profits than under formal contracting. Finally, if δ is large, then the principal's credibility problems are not severe enough to affect the bargaining outcome, so the principal earns the same as under formal contracting.

An implication of Proposition 1 is that profits under relational contracting will be non-monotonic in δ. When $\delta < \alpha/2$, profits are lower than under formal contracting, and are increasing in δ, as a higher discount factor leads the parties to agree on a more efficient effort level. When δ first exceeds $\alpha/2$, profits continue to increase in the discount factor, and are strictly higher than under formal contracting. However, as δ gets closer to $1-\alpha/2$, profits begin to decrease in the discount factor, as the principal loses bargaining power. After δ exceeds $1-\alpha$, profits remain constant, at the same level as under formal contracting.

Notice that the two threshold values for the discount factor, $\alpha/2$ and $1-\alpha/2$, depend directly on the principal's weight in Nash bargaining, captured by the parameter α. When the principal's weight in Nash bargaining is high, these two threshold values are close to one another. Thus, the range of δ for which relational contracting leads to higher profits, namely $\delta \in (\alpha/2, 1-\alpha)$,

[11] That is, the agreement to reduce effort below e^f benefits the agent, if (e^f, B^f) is not feasible under relational contracting. The agent would be even better off if it were possible to implement (e^f, B^f), i.e. the efficient effort level along with a high bonus, as under formal contracting.

is relatively small. Intuitively, if the principal would already enjoy a large share of the surplus under formal contracting, then relational contracting cannot increase this share by very much. Thus, the main impact of relational contracting is to drive down effort, which reduces profits. In the extreme case, $\alpha = 1$, the principal would capture all surplus under formal contracting, and therefore would never earn higher profits under relational contracting, regardless of the value of $\delta \in (0, 1)$.

In contrast, when the principal's weight in Nash bargaining is low, these two threshold values are quite far away from one another. Thus, the range of δ for which relational contracting leads to higher profits is relatively large. Intuitively, if the principal can claim little surplus under formal contracting, then relational contracting can in principle increase this share by quite a lot. The result can be higher profits, even if relational contracting also drives down effort to a low level. In the extreme case, $\alpha = 0$, the principal would not capture any surplus under formal contracting, and would therefore always earn higher profits under relational contracting, for all values of $\delta \in (0, 1)$.

We now comment on how we bring these theoretical results to the data. First, we view formal versus relational contracting as a firm choice variable. While this view would not be reasonable in all settings, we feel it is reasonable in ours, given that we interpret formal contracting in terms of ESOP, and relational contracting in terms of offering employees a profit-sharing plan. Second, we focus on intermediate and high ranges of δ, rather than very low values (i.e. values $\delta < \alpha/2$). Interpreting δ in terms of the probability of firm survival in each period, we are unlikely to observe firms in the data for which this probability is too low. Third, we suppose that amongst firms which are indifferent between formal and relational contracting, at least some will opt for the former rather than the latter.

Given this approach, model's empirical predictions are as follows. The use of relational contracting should be associated with i) a smaller discount factor (or chance of survival), ii) higher firm profit, and iii) lower effort (or efficiency), holding everything else constant.[12]

[12]Indeed, the implication of Proposition 1 is that we should see relational contracting precisely when it is less efficient than formal contracting. That being said, the argument is not that firms will opt for relational contracting *because* it is inefficient, but rather because it can increase their bargaining power vis-a-vis employees.

4 Dataset

Our dataset merges Form 5500 Datasets and Compustat Annual provided by the Department of Labor and Wharton Research Data Services, respectively. The former database is enabled by the Employee Retirement Income Security Act (ERISA), which covers most private sector employee benefit plans.[13] There are two types of benefit plans. One is a pension plan and the other is a welfare plan (such as health, disability, and life benefits). We do not use data on welfare plans because our theory only pertains to the retirement plans as a contractual mechanism to share the firm's surplus with the employees in the form of incentive pay (i.e., deferred compensation).[14]

Any sponsor (i.e., employer) of a pension plan subject to ERISA must file information about the plan every year, regardless of whether it is a defined benefit or contribution plan and whether contributions are made or not in that year. Note that plans can hold assets either directly or indirectly in the form of investments in pooled investment arrangements. Sponsors of such arrangements are called Direct Filing Entities (DFE), and they may also be required or can choose to file a Form 5500, over and above the filings by employers. We drop DFE filings and instead concentrate on ERISA filings by employers.[15]

Our data only contains Form 5500 fillings, and not Form 5500-SF (Short Form) filings. The Short Form is used for plans with fewer than 100 participants, and these are not public companies. Since we have no financial information on private companies, we cannot make use of the Short Form filing data for our tests.

Our sample period runs for six years, from 2009 to 2014. We extracted Form 5500 Datasets from 2009 because Form 5500 Database website says that there were changes to the Form 5500 and required electronic filing beginning with the 2009 plan year. We stop at the fiscal year 2014

[13]ERISA does not cover plans maintained by government entities, or plans which are established solely to comply with workers' compensation, unemployment, or disability laws. ERISA also does not cover plans maintained outside the United States for the benefit of nonresident aliens.

[14]Since welfare benefits are fixed and provided upfront conditional on employment, it can be thought of as a part of the fixed salary in our model. Hence, we drop all plans that do not have a pension type code. Most of them start with a plan number greater than 500, indicating welfare only plans.

[15]DFE filing is redundant for our purpose. Assets invested in DFEs are reported as interest in DFEs apart from other assets reported on Schedule H. Thus, the line items for DFE interest hide the plan's underlying asset class, but our prediction is not about investment portfolio of pension plans.

since 2015 data were incomplete.

The pension feature code associated with each plan is important for our purpose. All applicable features are listed on the Instructions for Form 5500 as two-digit alphanumeric codes. Codes need not be mutually exclusive, so a plan can list more than one features. For instance, a plan can be an ESOP, or a 401(k) plan, or both. We focus on the codes starting with 2, which pertains to the defined contribution pension, and ignore the codes belonging to other types of plans (i.e., defined benefit pension, other pension benefit, and welfare benefit).

There are 20 feature codes available for defined contribution plans; however, we only use the four major codes that cover most of the plans. They are Profit-sharing [2E], Stock bonus [2I], ESOP other than a leveraged ESOP [2O], and Leveraged ESOP [2P]. The first two are the discretionary profit sharing plans as we will refer in the rest of this paper. That is, the employer is granted responsibility for determining whether and how much the company contributes to these plans; i.e. companies are not required to contribute a set amount.

The reason we classify stock bonus plans under relational contracting is that payments are discretionary. Specifically, Internal Revenue Service § 1.401-1(b)(1)(iii) provides that a stock bonus plan is a plan established and maintained by an employer to provide benefits similar to those of a profit-sharing plan, except that the benefits are distributable in stock of the employer company. For the purpose of allocating and distributing the stock of the employer which is to be shared among his employees or their beneficiaries, such a plan is subject to the same requirements as a profit-sharing plan.

On the other hand, an ESOP involves a commitment on the part of the employer to allocate a certain amount of firm equity to the employee pension plan over time (i.e., subject to vesting). In particular, in the case of a leveraged ESOP, the employer is required to make contributions to the ESOP each year to satisfy its annual loan obligation. Thus, from the employee's standpoint, the employer contribution is almost certain, given continued employment, and they can reap the benefits from their allocation (e.g., dividends or capital appreciation) by increasing the equity value.

The only major code besides the four codes that we use is Code section 401(k) feature

[2J]. Note that a 401(k) feature means that employees can make contributions to the plan. For instance, a profit sharing plan or an ESOP can have the 401(k) feature if it also accepts contributions from the employees. 401(k) plans are in fact quite common, so the plans do often have the additional 401(k) feature. However, we are analyzing how the employers share the surplus with the employees, and not whether employees can also make contributions on top of it. Thus, we do not further distinguish plans based on whether a profit-sharing plan or an ESOP has a 401(k) feature.[16]

There are some data cleaning issues. For instance, an employer can sponsor multiple pension plans, which may not have the same sets of pension feature codes. In such cases, we aggregated/collected all pension feature codes for a given sponsor in a reporting year. Also, in a small number of cases, the plan's reported feature codes do not stay the same across years, which we think is due to reporting errors. For instance, it is unlikely that a plan suddenly stopped being an ESOP in a year and then decided to be an ESOP again in the following year.[17]

The discretionary/commitment nature of employee retirement plans we want to examine is likely to be a predetermined, institutional choice in our sample period. However, it is possible that the feature of pension benefits is correlated with the conditions firms were facing when they set up the plan. Hence, we pick up a few measures from Form 5500 that may capture some factors that are history-dependent, and that we can use as control variables. One is the plan age, as constructed by subtracting the effective year of plan from the current reporting year. Another is the number of participants in the plan as of the end of the reporting plan year.

We then merge our Form 5500 data to that of Compustat Annual. The two datasets can be linked by the sponsor's Employer Identification Number (EIN). To our knowledge, joining these two datasets has not been attempted before; however, the join has a notable limitation because a firm can have more than one EINs for various reasons (e.g., ownership and tax). To mitigate

[16] A 401(k) plan can have a matching contribution by the employer. Note that matching does not depend on firm performance and hence is steady (subject to eligibility) while profit-sharing employer contributions can fluctuate significantly and ESOP value similarly depend on the stock price.

[17] There are also some cases in which the calendar or report year in a Form 5500 filing is different from the year for which the Form 5500 was filed (dating back several years). Unsure of whether this is a late filing or a misunderstanding/reporting error, we decided to drop such observations.

this concern, we first drop pension plans that are a multiemployer plan or a multiple-employer plan, which are about three percent of all 5500 plans. Using only single-employer plans, we were able to match about 17,000 Compustat firm-years to Form 5500 data, in which there are 3,562 unique firms.

We then use the companies' financial data from Compustat to construct some variables that represent theoretical counterparts of our model. First, we proxy for the firm's discount factor with the probability that a firm will go into bankruptcy, as proposed by Altman (1968). Altman Z-Score is a widely used empirical model in finance that predicts the probability of financial distress in two years, based on multiple income and balance sheet items.[18] The higher the z-score, the less likely the firm will go bankrupt; and z-scores above 3 are often considered to be in a safe zone. Table 1 shows that the average z-score is 2.46 in our sample with a relatively large variance.[19]

Second, we use the firm's operating profit (i.e., earnings before interest and taxes) divided by the number of employees to proxy for the firm's share of the surplus. The division is done because our model describes an employment relationship for a representative worker regardless of the number of employees. Note that the operating expenses include non-labor costs, but staff expense alone is no longer collected by Compustat for many of the sample firms. Thus, we use the operating income per employee as the firm's share of the employee-generated surplus, assuming that other non-labor inputs are exogenously given and do not generate any surplus by themselves.

Third, our empirical proxy for labor efficiency is a revenue productivity that can be estimated using a stochastic frontier model. The logic here is that firms in the same sector can be compared with one another in terms of their revenue-generating ability for a given employment size. Thus, there is a stochastic 'frontier' of this revenue-employment relationship, whereby each firm's sale

[18]To be precise, Altman's Z-Score is calculated as 1.2*wcap/at + 1.4*re/at + 3.3*ebit/at+0.6*mkcap/lt + 0.999*sale/at, where the variable labels are explained in Table 1. Note that some items such as wcap have more missing entries than others, so the resultant sample size will decrease further.

[19]There are alternative models, based on the structural option pricing model of Black and Scholes (1973), that can be used to predict bankruptcy (e.g., Distance to Default); however, they are sensitive to model assumptions and the z-score is found to generate more stable ratings (Miller, 2009).

is offset by a scaling factor (an inefficiency term) from this frontier which follows a truncated normal distribution, as well as the conventional i.i.d. error term.[20]

To estimate this (time invariant) scaling factor for each sample firm, we group firms by industry sector (a two-digit NAICS code) and for each group estimate a stochastic frontier model, where the dependent variable is the log of sale and the independent variables are the log of employees and the set of year dummies.[21] The estimated scaling factor ranges from 0 to 1; and the higher the value is, the closer is the firm to the frontier. In Table 1, the average scaling factor is 0.11, indicating that the average firm is far below the industry frontier.

5 Empirical Evidence

The main feature of our model's predictions is that it contrasts the outcomes associated with formal and relational contracting. This distinguishes it from the literature on shared capitalism which cast the profit-sharing plan and the ESOP in a similar role for motivating employees. Hence, our approach to model the two forms of shared capitalism using a contracting framework necessitates that we show evidence of data generated from such processes.

Our predictions follow from Proposition 1. As mentioned thereafter, we think that the case in which the discount factor is sufficiently small is not likely to be observed in our data of publicly trading firms. Barring this, our model yields concrete predictions concerning the level of discount factor, firm's share, and productive efficiency depending on the type of surplus sharing arrangement (i.e., discretionary plans such as profit-sharing and stock bonus plans versus commitment plans such as leverage and non-leveraged ESOPs).

Specifically, we flag the firm-year observations that reported ESOP or leverage ESOP features in their Form 5500 filing and use the indicator ($ESOP_{it}$) as the main explanatory variable of

[20] As pointed out by Foster et al. (2008), a revenue productivity does not measure a physical productivity (technical efficiency) in that revenue may include firm-specific prices, such as markups. However, we cannot distinguish a firm's physical and revenue productivities with our Compustat data.

[21] Excluding the year dummies does not significantly affect the estimates of the scaling factor. In one sector, the model cannot be estimated because of a small sample size. On the other hand, estimating the model with a time-varying scaling factor always almost fails to converge using our dataset.

interest. The estimation equation is given by

$$Y_{it} = \alpha + \beta ESOP_{it} + X'_{it}\gamma + \mu_i + \varepsilon_{it}, \tag{5}$$

where Y_{it} can be the z-score, or the operating income per employee, or the revenue efficiency, of firm i in year t. Controls in X_{it} include proxies for firm size (total asset and market capitalization), plan characteristics (plan age and active participants in the plan) and sector and year dummies.

μ_i denotes the unobservable firm-specific effect and ε_{it} is the usual i.i.d. disturbance. It is not relevant to estimate a fixed effects model because the main variable of interest ($ESOP_{it}$ is time-invariant for the vast majority of firms. To use random effects, a concern might be that the unobserved effect μ_i may be correlated with $ESOP_{it}$. For that reason, we run a Hausman test, the result of which suggest we cannot reject the null hypothesis of no correlation. and X_{it}.

Bringing things together, we estimate equation (6) in Ordinary Least Squares with random effects and standard errors clustered at the firm level, when Y_{it} is the z-score or the operating income per employee. Since the firm's revenue efficiency is estimated using a time-invariant stochastic frontier model, we collapse the data to the mean and run simple cross-sectional OLS regressions with robust standard errors, when Y_{it} is the revenue efficiency. Finally, we include the full set of year and sector dummies (using the two-digit NAICS) to account for any systematic difference in the outcome variables.

Table 2 shows that ESOP firms tend to have a higher z-score than non-ESOP firms. The positive coefficient on ESOP is statistically significant in all three columns and thus renders support for the model's prediction that only those firms with a sufficiently high discount factor would use ESOPs. The results are also robust to the inclusion or exclusion of controls, and the results remain qualitative the same when we remove the set of year and sector dummies.

Next, Table 3 shows that ESOP firms tend to have a lower operating profits per employee, consistent with the model prediction. The coefficient on ESOP is negative and statistically significant as long as we control for the firm size proxies (this pattern also holds if we remove the set of year and sector dummies). That being said, the results here are somewhat sensitive to the inclusion or exclusion of firm characteristics.

Lastly, Table 4 shows that in a cross-section of firms (using the average over the sample period), ESOP firms are associated with a higher level of per employee revenue efficiency, which is statistically significant and also in line with our prediction. In this table, the coefficients on the plan characteristics (age and participants) become statistically significant, indicating that firms with older benefit plans and smaller plan participants tend to be less efficient, but the marginal effect of ESOP on efficiency is positive in all three columns.

6 Conclusion

In this paper, we have explored how commitment versus discretion, as captured by formal and relational contracting, can influence bargaining between firms and workers, and thereby affect profits. Our theoretical results suggest that some firms will prefer to have discretion in deciding whether and how much surplus to share with employees, even though this also reduces efficiency. In contrast, others prefer being able to commit to share the surplus. In a model of at-will employment and interim Nash bargaining, we laid out the conditions under which firms may prefer commitment versus discretion. These depend on both the parties' relative weights in bargaining and on the discount factor.

Empirically, we consider how the model's implications may shed light on different types of defined-contribution retirement benefit plans, which comprise a large chunk of incentive compensation for rank and file employees. Our preliminary results suggest some support for the model predictions. Given the particular structure of the predictions that pit discretionary employer contributions to retirement plans against commitment through employee stock ownership, our findings add to the literature that examines differential effects of the form of shared capitalism.

7 Appendix

Proof of Proposition 1. As stated in the main text, under formal contracting, the parties agree on $e^f = 1/2$ and $B^f = (2-\alpha)/4$, with resulting profits $\pi^f = \alpha/4$. Under relational contracting, the principal's dynamic enforcement constraint, (4), either binds at the optimum or it does not. If it does not, then we must have $e^r = 1/2$ and $B^r = (2-\alpha)/4$, just as under formal contracting. Suppose instead that some $e \neq 1/2$ was agreed upon in bargaining, and that (4) did not bind. Then both players could agree on a value of e that was marginally closer to 1/2, which would increase total surplus $y(e) - c(e)$, and for which (4) would still not bind. This means that B could be marginally adjusted in a way that increases the pay off of both principal and agent. This would increase the weighted Nash product, (1), resulting in a contradiction.

Now suppose (4) binds at the optimum, so that $B = \delta y(e)$. Then the weighted Nash product, (1), becomes

$$(y(e) - \delta y(e))^{\alpha}(\delta y(e) - c(e))^{1-\alpha}.$$

Substituting $y(e) = e$ and $c(e) = e^2$ and simplifying yields

$$(1-\delta)e(\delta - e)^{1-\alpha}.$$

Thus, amongst the bargaining outcomes for which (4) binds, the value of e that maximizes the weighted Nash product is that which maximizes $e(\delta - e)^{1-\alpha}$. Taking the first order condition gives effort level $e^r = \delta/(2-\alpha)$. Substituting back into the dynamic enforcement constraint yields benefit $B^r = \delta^2/(2-\alpha)$. The principal's payoff is then $\pi^r = (1-\delta)\delta/(2-\alpha)$. This is the highest payoff under relational contracts, given that (4) binds.

Note that we have $\alpha/4 > (1-\delta)\delta/(2-\alpha)$, and $\delta^2/(2-\alpha) > (2-\alpha)/4$, whenever $\delta/(2-\alpha) > 1/2$, which can be shown by direct comparison. This means that under relational contracts, both effort and benefit will be lower than under formal contracting, $e^r < e^f$ and $B^r < B^f$, whenever the principal's dynamic enforcement constraint binds.

The parameter values for which (4) will bind under relational contracting are those for which this constraint is violated under formal contracting. The relevant condition is $B^f > \delta e^f$, i.e.

$\delta < B^f/e^f$. Given $B^f = (2-\alpha)/4$ and $e^f = 1/2$, this reduces to $\delta > 1-\alpha/2$, as required.

To complete the proof, we show that $\pi^r < \pi^f$ for $\delta < \alpha/2$, but that $\pi^r > \pi^f$ for $\delta \in (\alpha/2, 1-\alpha/2)$. We have shown that for $\delta < 1-\alpha/2$, profits under relational contracting are $\pi^r = (1-\delta)\delta/(2-\alpha)$, whereas profits under formal contracting are $\pi^f = \alpha/4$. This implies $\pi^r < \pi^f$ is equivalent to

$$\frac{\delta(1-\delta)}{2-\alpha} < \frac{\alpha}{4}.$$

or equivalently

$$\delta^2 - \delta + \frac{\alpha(2-\alpha)}{4} > 0. \tag{6}$$

The left-hand-side of (6) is quadratic in δ, with two roots, namely $\delta = \alpha/2$ and $\delta = 1-\alpha/2$, and is strictly positive when evaluated at $\delta = 0$. Thus, (6) holds for all $\delta < \alpha/2$, so that $\pi^r < \pi^f$ holds for such values of δ. Moreover, (6) is violated for all $\delta \in (\alpha/2, 1-\alpha/2)$, so that $\pi^r > \pi^f$ holds for such values of δ. ■

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	N
ESOP (1=yes; 0=no)	.1774	.3820	15502
Total assets (at)	11777	100725	15304
Working capital (wcap)	487	2282	12744
Retained earnings (re)	1136	8618	15181
Operating profit (ebit)	570	3487	15295
Market cap. (mkcap)	5127	20332	14348
Total liabilities (lt)	9524	94990	15259
Sale (sale)	3902	15953	15298
Employees (emp)	11.74	55.54	14690
Altman z-score	2.460	20.40	11829
Profit per employee	73.87	1262	14674
Revenue efficiency	.1126	.1974	15478
Plan age	22.18	14.72	15502
Plan participants	4025	22460	15484

The dataset is an unbalanced annual panel of the Compustat firms from 2009 and 2014 that are matched to the Form 5500 Dataset by EIN, in which there are 3562 firms having at least one of the following Pension Plan Characteristics Codes: 2E (Profit-sharing), 2I (Stock bonus), 2O (ESOP), and 2P (Leveraged ESOP). ESOP is an indicator for 2O or 2P, which are time-invariant within firm in the vast majority of cases. Financial variables (at, wcap, re, ebit, mkcap, lt, sale) are in millions and employees (emp) are in thousands. Altman z-score is calculated as (1.2*wcap/at + 1.4*re/at + 3.3*ebit/at+0.6*mkcap/lt + 0.999*sale/at). Profit per employee is ebit/emp. Revenue efficiency is estimated as the time-invariant technical efficiency by fitting a stochastic frontier model in a NAICS 2-digit group of firms, where the output is the log of sale and the input is the log of employees and a set of year dummies.

Table 2: ESOP and Bankruptcy Score

Variable	(1)	(2)	(3)
ESOP	.5202	.5186	.5100
	(.1907)***	(.1941)***	(.1939)***
Total assets		–.0761	–.0766
		(.0163)***	(.0163)***
Market cap.		.0614	.0615
		(.0195)***	(.0196)***
Plan age			.0033
			(.0023)
Plan participants			.0006
			(.0005)
NAICS (2-digit) dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R^2	.0099	.0107	.0108
N	11829	11829	11814

The dependent variable is Altman z-score, where a higher z-score means a lower probability of bankruptcy. ESOP is 1 if the firm has an ESOP or leveraged ESOP according to Form 5500; and 0 otherwise. Coefficient estimates in random effects models are presented with standard errors clustered at the firm level. Total assets, market cap and plan participants are divided by 1,000. Statistical significance is denoted as *** 1%, ** 5%, * 10%.

Table 3: ESOP and Operating Profit

Variable	(1)	(2)	(3)
ESOP	–82.50	–39.10	–38.36
	(63.17)	(19.63)**	(19.59)**
Total assets		8.897	8.900
		(.8800)***	(.8793)***
Market cap.		–3.562	–3.573
		(1.210)***	(1.216)***
Plan age			–.4078
			(.3613)
Plan participants			–.1493
			(.1546)
NAICS (2-digit) dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R^2	.0139	.0609	.0611
N	14674	14023	14008

The dependent variable is operaing profit (earnings before interest and taxes) divided by the number of employees. ESOP is 1 if the firm has an ESOP or leveraged ESOP according to Form 5500; and 0 otherwise. Coefficient estimates in random effects models are presented with standard errors clustered at the firm level. Total assets, market cap and plan participants are divided by 1,000. Statistical significance is denoted as *** 1%, ** 5%, * 10%.

Table 4: ESOP and Revenue Efficiency

Variable	(1)	(2)	(3)
ESOP	.0182	.0255	.0297
	(.0094)*	(.0090)***	(.0096)***
Total assets		–.0086	–.0112
		(.0287)	(.0313)
Market cap.		.5451	.4555
		(.1910)***	(.1771)***
Plan age			–.0006
			(.0002)***
Plan participants			.3737
			(.1675)**
NAICS (2-digit) dummy	Yes	Yes	Yes
R^2	.2923	.3475	.3498
N	3460	3259	3259

The dependent variable is the time-invariant scaling factor estimated from the stochastic frontier model. ESOP is 1 if the firm has ESOP or leveraged ESOP according to Form 5500; and 0 otherwise. Data are collapsed to the mean, and coefficient estimates in OLS models are presented with robust standard errors. Total assets, market cap and plan participants are divided by 1,000,000. Statistical significance is denoted as *** 1%, ** 5%, * 10%.

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