Four Essays On Deferred Compensation in Labor Contracts

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Chapter 1

Introduction: Promises Instead of Cash

"It is better that you should not vow than
that you should vow and not pay."
(Ecclesiastes 5:5)

In the past few decades, public attention to compensation arrangements of all possible types has dramatically increased. This tendency has also been shared by the deferred compensation arrangements (Tauber and Levy, 2002). Such a trend was reflected in labor economics among the first by Salop and Salop (1976), Lazear (1979, 1981), Akerlof and Katz (1989), and Hutchens (1987, 1989). The authors raised a discussion emphasizing an important role of deferred payments as an efficient mechanism to cope with principal-agent problems.

Deferred compensation in labor contracts may put on various "forms": Pensions, insurance, shares, stock options, etc (see e.g., Tauber et al., 2002; Askildsen et al., 2003a). Practically all deferred compensation schemes have one specific trait: Their expected magnitude depends on the "success" of the firms, "risk taking" attitude, and the fact that the employees remain attached to the firm in the future (Askildsen et al., 2003a). There is therefore a common trouble with all deferred payments, namely, that they "may never materialize"; "firms may default" on their deferred compensation plans

(Merton, 1985; Diamond et al., 1985; Lazear, 1998; Askildsen et al., 2003a). A firm can decrease payments by changing a compensation scheme, by going bankrupt and firing employees, or simply by "reneging on its promises" (Lazear, 1998; Askildsen et al., 2003a). Recent corporate and accounting scandals, followed sometimes by striking bankruptcies where rank-and-file employees lost their retirement income, illustrate such defaulting (e.g., Enron, United Airlines). These scandals have initiated a wave of restructuring measures aimed, among other things, at reforming the corporations' codex of conduct. Among the reformations, the issues related to deferred compensation took the central role. At the same time, according to Hall (2000), "while there are many reasons" why "companies" have been so successful "over the last two decades", it is not a "coincidence" that the upswing has occurred at the peak of the "shift" in pay from "cash" to deferrals. Recalling the compensation approach 20 years ago, when for example, "most executives" were rather "paid like bureaucrats" and behaved "like bureaucrats", modern "executives" are normally "paid like owners" and behave "like owners" (Hall, 2000; Hall et al., 2003). In other words, deferred compensation has "changed corporate" governance immensely. Yet, "has the change been for the better or for the worse?" – the "long-term" effect of deferred compensation on employment relations is still far "less clear" (Hall, 2000).

Concerning this thesis, we seek to shed light on some important aspects of deferred compensation provision. We are interested in developing a better understanding of the problems related to labor contracts and the provision of deferred compensation, in particular the implications of the bargaining activities for deferred payments between firms and workers. In fact, bargaining over a labor contract with deferred payment implies a complex trade-off between deferred compensation and cash payments. However, the standard firm-union bargaining literature[1] – being mostly elaborated "when the biggest component of (...) compensation was cash, in the form of salaries and bonuses"[2] – does not pay attention to the issues related to deferred

[1]See e.g., McDonald and Solow (1981), Grout (1984), Bean (1984), Oswald (1985), Manning (1987), Lockwood and Manning (1989), and Booth (1995) for survey.

[2]See Hall (2000).

compensation provision. Now the compensation structure is different. Many compensation plans include to a great extent either long-term or short-term deferred payments. Bargaining *per se* should therefore look differently as well.

In contrast to the standard bargaining literature, we concentrate on bargaining at the individual level (employer-employee), which allows us to focus on a trade-off between cash and deferred compensation in the labor contract (chapters 2, 3, 4), as well as on some anomalies in deferred compensation provision (chapter 5). This approach lets us not only address the problems in question using standard economic techniques, but also employ methods of experimental and behavioral economics to provide a new perspective on various aspects related to wage bargaining in general, and the provision of deferred compensation specifically. Finally, our research approach is in line with the fundamental approaches of behavioral labor economics and personnel economics[3]: Employer - employee relations, contract structure, and organizational behavior are essentially "economic issues", therefore "there is no reason to cede control over these areas" to psychology or sociology.

1.1 Background

To understand deferred compensation, we must address its background. Deferred compensation plans attempt to reduce principal-agent problems by changing the time of compensation payment. In general, the notion "*deferred compensation*" defines any agreement where the paying to workers for accomplished or ongoing work is "postponed" (Allen et al., 1976). The deferrals may be a short-term or long-term ones, for example, "until retirement" (Tauber et al., 2002). Therefore, in the literature deferred compensation plans are often known as a *seniority pay*.

Seniority Pay. Economists have long payed attention to the fact that wages increase with time. Normally, this correlation was explained from the human capital theory point of view (Becker, 1964). It basically argues that

[3]See Lazear (1995).

with age workers become more experienced, and therefore, enhance their productivity. As a result, they are payed more compared to the previous periods. Another explanation for the positive correlation between seniority and wage increase appeared in the 80s (see e.g., Lazear, 1979, 1981[4]; Hutchens, 1989). According to this approach, more experienced (i.e., older) employees receive earnings "above their Marginal Revenue Product" (MRP). On the other hand, less experienced (i.e., younger) employees are compensated "less than their MRP" (McConnell and Brue, 1992; Lazear, 1998; Cahuc and Zylberberg, 2004). As Lazear (1995) states, deferred compensation scheme and "piece rate" pay are to some extent alike.[5] He says, that a worker is also "compensated on the basis" of his/her "performance", but there are "two" important "differences" between them. The first "difference", according to Lazear, is that the "evaluation" "period" for delayed-payments compensation schedules is "usually longer" compared to the evaluation period in "piece rate pay". For instance, the period can take months, or even "years". Therefore, the author states that a deferred compensation profile may be compared to a piece rate profile where the evaluation period is "very long". More precisely, Lazear argues that:

> Older workers are paid high salaries, not so much because of their superior performance while they are old but rather because their high compensation serves to motivate them during the early years of their careers. (Lazear, 1995, p.40)

The second big "difference" between deferred plans and piece rate pay, as stated by Lazear, is that the employment relations must exist to have the deferred benefits materialized. He says that it is crucial for a deferred compensation profile, that the worker stays with the firm (and the firm must exist) so that the rewards earned earlier could be paid. A typical deferred compensation profile is illustrated in Figure 1.1. Note that the wages of the workers are less than MRP in the beginning of their career, but they upturn in the later periods of tenure.

[4]These works have first introduced the idea in the context.

[5]For more details on piece rate pay see e.g., Gibbons (1987), Lazear (2000), Carmichael and MacLeod (2000), Gneezy and Rustichini (2000).

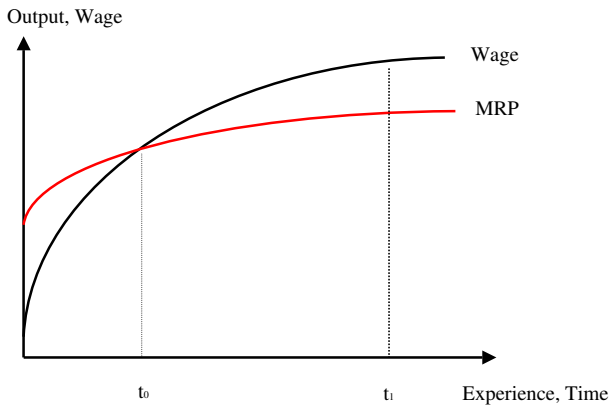

Figure 1.1: Deferred compensation profile (*Source: Lazear, 1998*).

Incentives & Retention. The reason why a firm and its workers come out with a deferred compensation agreement is that it can be beneficial to both sides (see Lazear, 1979). From the firm's point of view, this pay scheme may be the most convenient way to deter shirking (*incentive role*). A dismiss, as a punishment for possible shirking, would mean that a worker must lose the increased seniority pay. Therefore, he/she would rather work diligently to stay employed and acquire the deferred benefits: Earnings above his/her productivity (McConnell et al., 1992; Lazear, 1995, 1998; Cahuc et al., 2004). Deferred pay can also reduce employee turnover (*retention role*). Workers who leave earlier forfeit the rights to obtain deferred benefits (Salop et al., 1976; McConnell et al., 1992; Lazear, 2003). From the worker's point of view, differed compensation profile might be even preferable, e.g., as a form of "compulsory saving", as a sign of career advance, or as an "insurance" (see, e.g. Diamond and Mirrlees, 1985; Frank and Hutchens, 1993).[6]

Finally, the deferred payments arrangement brings about a reduction of principal-agent problems, and as a result, gives an additional productivity upswing. The productivity rise, in turn, provides additional gain, allowing

[6]Apart from that, one can argue that the basic decision to enter the delayed payments contract roots from the Investment Theory's individual "consumption-saving choice": "The individual decides how much of his wealth to allocate to current consumption and how much to invest for future consumption", see Merton (1978).

the firm and its employees to increase their earnings. In other words, younger employees trade current cash income off for the possibility to earn more in future. They accept this trade-off because "the increased work effort" and "productivity" allow "higher" income in the long run (McConnell et al., 1992; Lazear, 1998; Cahuc et al., 2004).

Promises and Risk of Bankruptcy. The deferred compensation scheme depicted in figure 1.1, basically represents a *deal* between firm and its employees to *commit* to each other and can be defined as an *"implicit contract"*. Such a contract is "implicit", because it mostly relies on trust between firms and workers, and not necessarily on formal law, or a "written" document (Salanie, 1997). In contrast to explicit contract, which is enforced by a "third party", implicit contract is "self-enforcing", and supported by equilibrium behavior of the parties (McConnell et al., 1992; Salanie, 1997; Cahuc et al., 2004).[7] In the manner argued by Carmichael:

> Self-enforcing contracts are collections of promises that, while they may not be legally binding, are nonetheless credible. Everyone can be confident that the promises will be kept. (Carmichael, 1989, p.67)

In this context Allen et al., giving a more general definition for the deferred compensation plans, put the relation between deferred payment and promises this way:

> A (...) deferred compensation plan implies nothing more than an agreement whereby person (or legal entity) promises to compensate another for services rendered currently with actual payment for those services delayed until sometime in the future. Such agreements are almost invariably reduced to writing, and are mutually supported by the employer's promise to pay deferred benefits and the employee's promise to render services in exchange therefor. (Allen et al., 1976, p.352)

Consequently, one serious drawback of deferred compensation agreements is that the employee does not have much confidence that the employer will be financially able to comply with promises made when the payment time arrives (Allen et al., 1976; Lazear, 1998). Therefore, the *"risk concept"*

[7]For a detail discussion on implicit contracts see e.g., Rosen (1985).

is the most essential issue that goes through "all" deferred compensation profiles. Risk in this case specifies that an employer may become bankrupt and, as a consequence, expected gains might be lost (Tauber and Levy, 2002). Paraphrasing Lazear (1998), if "business conditions turn" bad, any "firm may end up going bankrupt" – reneging "on its promises". He says that even large firms cannot take into account all factors that might cause the insolvency. As a result, "the utility loss from the possibility of default could be substantial" (Merton, 1985). The employees have therefore to obtain some guarantee that the deferred rewards will finally be delivered. They have to at least have some "confidence" and trust in the employer's liability before accepting any financial "promises" (Allen et al., 1976; Lazear, 2000; Tauber et al., 2002). Lazear summarizes the arguments this way:

> Since there is some chance that any firm might default on its implicit wage obligations workers (...) must be wary of [*firm's*] promises (...). (Lazear, 1998, p.288)

The employer, in return, has to care about his/her "reputation" in order to take on obligations that may exist much longer than the factual time of worker's employment (Allen et al., 1976; Lazear, 1995, 1998). A formal contract, though of no small account, alone, can not help to prevent possible conflicts. Even though "the parties would" rather prefer to not think about a hypothetical litigation, a lot of deferred compensation contracts end up in the "court" (Allen et al., 1976). Trust, honesty and "good faith" then, may be just as much valued as the accurately prepared documents (Allen et al., 1976; Tauber et al., 2002). To sum up: Mutual promises and the risk of bankruptcy are what makes bargaining over deferred compensation different from canonical wage bargaining. By taking this into consideration, we try to bridge a gap in the understanding of deferred compensation provision and therefore contribute to the literature on labor contracts and wage bargaining. With this background, the thesis takes the reader through four logical steps, which mirror its organization.

1.2 Organization of the Thesis

We develop the thesis through four consequent steps. First, we introduce a theoretical model of bargaining over deferred compensation. Second, we complement the model with an empirical illustration from laboratory experiment. Third, we show how deferred compensation bargaining outcome depends on the behavior of the bargaining parties. And fourth, we explain how anomalous forms of deferred compensation may appear without bargaining. More specifically, the structure of the thesis appears as the following:

Chapter 2 introduces our modelling approach.[8] It presents a theoretical model of bargaining over deferred compensation. Here we use the axiomatic Nash bargaining framework not only to predict a bargaining outcome, but also to examine an issue of more specific nature: The retention role of deferred compensation. Compared to the incentive role (which is extensively studied issue, but also seems to not always be consistent with empirical findings), the retention justification has rather been overlooked, yet it seems to be supported by reality (Lazear, 2003). Therefore, in this chapter we shed additional light on the retention role of deferred compensation. Specifically, the analysis focuses on employment relations affected by liquidity constraints and salary reduction. We examine the circumstances which make employees involved in this process decide either to stay with or leave an employer. The main interest is the optimal combination of cash and deferred compensation (e.g., stock options) that a firm can use to keep qualified personnel in order to avoid bankruptcy. The parties first bargain over a compensation scheme. Then, on the labor market, the employee decides between a stock option grant or alternative job offers. We use the cooperative Nash bargaining solution to distribute a surplus of random size and find the optimal structure of the compensation scheme.

Our results show that it is possible to renegotiate the initial contract in order to keep the employee and try to avert bankruptcy. Indeed, under certain circumstances we can define an optimal amount of cash that a firm

[8]This chapter is also issued as a working paper Gonzalez and Gurtoviy (2004).

may offer to its employee. Together with a corresponding share of stock options, this could prevent him/her from leaving. We also show the importance of the specific functional form of the wage-renegotiations schedule in determining the firm's optimal choice of cash and deferred payments. We conclude that the deferred compensation might be used as a possible contractual mechanism to retain qualified personnel. The work has been inspired by the specific cases of start-ups with liquidity constraints. Nevertheless, using a simple two-stage structure and the axiomatic Nash bargaining solution makes our model flexible enough to provide insights into the bargaining issues of a broader character.

Chapter 3 complements the theoretical results obtained in chapter 2 with empirical analysis. In particular, using experimental techniques, the chapter gives insight into human behavior concerning bargaining over deferred compensation. More specifically, we adjust our theoretical model to the laboratory environment and examine it using experimental data. We want to see to what extent our theoretical bargaining solution can predict the outcome in the laboratory; in other words, how do *people* coordinate on the division of uncertain deferred benefits. To determine that, we implement bargaining over a compensation package which consists of deferred compensation and base wage. As a result, parties bargain over deferred benefits taking into account some immediate transfers from one player to the other.

The experiment begins with the players making decisions on the share of the deferred benefits (or joint surplus, in experimental terms) that they demand for themselves. In a strategic way they specify their demands for every possible value of the transfer. The important feature of our model is that the players face different kinds of uncertainty during the game. First, it is not exactly clear which value of the transfer will be realized. Second, the size of the deferred benefits is random. Therefore, the players are supposed to take this uncertainty into account when they make decisions. The result obtained in the experiment can only be partly explained by the standard theory. As opposed to the theory prediction, a large part of the subjects coordinated on the fair division of the joint surplus. We explain our results assuming that

along with pure economic preferences people possess some social ones, namely preferences for fairness and inequality aversion (see Fehr and Schmidt, 1999, 2003). The chapter presents further experimental results, which show that non-monetary incentives also affect the actions and the decisions of people in an uncertain environment. In particular, we discuss the influence of social preferences on bargaining over deferred benefits. While answering the question whether the standard theory or the newly developed fairness theory explains players' behavior better, we find clear evidence that players mostly try to coordinate on the fair division of the joint surplus, taking into account the transfer from one player to the other. In the noncooperative structure of the game, players behave rather fairly and cooperatively, and expect the same kind of behavior from their fellow players.

Chapter 4 continues analyzing the deferred compensation bargaining outcome and shows how it depends on the behavior of the parties involved. Namely, it demonstrates that mutual commitments (i.e., firm-worker contracted promises) to cooperative behavior affect the provision of deferred compensation. This is true due to the role that bankruptcy risk plays in delayed-payments arrangements.

While defining the bargaining model and explaining its assumptions, we demonstrate how it encompasses the classical models of firm-union bargaining to tie up promises and deferred compensation arrangements. We adjust the approach suggested by Askildsen et al. (2003a,b) to consider a bargaining process at the individual level (employer-employee), and to include the parties' behavior. We define behavior here as different levels of parties' effort: Worker effort to find a new job, and firm effort to avoid bankruptcy. The approach allows us to show how the risk of bankruptcy and individual behavior can affect the trade-off between base payment (wage, salary) and deferred compensation (stock options, pensions, etc.). It can be shown, that deferred compensation provision is very much dependent on a cooperative kind of behavior, and as a result on mutual promises. Basically, such reasoning supports the intuition that behavior of the parties makes bargaining power efficient in the light of deferred-payment arrangements. The presented

framework helps us to illustrate how the standard bargaining approaches can be useful to understand a number of aspects related to the individual bargaining. In our context, it provides an interesting perspective on the relationship between bargaining and individual behavior (i.e., individual efforts) as well as on the trade-off between base wage and deferred payments.

Chapter 5 shows how the anomalous forms of deferred compensation may appear without bargaining. The chapter continues the discussion started in the previous chapter and explains how the absence of long-term commitments and contract enforcement may create the non-contracted form of deferred compensation – wage arrears, the delayed payment of wages.

Empirical research made in the 90s normally considers wage arrears as a financial "adjustment" tool for firms to decrease labor costs while overcoming monetary problems. In this chapter, however, we employ a newly developed approach that views wage arrears as a type of group (conformity) "behavior within" a society (see Earl et al., 2004). We extend the framework which demonstrates how socioeconomic context and market conditions can affect individual "managerial behavior", as well as managers' "decisions" regarding wage payments. In particular, referring to the effects of group behavior, we offer a model to analyze wage payments (i.e., wage delays). In this context, we also stress the role of social norms. The primary outcome of this chapter is the existence of the multiple equilibria and new equilibrium selection approach. Different equilibria in this context mean that the equilibrium "to pay" and the equilibrium "not to pay" are both theoretically possible. The analysis also demonstrates how group behavior affects individual actions: Through an intricate interaction of norms, incentives and beliefs, it formes different socioeconomic frameworks, which consequently affect individual decisions. As a second step in this chapter, we apply a Random Utility Approach to select among multiple equilibria, which are typical outcome for these types of models. In addition, our result offers a completely new avenue for equilibrium selection in the social norm framework.

Chapter 2

Bargaining over Deferred Compensation and Employee Retention

Urged by cash constraints[1], firms often seek to renegotiate the labor contracts and design compensation schemes that may allow to both reduce current payment obligations and to retain qualified personnel. *The Economist*, commenting on a factual situation, puts it this way:

> To judge by the airlines' share prices, the stock market seems to be betting on imminent mass bankruptcies (...). The only way that most of the American airlines are not yet in it (...) is to renegotiate their labor contracts before they go bust. (The Economist, March 22nd-28th, 2003, p.57-58)

One common solution is to defer part of previously agreed-upon compensation payments. This may help not only to avert bankruptcy in the short run, but also to induce employees to stay in their jobs until the firm recovers liquidity.

This work, therefore, introduces a theoretical model of bargaining over the compensation scheme, which includes deferred payments. While discussing a bargaining outcome, we also address the issue of a more specific nature: The retention role of deferred compensation. In particular, the model deals

[1] E.g, firms with bankrupt debtors, firms under financial stress, start-ups.

with the problem of employee retention in firms that experience financial constraints but have a good chance of recovering. Whereas wage arrears in geographic areas characterized by poor contract enforcement and low-skilled labor (e.g., mining or heavy industries in *hinterland* regions of Eastern European countries) are analyzed in the chapter 5 of the present thesis, here we focus on high-skilled, non-substitutable employees who are likely to receive several attractive job offers in the labor market.

Literature on deferred compensation (see, e.g., Lazear, 1990, 1998, 2003; Prendergast, 1993) has stressed the retention role in the context of incentive contracts.[2]A special focus against this background is made in relation to stock options (e.g., Core and Guay, 2001; Hall and Murphy, 2003; Oyer, 2004; Oyer and Schaefer, 2005). We examine this generally accepted form of profit sharing between firms and employees and consider its use as part of a payment scheme in the context of liquidity constraints.

2.1 Stock Options

Many companies grant stock options not only to top managers, but also to the majority of high-skilled personnel (Oyer and Schaefer, 2005). Moreover, quite a few authors (e.g., Core and Guay, 2001) observe the broader employee options plans in firms with liquidity problems. Although employees are not always the cheapest source of credit for a firm facing cash constraints, other effects of stock option make this practice common. In particular, equity payments may motivate personnel to be more productive in the long run, help a firm to select out qualified employees, and finally, to retain them (Tauber et al., 2002). If the motivational (i.e., incentive) role of stock options is well-studied in the literature, the selecting/retention role of stock options has not yet received much consideration; however it is well supported by reality (Lazear, 1990, 2003). Following this reasoning, we focus on the use of stock options in lieu of cash with the primary objective of retaining skilled employees. Stock options can function as "golden handcuffs" to make em-

[2]Other common effects mentioned in this literature are related to *motivation* and *selection*.

ployees stay with firms despite "better" looking outside opportunities (see, e.g., Morse et al., 1997; Lazear, 1998). Therefore, this kind of equity compensation can especially be of big use in companies where human capital has a particular value, in companies with financial constraints, and difficulties to obtain credits (e.g., Oyer, 2004).

In the empirical literature, the retention role of stock options has already attracted some attention (e.g, Core and Guay, 2001; Hall and Murphy, 2003; Oyer, 2004). For instance, according to Oyer (2004), stock options may help companies to devise payment schemes that will "retain" workers facing fluctuating "market wages", especially if the "costs of employee turnover" are "high". More precisely, in his empirical analysis Oyer argues that stock options can be most efficiently used if level of "market wages" changes (grows/falls down) rapidly, the costs of replacing personnel (i.e., "turnover") are "high", and the economy conditions are rather unstable.

Oyer (2004) basically says that a firm has "three" possible strategies to form its compensation policy. First, the firm can renegotiate compensation package whenever a worker receives an "outside offer". The firm may do this when wages "do not change" too frequently. Second, the firm may pay a bonus conditional on the firm's profit. This strategy might be preferable when wage renegotiation costs are too "high". Lastly, the firm may come out with employment contracts that include cash payments and stock options. Options are "correlated" to the employees' "outside" opportunities, which in turn, makes them be *attached* to the firm while the outside opportunities get better (Chang, 2001). The latter case is the focus of this work. Although the topic is widely discussed in the empirical literature, little attention has been paid to the bargaining aspect of this problem. We focus therefore on bargaining over a combination of cash payment and stock options in the labor contract, which may help to retain employees. The chapter is organized as follows: In Section 2.2 we present the theoretical model; in Section 2.3 we state the bargaining problem and present the solution; in Section 2.4 we examine whether there is an optimal combination of cash and stock options that ensures employee retention. Section 2.5 concludes with a discussion of the implications that follow from our results.

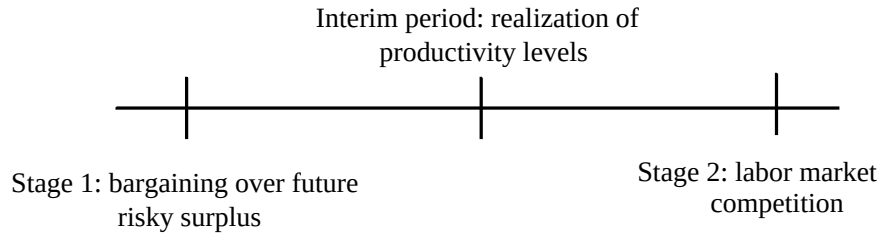

Figure 2.1: Time sequence of the game.

2.2 Model

Consider an employment relationship between a firm and an employee that is at risk of breaking up due to the firm's lack of finance. In particular, suppose that the firm (she, F) faces severe liquidity constraints (e.g., because the payments from customers or the revenues from some investment project did not arrive on time) and is not able to pay the salary to her only employee (he, E). Therefore, the firm has two possibilities: Either to shut down or to engage in further debt to cover her payroll. The first possibility terminates the relationship by declaring bankruptcy, thus obtaining a profit normalized to zero in both the first and the second stage, $U_1^F = U_2^F = 0$. The alternative is an attempt to continue the employment relationship when expecting a sufficiently high revenue in a second stage of the game. In this case, F could engage in additional debt to obtain some cash from a bank, the government, etc. and renegotiate the labor contract in order to dissuade E from leaving the firm, at least until expectations regarding future revenue (or the lack of it) become clear.

The decision process is shown in Figure 2.1. It includes two decision stages (1 and 2), as well as an interim stage in which some random events occur. The analysis of stage 1 begins at the point of time when E is already an employee of F. Here we assume that E has already delivered work effort, but due to some exogenous event (e.g., payment delays by customers), the firm is short of cash to pay the employee's salary, regardless of E's level of productivity. The

only decisions to be made in stage 1 concerns the renegotiation of the original salary, w_1. In particular, we let F and E bargain in stage 1 about a new compensation scheme specifying the fraction (percentage) of future profits that the firm can offer the employee in lieu of immediate cash payments. Stage 2 is a labor market stage, in which E has the choice among several job offers. We proceed now to describe each stage in detail.

2.2.1 Stage 1: Renegotiating the Labor Contract

The game begins with both parties bargaining about a compensation scheme $b(\alpha)$, such that if F pays only a fraction α of the salary w_1 to the employee in the first period, she is obliged to give him a fraction $1 - b(\alpha)$ of the second period profits, which are denoted by S^* and defined as the difference between the firm's revenues and the employee's salary (Section 2.2.3 explains this in detail).[3] This form of deferred compensation (in our case, a stock-option grant) is lost if the employee leaves the firm. In what follows, we show that the equity-compensation scheme $b(\cdot)$, which results from the salary renegotiation, is an increasing function of α, meaning it is possible to substitute stock options for immediate cash payments in order to retain the employee. Moreover, if the outcome of the renegotiation includes some payment in cash in stage 1 (i.e., if $\alpha > 0$), we assume that it has to be financed by a credit at interest rate $r \in \mathbb{R}$. Therefore, paying a fraction $\alpha \in [0, 1]$ of w_1 to the employee in stage 1 results in an additional liability equal to $(\alpha w_1)r$ for the firm.

If the renegotiation of w_1 fails, we assume that E leaves the firm without being paid and F goes bankrupt, both obtaining a zero utility level in the first period: $U_1^E = U_1^F = 0$. In contrast, if an agreement is reached in stage 1, the employee obtains

$$U_1^E = \alpha w_1,$$

[3] $b(\alpha)$ and $1- b(\alpha)$ represent the second stage shares of the firm and the employee, respectively.

while the firm ends up with a total liability of

$$U_1^F = -\alpha w_1(1+r).$$

Although the employee is not substitutable for the firm, F is not the only employment opportunity for E. As a highly qualified employee, E could easily find an alternative job in the labor market, where other n *ex ante* identical firms (indexed by the set $\mathcal{L} = \{1, \ldots, n\}$) are ready to make competitive salary offers w_2^i, $i \in \mathcal{L}$, in the second stage, depending on the different productivity levels $(p_1, \ldots, p_n)$ that the employee can attain at each of the n firms. Although these future productivity levels are uncertain during stage 1, it is common knowledge that $\forall i \in \mathcal{L}$, $p_i \sim \text{Uniform}[0, P]$ and that the productivity that E will be able to attain in the second stage at F, if their partnership is preserved, is $p_F \sim \text{Uniform } [0, P_F]$, with $P_F > P > 0$. Assuming $P_F > P$ means that E has already acquired some firm-specific abilities in the first stage, which are not transferable to other firms. If the partnership is preserved (at least until the second stage labor market competition), F's prospects of being the most productive among all potential employers of E are better than for any of the other n firms. Thus, F has a better chance to compete for the employee in the second stage. More specifically, the *ex ante* probability that F will be able to profitably overbid the salary offers made by the other n firms increases with $P_F - P$. It therefore may be advantageous for F to retain E even at the cost of additional debts.

2.2.2 Interim Stage: The Realization of Productivity Levels

Before stage 2 begins, there is an interim stage at which the levels of employee productivity in each firm (i.e., the realized values of the p_i's) are observed. The fact that these firm-specific levels of productivity are observed before production takes place, accounts for the situation in which companies receive

orders in advance.[4] We write $p_{(1)} = \max_{i \in \mathcal{L}} p_i$ for the highest productivity level among the n competing firms, and denote by $i^* = \arg\max_{i \in \mathcal{L}} p_i$ the most productive one. Similarly, we let $p_{(2)} = \max_{i \in \mathcal{L} \setminus i^*} p_i$ be the second highest productivity level among the competitors.

2.2.3 Stage 2: Labor Market Competition

Stage 2 of the game begins after the potential productivity of the employee in each of the existing firms becomes commonly known. In this stage, the firms on the market make simultaneous salary offers to E[5] and Bertrand competition leads each of them, except for the most productive one, to offer a salary equal to its own productivity level. Only the most productive of all existing firms offers a salary lower than its own productivity, namely the employee's opportunity-cost salary,[6]

$$w_2 = \begin{cases} p_{(1)} & , \quad \text{if} \quad p_F \geq p_{(1)} \geq p_{(2)} \\ p_F & , \quad \text{if} \quad p_{(1)} > p_F \geq p_{(2)} \\ p_{(2)} & , \quad \text{if} \quad p_{(1)} > p_{(2)} > p_F. \end{cases} \tag{2.1}$$

Here it is important to stress that E's share $1 - b(\alpha)$ of profits is a fraction of his productivity in firm F, p_F, minus his opportunity-cost salary, w_2, conditioned on E being hired by F. Therefore, E will always prefer firm F to bid in the labor market, since this can only increase his expected competitive salary $\mathrm{E}w_2$. In other words, E has an interest in helping F to avoid bankruptcy in the first stage, regardless of who finally hires him in stage 2.

Assuming that the employee always accepts the highest salary offer in the second period, two types of employment are open to him:

1. If his initial employer F survives bankruptcy and becomes the most

[4]For instance, this is usual practice in the production of software and consulting services.

[5]Firm F may or may not exist in stage 2, depending on whether the employee E was retained or not.

[6]The employee's opportunity-cost salary, w_2, is equal to the second-order statistic of the sample of *all* productivities (including the productivity of firm F, which is equal to zero if it did not survive bankruptcy) since it is the salary that the employee would receive upon contracting with the second most productive firm.

productive firm in stage 2 (i.e., if $p_F \geq p_{(1)}$), she employs him, offering a second period salary equal to $w_2 = p_{(1)}$ according to (2.1). Additionally, E is entitled to the share $(1 - b(\alpha))$ of the second stage profits S, as agreed upon during the contract renegotiation process in stage 1, where

$$S = p_F - p_{(1)}.$$

2. In case that F does not become the most productive firm (i.e., if $p_F < p_{(1)}$), E is hired by the firm i^* with salary $w_2 = \max\left\{p_F, p_{(2)}\right\}$, and any stock options (i.e., the share of the second stage profits) held by the employee become void.

Therefore, at the end of stage 2, the employee receives his second period salary w_2 and, if his initial employer F turns out to be the most productive firm, he also receives a share $(1 - b(\alpha))S$ of the surplus. Only in this latter case does F receive a payoff equal to $b(\alpha)S$. Put differently, F's utility in the second stage is equal to

$$U_2^F = b(\alpha)S^*,$$

where, $S^* = \max\{0, S\}$, while the utility of E in stage 2 is given by

$$U_2^E = w_2 + [1 - b(\alpha)]\, S^*,$$

with

$$w_2 = \begin{cases} p_{(1)} & \text{, if } S^* > 0 \\ \max\left\{p_{F,}\ p_{(2)}\right\} & \text{, otherwise.} \end{cases}$$

2.3 Bargaining Outcome

In this section, we present the cooperative bargaining solution for stage 1 of the game, assuming that both E and F have equal bargaining power. We specifically apply the Nash bargaining solution to the problem of finding the share $b(\alpha)$ of future uncertain profits that the firm would have to offer the employee along with cash payments αw_1 in order to retain him. The utility

of the firm and the employee for two periods can now be written as

$$\mathrm{E}U^F = \mathrm{E}\left[U_1^F + U_2^F\right] = \mathrm{E}\left[-\alpha w_1(1+r) + b(\alpha)S^*\right]$$

and

$$\mathrm{E}U^E = \mathrm{E}\left[U_1^E + U_2^E\right] = \mathrm{E}\left[\alpha w_1 + w_2 + (1-b(\alpha))S^*\right],$$

respectively. Note that since the productivity levels of stage 2 are still unknown in stage 1, an agreement over a combination of cash and stock options must be reached considering *expected* utilities. Hence, the bargaining problem in the next section is solved by taking into account both the probability that F becomes the most productive firm in the future and the expected size of the bargaining surplus.

2.3.1 Bargaining Setting

The bargaining setting in our model is characterized by two important features. First, we assume that utility is not *completely* transferable between the firm and the employee. Second, we allow for the possibility of *bankruptcy*, which means that liabilities acquired by the firm in stage 1 can only be paid back to the creditor in full if the firm makes enough profits in stage 2.

The *nontransferability assumption* captures the idea that payments made to the employee in the first stage, αw_1, as well as additional expected gain in the second stage salary, $\Delta \mathrm{E}w_2$ (see expression (2.4)), are both not transferable to the firm. This means that the total expected utility of the firm is constrained by[7]

$$\mathrm{E}U^F \leq \mathrm{E}S^* - \alpha w_1(1+r)\theta, \tag{2.2}$$

where

$$\theta = \Pr(p_F > p_{(1)}) = 1 - \frac{n}{n+1}\frac{P}{P_F}$$

is the probability of F being the best employment opportunity for E (the

[7]In other words, (2.2) means that what the firm can obtain in the second stage is at most equal to the expected value of the joint surplus, $b(\alpha)\mathrm{E}S^* \leq \mathrm{E}S^*$.

most productive firm) in stage 2, and

$$\mathrm{E}S^* = \frac{(P_F - P)^2}{2P_F} + \frac{(n+3)}{(n+1)(n+2)} \cdot \frac{P^2}{P_F}$$

is the expected value of profits in that stage (see Appendix 1).

The *limited liability assumption*, $\mathrm{E}U^F \geq 0$, requires the introduction of an exogenous actor (e.g., a bank or the government). This exogenous actor must be willing to give credit to the firm during stage 1, knowing that this credit will be unrecoverable if the firm is not able to hire the employee in stage 2 (an event which occurs with probability $1 - \theta > 0$), and that the credit is recoverable only up to the realized value of $b(\alpha)S^*$. In other words, while the employee receives αw_1 in stage 1 with certainty, the firm pays back to the creditor $\alpha w_1(1+r)$ in stage 2 only with probability $\theta < 1$, and this payment is subject to the limited liability constraint of the firm.

Assuming for a moment that the limited liability constraint is not binding ($\mathrm{E}U^F > 0$), and denoting the difference between the amount received from the creditor and the expected payback as

$$\beta(\alpha) \equiv \alpha w_1(1 - (1+r)\theta),$$

it is possible to distinguish three cases, depending on the value of the interest rate r:

1. If $\alpha w_1 > \alpha w_1(1+r)\theta \Rightarrow r < \left(\frac{1-\theta}{\theta}\right)$, the interest rate is such that stage 2's expected refund is lower than what the employee received in stage 1, i.e., $\beta(\alpha)$ can be interpreted as an increase in the agreement surplus since the creditor is providing funds in excess to what the firm will pay back in expected value.

2. If $\alpha w_1 < \alpha w_1(1+r)\theta \Rightarrow r > \left(\frac{1-\theta}{\theta}\right)$, the interest rate is such that stage 2's expected refund is higher than what the employee received in stage 1, i.e., the resulting negative value of $\beta(\alpha)$ decreases the agreement surplus.

3. If $\alpha w_1 = \alpha w_1(1+r)\theta$, the interest rate r^* that exactly matches F's

odds of bankruptcy

$$r^* = \left(\frac{1-\theta}{\theta}\right), \tag{2.3}$$

can be easily shown to be the unique competitive interest rate at which creditors make neither losses nor profits in expected value since $(1 + r^*)\theta = 1$, or $\beta(\alpha) = 0$.[8]

As explained in Section 2.2.3, another particular feature of our model is the fact that the competitive salary expected by the employer in stage 2, $\mathrm{E}w_2$, depends on the success of the agreement in stage 1. Defining $k = 1$ if bargaining succeeds, and $k = 0$ otherwise, it is possible to show that (see Appendix 1):

$$\mathrm{E}(w_2|k) = \begin{cases} \left(\frac{n}{n+1} - \frac{n}{(n+1)(n+2)} \cdot \frac{P}{P_F}\right) P, & \text{if } k = 1, \\ \left(\frac{n-1}{n+1}\right) P, & \text{otherwise.} \end{cases}$$

Hence,

$$\Delta\mathrm{E}w_2 \equiv \mathrm{E}(w_2|1) - \mathrm{E}(w_2|0) > 0 \tag{2.4}$$

is the additional gain in the joint surplus corresponding to the employee's direct interest in helping the firm to survive.

2.3.2 Bargaining Solution

We can now state the bargaining problem faced by E and F in the canonical form (B_α, d), where B_α is the set of feasible agreements (bargaining set) and $d = (d^E, d^F) = (\mathrm{E}(w_2|k = 0), 0)$ is the conflict payoff. Taking into account the *nontransferability* and *limited liability* assumptions, and defining $\widetilde{U}^j \equiv \mathrm{E}(U^j - d^j)$, $j = E, F$, we have

$$B_\alpha = \left\{(\widetilde{U}^E, \widetilde{U}^F) : \widetilde{U}^E + \widetilde{U}^F \leq \mathrm{E}S^* + \Delta\mathrm{E}w_2 + \beta(\alpha)\ ,\ \widetilde{U}^F \leq \mathrm{E}S^* - \alpha w_1(1+r)\theta\right\}.$$

[8]Note that according to expression (2.3), a firm with higher probability of success θ should be able to obtain financial support at a lower interest rate.

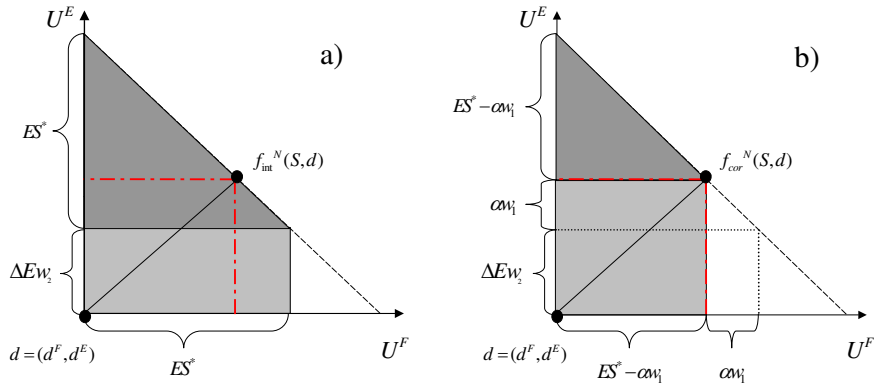

Figure 2.2: Nash bargaining solution for $\beta(\alpha) = 0$ ($r = r^*$). The shaded area is the bargaining set: a) Cash payments are equal to zero; b) Cash payments are equal to αw_1.

Then the Nash bargaining solution with symmetric bargaining power

$$f^N(B_\alpha, d) = \underset{(\widetilde{U}^E,\widetilde{U}^F)\in B_\alpha}{argmax}\ \widetilde{U}^E \cdot \widetilde{U}^F$$

results in the following two cases :

1. Internal solution:

$$\widetilde{U}^E_{int} = \widetilde{U}^F_{int} = \frac{\mathrm{E}S^* + \Delta\mathrm{E}w_2 + \beta(\alpha)}{2}, \tag{2.5}$$

   implying

$$b(\alpha)_{int} = \frac{1}{2} + \frac{\Delta\mathrm{E}w_2 + \alpha w_1(1 + (1 + r)\theta)}{2\mathrm{E}S^*};$$

2. Corner solution:

$$\widetilde{U}^E_{cor} = \Delta\mathrm{E}w_2 + \alpha w_1, \quad \text{and} \quad \widetilde{U}^F_{cor} = \mathrm{E}S^* - \alpha w_1(1 + r)\theta \tag{2.6}$$

   which implies $b(\alpha)_{cor} = 1$.

See graphical representation of the bargaining solutions for $\beta(\alpha) = 0$ on Figure 2.2.

Whether the bargaining problem results in a corner solution or an internal solution, depends on the size of the first stage cash payments, αw_1, or more precisely - on the size of α. Substituting (2.5) in (2.6), it is straightforward to obtain the threshold value of α where $\widetilde{U}_{int}$ turns into $\widetilde{U}_{cor}$

$$\alpha^* \equiv \frac{\mathrm{E}S^* - \Delta\mathrm{E}w_2}{w_1(1+(1+r)\theta)}.$$

To put it differently

$$\widetilde{U}^{E,F} = \begin{cases} \widetilde{U}^{E,F}_{int} & \text{, if } \alpha \leq \alpha^* \\ \widetilde{U}^{E,F}_{cor} & \text{, otherwise.} \end{cases}$$

The solution, therefore, can be summarized by the compensation schedule[9]

$$b^*(\alpha) = \begin{cases} \frac{1}{2} + \dfrac{\Delta\mathrm{E}w_2 + \alpha w_1(1+(1+r)\theta)}{2\mathrm{E}S^*} & \text{, if } \alpha \in [0, \alpha^*] \\ 1 & \text{, otherwise.} \end{cases} \tag{2.7}$$

In order to illustrate our bargaining solution numerically, we construct the example depicted on Figure 2.3.[10] The example illustrates that only for small values of cash payments (αw_1) can the employee expect to receive a part of the profit. Moreover, the share of the profit he receives is fairly small. The biggest share in our example amounts to approximately 14% of the profit, and it decreases (up to zero) as the cash payments increase. The following section discusses the bargaining outcome and its implication for retention in more detail.

[9]Note, it is easy to show that $\frac{1}{2} + \frac{\Delta\mathrm{E}w_2 + \alpha w_1(1+(1+r)\theta)}{2\mathrm{E}S^*} \leq 1, \forall \alpha \in [0, \alpha^*]$.

[10]The example is calculated according to the following parameters: $n = 1$, $p_F \sim$ Uniform $[0, 200]$ and $p_1 \sim$ Uniform $[0, 100]$; we calculated the probability that F will become the most productive firm in the second stage with $\theta = \frac{3}{4}$; the expected value for the joint surplus equals to $\mathrm{E}S^* = 58\frac{1}{3}$; the employee's second period salary in case F stays in the market at the second period is $\mathrm{E}w_2 = 41\frac{2}{3}$, and $\mathrm{E}p_{(2)} = 0$ otherwise. For this example we also have chosen six consequent values of cash payments, $\alpha w_1 = \{0, 10, 20, 30, 40, 50\}$ (see Appendix 1).

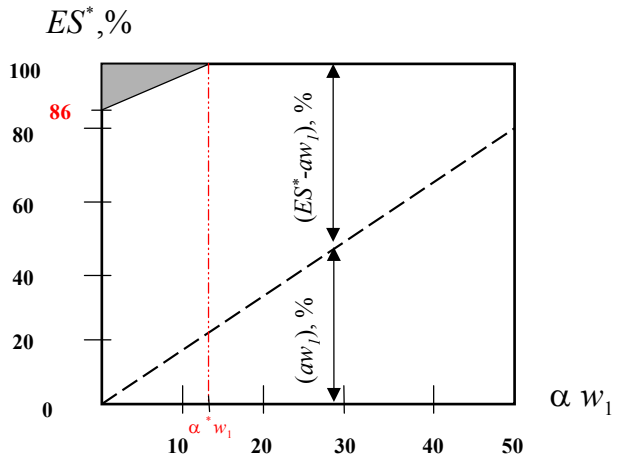

Figure 2.3: Predicted bargaining outcome according to the example parameters. The shaded area represents the employee's share.

2.4 How Much to Pay in Cash

We have shown, that bargaining can result in two compatible solutions: The internal solution and the corner solution. Following expression (2.7), the internal solution means that the part of the profit, $(1-b^*(\alpha))\mathrm{E}S^*$, which the employee can obtain is defined by $\alpha \in [0, \alpha^*]$. Whereas the corner solution indicates that if the cash payments exceed α^*, the whole profit is taken by the firm. Therefore, we can say that the employee may receive a part of the profit only in the case if cash payments do not exceed the employee's expected part of the profits

$$(1 - b^*(\alpha))\mathrm{E}S^* \geq \alpha w_1,$$

which is true $\forall \alpha \in [0, \alpha^*]$.

As a result, all values $\alpha \in [0, \alpha^*]$ would yield to the employee and the employer the same expected utility (under the assumption of risk neutrality), given the solution schedule $b^*(\alpha)$. Alternatively, the employee is indifferent to receive (and the firm to give) any amount of payments up to α^*, either as a

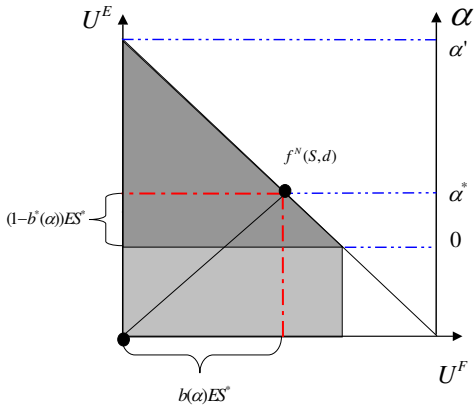

Figure 2.4: Different α in relation to the bargaining set.

first stage cash (αw_1) or as a second stage part of the profit ($(1-b^*(\alpha))\mathrm{E}S^*$). Moreover, these payments also provide the same incentive for the employee to stay with the firm at least until the productivity levels of the second stage become common knowledge. In this context a reasonable question arises: Is there an optimal value of α which can help the firm to retain the employee and to avert bankruptcy? To see this, we consider the consequences of different values of α, both from the firm's and the creditor's perspective.

The cost of credit in stage 1 is a key determinant of the firm's expected utility. In particular, from expression (2.5) it is clear that the utility of the firm is a monotonically increasing (or decreasing) function of α if the interest rate is $r < r^*$ (or $r > r^*$).[11] Also, from equation (2.6), it is readily evident that cash payments higher than $\alpha^* w_1$ always decrease the firm's expected utility.[12] Thus, from the viewpoint of the firm, the preferred value of α is $\alpha^F = \alpha^*$ if $r < r^*$, and $\alpha^F = 0$ if $r > r^*$. If the interest rate is equal to competitive value r^*, the firm is indifferent between any value of α within the range $[0, \alpha^*]$ (see Figure 2.4). Furthermore, the firm's expected creditworthiness (i.e., its expected ability to pay at the end of stage 2) is given

[11] This and the following result we obtain as long as the firm's limited liability constraint is not binding ($\mathrm{E}U^F > 0$).

[12] We neglect the case $r \leq -1$.

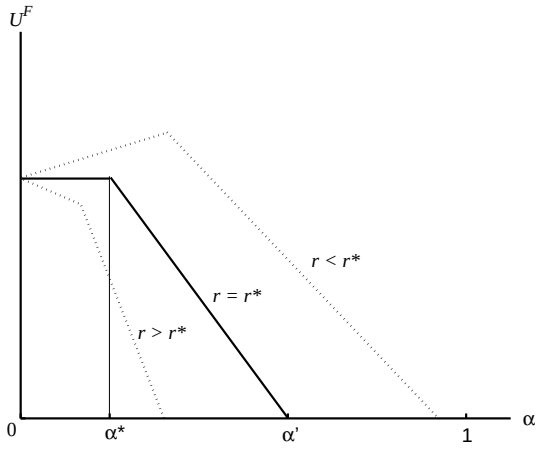

Figure 2.5: Firm's expected utility as a function of α.

by $b^*(\alpha)\mathrm{E}S^*$. It is straightforward to show that, for all values $\alpha \in [0, \alpha^*]$ the *limited liability assumption* holds

$$b(\alpha)\mathrm{E}S^* \geq \alpha w_1(1+r)\theta, \tag{2.8}$$

meaning that all cash payments to the employee that lead to an internal solution in the bargaining stage will, in expectation, allow the firm to avoid bankruptcy. Recalling that $b^*(\alpha) = 1$ for all $\alpha \geq \alpha^*$ and using (2.2), one can similarly show that there is a threshold value

$$\alpha' \equiv \frac{\mathrm{E}S^*}{w_1(1+r)\theta} > \alpha^*$$

above which the firm is not expected to make enough profits to pay back the full amount of the credit taken out in stage 1. This is due to the fact that, given a corner solution, a higher value of α only increases the firm's liabilities but not its expected ability to pay. Thus, the creditor should not lend an amount higher than $\alpha' w_1$, regardless of the value of r, since a loan of this magnitude is likely to lead the firm into bankruptcy (see Figure 2.4). Finally, it should be clear by now that whereas the creditor's return is identically equal to zero at the competitive interest rate r^*, it is increasing (or

decreasing) in $\alpha \in [0, \alpha']$ in case that $r > r^*$ (or if $r < r^*$). Therefore, a profit-maximizing creditor should lend money – up to α' – as long as the interest rate is higher than, or equal to, the firm's odds of bankruptcy. Otherwise, the creditor should not provide any credit (see Figure 2.5).

2.5 Concluding Remarks

We argued that a firm in financial trouble may not only have an incentive to retain its employee, but also the means to do it. Our results show that it is possible to renegotiate the initial contract in order to keep the employee and try to avert bankruptcy. Indeed, under certain circumstances, we can define an optimal amount of cash that a firm may offer to an employee, along with a corresponding share of deferred compensation, in order to prevent him from leaving. The optimal combination of cash and deferred compensation derived in the model crucially depends on how the firm's odds of failure compare to the interest rate of available credit. If the latter is lower than the former, then it will be profitable for the firm to take on further liabilities in order to make a cash payment to the employee, while offering nothing in terms of deferred compensation. In contrast, when the interest rate is higher than the firm's odds of failure, the firm should offer a payment consisting only of stock options. This payment is greater the less important it is to the employee that the firm survives (i.e., the smaller the improvement in the employee's expected opportunity-cost salary). In its turn, this is related to the number and quality of the alternative job offers that he can expect to receive in the future. Although, we believe that using a simple two-stage structure and the Nash bargaining solution makes our model flexible enough to provide insights in the issues of more general interest, the outcome of the model, however, to a great extent depends on the *exogenous* factors (i.e., interest rate, number of job offers) as well as rational behavior of the players. As a result, the model does not show how the *endogenous* factors (e.g., parties' behavior, different preferences) may affect the bargaining outcome. While chapter 4 addresses this concern in the theoretical framework, the next chapter (3) gives experimental insight into the issue.

Appendix 1

The productivity levels of the competing firm are *iid* Uniform$(0, P)$ random variables. Thus, the productivity of the most productive firm, $p_{(1)}$, has a density function $f(p_{(1)}) = \frac{np_{(1)}^{n-1}}{P^n}$. On the other hand, the productivity of the firm F, denoted by p_F, has density $f(p_F) = \frac{1}{P_F}$, with $P < P_F$. Since all productivity levels are independent, the joint density of p_F and $p_{(1)}$ is given by

$$f(p_F, p_{(1)}) = \frac{1}{P_F} \frac{np_{(1)}^{n-1}}{P^n}.$$

The probability that firm F is more productive than any other firm is equal to

$$\begin{aligned}
\theta = \Pr(p_F > p_{(1)}) &= \int_0^P \int_y^{P_F} f(x, y) dx dy \\
&= \frac{n}{P_F P^n} \int_0^P y^{n-1}(P_F - y) dy \\
&= \frac{n}{P_F P^n} \left[\frac{P_F P^n}{n} - \frac{P^{n+1}}{n+1} \right] \\
&= 1 - \frac{P}{P_F} \cdot \frac{n}{n+1}.
\end{aligned}$$

Note that $\lim_{n \longrightarrow \infty} \theta = 1 - \frac{P}{P_F}$.

To calculate the expected value of profits, $\mathrm{E}S^*$, where $S^* = \max\{0, S\}$ with $S = p_F - p_{(1)}$, we make use of the following

Lemma 1 *S is a random variable with density function*

$$f_S(s) = \begin{cases} \frac{1}{P_F} - \frac{(-s)^n}{P_F P^n} & , \text{ if } -P \leq s \leq 0 \\ \frac{1}{P_F} & , \text{ if } 0 < s \leq P_F - P \\ \frac{(P_F - s)^n}{P_F P^n} & , \text{ if } P_F - P < s \leq P_F. \end{cases}$$

Proof. Define the bivariate transformation $S = U(p_F, p_{(1)}) = p_F - p_{(1)}$ and $T = V(p_F, p_{(1)}) = p_F + p_{(1)}$ with Jacobian

$$J = \begin{bmatrix} 1/2 & -1/2 \\ 1/2 & 1/2 \end{bmatrix}.$$

Then, the joint density of S and T is given by

$$\begin{aligned} f_{S,T}(s,t) &= |J|\, f_{X,Y}(U^{-1}(s,t), V^{-1}(s,t)) \\ &= \frac{n}{2^n P_F P^n}(t-s)^{n-1}, \end{aligned}$$

with support $s \in [-P, P_F]$ and

$$t \in \begin{cases} [-S, 2P+S] & \text{, if } -P \leq s \leq 0 \\ [S, 2P+S] & \text{, if } 0 < s \leq P_F - P \\ [S, 2P_F - S] & \text{, if } P_F - P < s \leq P_F \end{cases}$$

Integrating with respect to t the marginal density $f_S(s)$ is obtained.■

Thus, taking expectations,

$$\mathrm{E}S^* = \frac{(P_F - P)^2}{2P_F} + \frac{(n+3)}{(n+1)(n+2)} \cdot \frac{P^2}{P_F}$$

We now calculate the expected value of the employee's opportunity-cost wage, given that renegotiation succeeds, $\mathrm{E}(w_2|k=1)$. Since its value is equal to the second-order statistic of the sample of *all* productivities (including the productivity of firm F), it is possible to prove the following:

Lemma 2 *The opportunity-cost wage is distributed as*

$$F_{w_2}(x|k=1) = \left(\frac{x}{P}\right)^{n-1} \left[\frac{x}{P} + n\left(1 - \frac{x}{P}\right)\left(\frac{x}{P_F}\right)\right].$$

Proof. We offer only a sketch of the proof, while referring to Casella and Berger (1990, Theorem 5.5.2) for its underlying logic. For any real value x, define the random variable Y_c as the number of firms other than F, whose

productivity turns out to be less than x. Recall that these productivities are *iid* Uniform$[0, P]$, so that $Y_c \sim$Binomial$(n, \frac{x}{P_F})$. Also, define Y_F as a Bernoulli variable with $\Pr(Y_F = 1) = \frac{x}{P_F}$. The employee's opportunity-cost wage is the second-order statistic of the whole sample of productivities (which includes $n + 1$ numbers). Thus, its distribution is given by $F_{w_2}(x|k = 1) = \Pr(W = n) + \Pr(W = n + 1)$, where $W = Y_c + Y_F$.

Using Lemma 2, the expected value of the employee's opportunity-cost wage is equal to

$$\mathrm{E}(w_2|k = 1) = \left[\frac{n}{n+1} - \frac{n}{(n+1)(n+2)} \cdot \frac{P}{P_F}\right] P.\blacksquare$$

Chapter 3

Fairness in Bargaining over Deferred Compensation. Experimental Study

The model in chapter 2 shows that a firm can use deferred compensation (stock options, equities, etc.) in order to keep qualified personnel to avert bankruptcy. Indeed, under certain circumstances, we can define an optimal amount of cash that a firm may offer to its employees, together with a corresponding share of deferred compensation, in order to prevent them from leaving. The model also shows the importance of the specific functional form of the wage-renegotiations schedule in determining the firm's optimal choice of cash payments under liquidity constraints. The chapter concludes that deferred payments function as a help to create a compensation system that not only serves as a financing device but also as an employee retention mechanism.

Our main challenge in the current part of the thesis is to figure out whether selfish and rational behavior, which was our basic assumption in the previous chapter, yields a good prediction or whether one has to change it. In particular it can be altered to assume, that along with pure economic concerns, people also possess social ones, namely preferences for cooperation, fairness and inequality aversion. As noted by Falk, Fehr and Fish-

bacher, there is considerable evidence that "*[i]n bilateral bargaining situations, anonymously interacting agents frequently agree on rather egalitarian outcomes although the standard model with purely selfish preferences predicts unequal outcomes*" (2003, p.20).

We adjusted therefore the theoretical model to the laboratory environment and ran the experiment. Indeed, the result obtained in the experiment can only partly be explained by the standard theory. Opposed to the theoretical prediction, a large number of the participants coordinated on the fair division of the future (deferred) profit. Sometimes this kind of *fair behavior* was very costly for them. In an endeavor to explain the observed regularities, we turned to the fairness theory, which currently constitutes "a small but rapidly growing part" of economic research (see, e.g., Fehr and Schmidt, 1999, 2003; Falk and Fehr 2003).

In essence, this chapter presents additional experimental results, which show that non-monetary incentives also affect the behavior of people in an uncertain environment. In particular, we consider the influence of social preferences on the bargaining over deferred compensation (benefits). The remaining chapter is organized as follows. The next Section provides a brief introduction to the fairness theory. In Section 3.2 we describe the rules of the experiment and make behavioral assumptions. The final Section discusses our results and outlines their implications.

3.1 Fairness and Inequality Aversion

Fehr and Schmidt (1999, 2003), as well as Fehr and Fischbacher (2002) remarked that there is enough ground to argue that "people" have "social preferences": Fairness, reciprocity, altruism, etc. Fehr and Fischbacher continue saying that "*[a] person exhibits social preferences if the person does not only care about the material resources allocated to her but also cares about the material resources allocated to relevant reference agents*" (2002, C2). They specify, that "relevant reference agents" may be "colleagues", family, "neighbors", etc. Following the way of research suggested by the authors, we focus on one type of social preference that is of a particularly importance for our

study – the preference for fairness.

In Fehr and Schmidt (1999, 2003), the authors make a scrupulous survey and cite instances, which show that people are more socially fair than is usually assumed in the classical economic theory: People "pay taxes" honestly (e.g, Riedl and Tyran, 2003), "vote" (e.g., Aldrich, 1997), become members of "unions and protest movements", or work diligently without considerable monetary incentives (e.g., Rehder, 1990). The same survey says that in the labor relation framework there is also many facts prove that level of compensation depends on the workers' and employers' common understanding of what "fair wage" is (e.g., Bewley, 1995, 1998; Campbell and Kamlani, 1997). In this context Fehr and Schmidt summarize that "*...a major reason for firms' refusal to cut wages in a recession is the fear that workers will perceive pay cuts as unfair which in turn is expected to affect work morale adversely*" (1999, p.817).

What is most relevant for our work, however, is that Fehr and Schmidt (1999) stress the high number of "bargaining experiments", demonstrating that people "care" not only "about material payoffs" but also take into account the "fairness of payoff distribution" (e.g., Güth and Tietz, 1990; Roth, 1991, 1995).[1] There is a number of papers that address the formal background of the fairness concept. First type of "fairness models" is classified as the "equity models" (see, e.g. Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). This type of models assumes that "fairness intentions" are not "behaviorally" important (*outcome-oriented models*). The second type of models (see, e.g. Rabin, 1993; Falk and Fishbacher, 2006), grants "fairness intentions" a central place (*reciprocity models*).[2] In order to keep the work simple and tractable, we restrict our attention to purely outcome-oriented models in the sense that we rule out any possible effects of intentions and, as a consequence, reciprocity.[3]

[1] See Fehr and Schmidt, 1999, 2003, for the discussion and examples.

[2] See for the classification and discussion Falk, Fehr and Fishbacher, 2000.

[3] Falk and Fishbacher emphasize that "*[i]nequality aversion sharply contrasts from reciprocity (...). [I]nequity aversion is a purely consequentialistic concept, i.e, intentions or motives play no role. Reciprocity on the other hand emphasizes the importance of intentions (...)*" (2006, p.297).

In other words, in line with Fehr and Schmidt (1999), we understand fairness here as an "inequality aversion". The authors argue that inequality aversion in this context means that parties do not prefer "inequitable outcomes", alternatively they are ready to trade off a part of monetary payoff for more "equitable outcomes". More generally, a person is sad to be "inequality averse" if he/she does not accept payoffs that are viewed as "unfair" (Fehr and Schmidt, 1999). According to Fehr and Schmidt (1999), such a point of view is based on a threshold, or "reference outcome". Moreover, the authors say that the "reference outcome" is also the product of complex "comparison processes" and in its turn strongly depends on the "reference agent or reference group" with whom the "individual interacts". For example, in our context it is reasonable to assume that a worker has a different perception of fair outcome interacting with colleagues and the employer.

As mentioned by Fehr and Schmidt (1999), the determination of the "relevant reference group" as well as "reference outcome" for a particular person is also an intricate issue. Many factors may influence both reference outcomes as well as reference groups: The "context" of individual interactions, the importance of "particular agents", their "social" similarity, etc. Therefore, the assumptions about reference outcome and reference groups for the experiment we make, taking into account the arguments made above. Paraphrasing Fehr et al. (1999) and Fehr et al. (2002), the "subjects" are "equal" in the lab environment, they are neither aware of the experiment's goal, nor of their roles in the experiment. Therefore, in this case it is possible to assume that the "reference group" is a "group of subjects playing against each other" whereas the "reference outcome" is defined by the "egalitarian outcome". As far as the outcome is concerned, we also use the assumption of the Fehr and Schmidt (1999) model that apart from "purely selfish players", there are players who rather "avoid inequitable outcomes": They "feel inequity" both "if they are worse off" and "if they are better off" compared to the other participants of the game. The behavioral assumptions in more detail are described in section 3.2.3.

In this chapter we essentially explore bargaining over uncertain deferred benefits (e.g., pensions, insurance, share of stocks, part of profits) in com-

bination with some immediate fixed payment. By immediate payment we simply mean a base wage, which the employer pays to the worker without any delay or postponing. In the experiment this payment is a transfer of a different size from the firm-player to the worker-player. Thereby, the players bargain over the uncertain deferred benefits with given different transfers. These transfers occur before uncertainty concerning the size of benefits is realized. In the real world such a situation may arise if a firm faces liquidity constraints and needs to renegotiate labor contracts in order to survive.[4] In this context, renegotiation in most cases means a reduction of the base wage in exchange for some promises of other pecuniary or non-pecuniary future benefits (i.e. deferred compensation in our framework). Apart from the above, our bargaining structure could be an example of bargaining over a substitution rate between base wage and deferred benefits.

Finally, although it has already been quite a lot said about fair behavior and inequality aversion, we present some new results with respect to how players coordinate in the world of uncertainty and risk. Moreover, we show the explanatory ability of social preferences in a somewhat modified Nash-demand game. Following the above arguments, we implement non-cooperative bargaining between two players over a surplus of random size contingent on fixed transfers from one player to the other. According to Güth et al. (2002), Nash's (1953) non-cooperative model could represent a similar case. The authors note that in Nash's "demand game", parties "simultaneously" decide on the shares of the "cake". If the demands are compatible, players obtain their parts; if not, they receive "nothing". "To select among the equilibria of this game", and consequently to reach a division that is "consistent with cooperative bargaining solution", Nash employs "uncertainty about the size of the pie". Güth et al. explain that Nash uses uncertainty rather as a "refinement device". While in our framework we use *uncertainty* with a primary purpose to reflect the risk, which the employer has over his/her profit, ultimately it plays the same role as in the Nash's model. The next section explains our experimental setting in full.

[4]See e.g., The Economist, March 22nd 2003 and The Economist, July 31st 2004, where this is discussed with particular reference to the American and British airlines.

3.2 Laboratory Experiment

3.2.1 Experimental Design

We conducted three experimental sessions at the laboratory of the Max-Planck-Institute in Jena, Germany, with a total of 82 subjects. Two sessions were carried out with 28 subjects each, while a third session was run with 26 participants. At the beginning of each session half of the participants were randomly assigned to the firm role (F) and the other half to the employee role (E). They kept their roles throughout the whole experiment. Each session consisted of 20 rounds. The first 10 rounds were only for training purposes (without payment and partner design) whereas the last 10 rounds were played in a perfect stranger matching design with real monetary incentives.[5]

Participants were fully aware of the fact that during the last 10 rounds they would only meet the same partner once. The instructions were explained in terms of ECUs (Experimental Currency Unit or Tokens, in experimental terms), and payments were calculated on the basis of earned ECUs (at the exchange rate 60 ECU = 1,00 Euro). Additionally, there was a show-up fee of 2,50 Euro (see the instructions in Appendix 1). The experiment was implemented using the zTree software (Fischbacher, 1998).

3.2.2 Description of the Game and Rules of the Experiment

The game has two periods (see Figure 3.1). A firm, facing liquidity constraints in the first period wants to renegotiate the contract in order to reduce the first period salary (base wage) of its only employee to overcome bankruptcy. It offers to substitute the salary reduction for deferred benefits (part of the firm's future profit) which are paid above the second period salary. The future profit (joint surplus) becomes available in the second period only

[5]Taking into account the relatively complex structure of the experiment, we let the participants play 10 initial rounds in every session as a trial run, without receiving real money. The data have shown that most of the participants used this opportunity for the purpose of training and experimenting with different strategies.

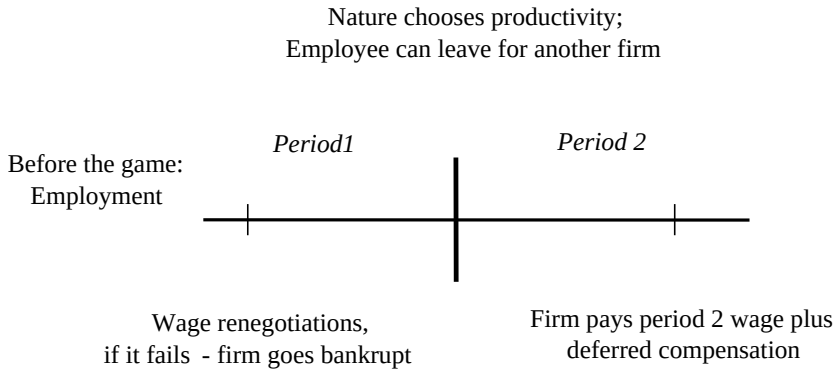

Figure 3.1: Timing of the model.

if one important condition is fulfilled. Namely, the firm has a higher productivity at this period than the only competitor. In this case the employee does not leave the firm to get a better second period salary at the more successful rival. Thus, there are two points of time when the initial employment relationship can cease to exist: First, in the end of the first period if the contract renegotiation fails; and second, at the beginning of the second period, if the firm's productivity is low and there is no possibility to pay neither deferred benefits nor competitive second period salary.

In order to receive sufficient data, we employed the strategy method (Selten, 1967), that is, players had to specify complete strategies in the game-theoretic sense. Every player had to indicate his demand of the surplus for every possible value of the transfer. In our experiment the transfer (base wage) is chosen randomly (by a computer) among five possible values, $w_1 = \{0, 10, 20, 30, 40, 50\}$.[6]

We choose the Nash-bargaining setting with high and low demands. Each participant $j = \{E, F\}$ was asked to state both a "Maximal Demand,%", $\overline{d}_j$, and a "Minimal Demand,%", $\underline{d}_j$.[7] At the beginning of every round each

[6]Since the major focus of the experiment is to find regularities in the division of the random surplus, the given structure of the game enables to guarantee that reciprocal behavior does not play a role in our experiment. In other words, the employee-players knew that the transfer's size does in no way reflect any intentions of the firm-players.

[7]In order to allow some additional level of coordination between players, two kinds

participant was requested to fill out all the cells of a table similar to the one depicted here

Transfer, w_1:	0	10	20	30	40	50
Maximal Demand(%), $\overline{d}_j$:						
Minimal Demand(%), $\underline{d}_j$:						

This was the only decision the players had to make. Afterwards, the payoffs of each pair of F and E participants were determined according to the following procedure.[8]

The computer randomly chooses values of productivity p_F and $p_{(1)}$, where p_F denotes the productivity of F and $p_{(1)}$ is the outside option for E in our model. Therefore, the value of the joint surplus between player F and player E is equal to max $\{p_F - p_{(1)}, 0\}$.

The theoretical payoff structure in the game was as follows:

1. If both the maximal and the minimal demands are non-compatible (i.e., $\overline{d}_F + \overline{d}_E > 100\%$ and $\underline{d}_F + \underline{d}_E > 100\%$), both participants receive zero profit:

   $\text{Payoff}_F = 0$

   $\text{Payoff}_E = 0.$

2. If the maximal or the minimal demands are compatible (i.e., $\overline{d}_F + \overline{d}_E \leq 100\%$ or $\underline{d}_F + \underline{d}_E \leq 100\%$), but the surplus is equal to zero ($p_F < p_{(1)}$):

   $\text{Payoff}_F = 0$

   $\text{Payoff}_E = w_1 + p_F.$

of demands – the maximal demand and the minimal demand – were introduced. Giving players the chance of stating two different demand levels allows us to increase the number of compatible demands between employer and employee. See, e.g., Gantner et al. (2001).

[8]While resembling all main features of the model by Gonzales and Gurtoviy (2004) the structure of the experiment has some differences which were necessary to implement the model in the laboratory.

3. If the maximal demands are compatible (i.e., $\overline{d}_F + \overline{d}_E \leq 100\%$), and the available surplus is greater than zero ($p_F > p_{(1)}$):

$$\text{Payoff}_F = -(1+r)w_1 + (p_F - p_{(1)})\overline{d}_F$$
$$\text{Payoff}_E = w_1 + p_{(1)} + (p_F - p_{(1)})\overline{d}_E.^9$$

4. If only the minimal demands are compatible (i.e., $\overline{d}_F + \overline{d}_E > 100\%$ but $\underline{d}_F + \underline{d}_E \leq 100\%$), and the available surplus is greater than zero ($p_F > p_{(1)}$):

$$\text{Payoff}_F = -(1+r)w_1 + (p_F - p_{(1)})\underline{d}_F$$
$$\text{Payoff}_E = w_1 + p_{(1)} + (p_F - p_{(1)})\underline{d}_E \ .$$

The interpretation of the payoff structure is as follows: If the demands of the firm and the employee for future surplus are not compatible, the employment relationship ends and both players receive their alternative payoffs, which are equal to zero in this case. In other words, the firm F goes bankrupt and the employee loses not only his base wage (transfer w_1), but also second period salary (since initial employer goes bankrupt the only remaining firm offers him zero) and deferred benefits.

If demands are compatible, which means they agree on the division of the future surplus, the employee receives the transfer. Afterwards, nature chooses the profitability of the firm and we have to check the presence of the joint surplus. If $p_F < p_{(1)}$, there is no available surplus. Thus, the employee leaves the firm to join the competitor, who has a higher productivity and is therefore able to hire E at the salary equal to p_F (which in this case turns out to be the employee's second period competitive salary). The initial employer goes bankrupt. All liabilities are normalized to zero. In other words, the firm does not have a negative balance of payments.

Finally, if the demands are compatible and the productivity turns out to be sufficient $p_F > p_{(1)}$, the initial employer is still the most productive firm

[9] In order to include in the experiment the effect of possible credit or subsidy for the firm, we use a cost parameter r (see Chapter 2). We defined $r_1 = 0.2$, $r_2 = 0.0$ and $r_3 = -0.2$ for the first, the second and the third sessions respectively.

on the market and the employee, therefore, stays. He receives the second period salary, $p_{(1)}$, as well as the deferred benefits. However, F might now face the problem of losing money. If the firm's net profit is not high enough to cover the costs of the transfer, the firm results in losses, $-(1+r)w_1 + (p_F - p_{(1)})\ d_F < 0$. Therefore, it is in the firm's interest to demand a part of the joint surplus which is at least equal to the transfer. In other words this restriction constitutes the firm's demand constraint, $(1+r)w_1 \leq (p_F - p_{(1)})\ d_F$.

3.2.3 Behavioral Assumption

This part presents two behavioral predictions for the bargaining game in question. We start with the theoretical prediction which assumes that all participants are rational, and behave rather in a selfish way. As a second step, we obtain the theoretical prediction adopting the assumptions of the fairness theory (Fehr and Schmidt, 1999).

Standard Theory Prediction (ST). Since an agreement itself already gives the transfer plus second period salary to the employee, it is clear that he will accept any amount of the joint surplus, ES^* (Point 2 and 3 of the payoff structure). Therefore, there is a unique subgame perfect equilibrium where the firm offers 0%, which is accepted by the employee. In other words, a rational and selfish employer always demands 100% of the surplus in order to avoid possible losses irrespective of the transfer size (see Figure 3.2b).[10] In the worst case this decision will give her at least zero as an outcome of disagreement (Point 1 of the payoff structure). As a result, following rational economic reasoning we have to expect the following. First, with probability θ the employer receives all net profit minus the expected value of the transfer Ew_1 if $p_F > p_{(1)}$, and at least 0 if $p_F < p_{(1)}$. Second, the employee receives the transfer plus the second stage salary Ew_2.[11]

[10]To make a clear-cut difference between selfish and fair employers we allow them negative payoff. We "motivate" employers rather to be selfish (to demand 100% and as a result in worst case to get zero) instead of offering some part of the surplus to the employees and possibly not to have enough money to cover transfer and make losses. In the laboratory, all negative payoffs were normalized to zero at the end of the experiment.

[11]Given the parameters of the experiment: $n = 1$, $p_F \sim$ Uniform $[0, 200]$ and $p_1 \sim$

Therefore the expected payoff of a selfish employer with $r = 0$ (session 2 in the experiment) is calculated as follows

$$\text{Expected Payoff}_F = -E[w_1]\theta + ES^* = -\frac{1}{6} \times (0+10+20+30+40+50) \times \frac{3}{4} + 58,3 = 39,55.$$

To make our theoretical and empirical results comparable, we correct the expected payoff taking into account the actual agreement rate.[12] From table 3.2 (Section 3.3), we see that players did not reach an agreement in all cases, but only in 78%. As a result the expected payoff of the firm player is

$$\text{Expected Payoff}_F = 30,8.$$

The employee's payoff is equal to the sum of the randomly chosen transfer and the second stage salary

$$\text{Expected Payoff}_E = Ew_1 + Ew_2 = \frac{1}{6} \times (0+10+20+30+40+50) + 41,6 = 66,6.$$

Taking into account the actual agreement rate, we end up with

$$\text{Expected Payoff}_E = 51,9.$$

Analogously we make the same calculations for session 1 with $r = 0,2$ and session 3 with $r = -0,2$.

Expected payoffs of the players in session 1 are

$$\text{Expected Payoff}_F = 27,9$$

$$\text{Expected Payoff}_E = 51,9.$$

Expected payoffs of the players in session 3 are

$$\text{Expected Payoff}_F = 33,7$$

$$\text{Expected Payoff}_E = 51,9.$$

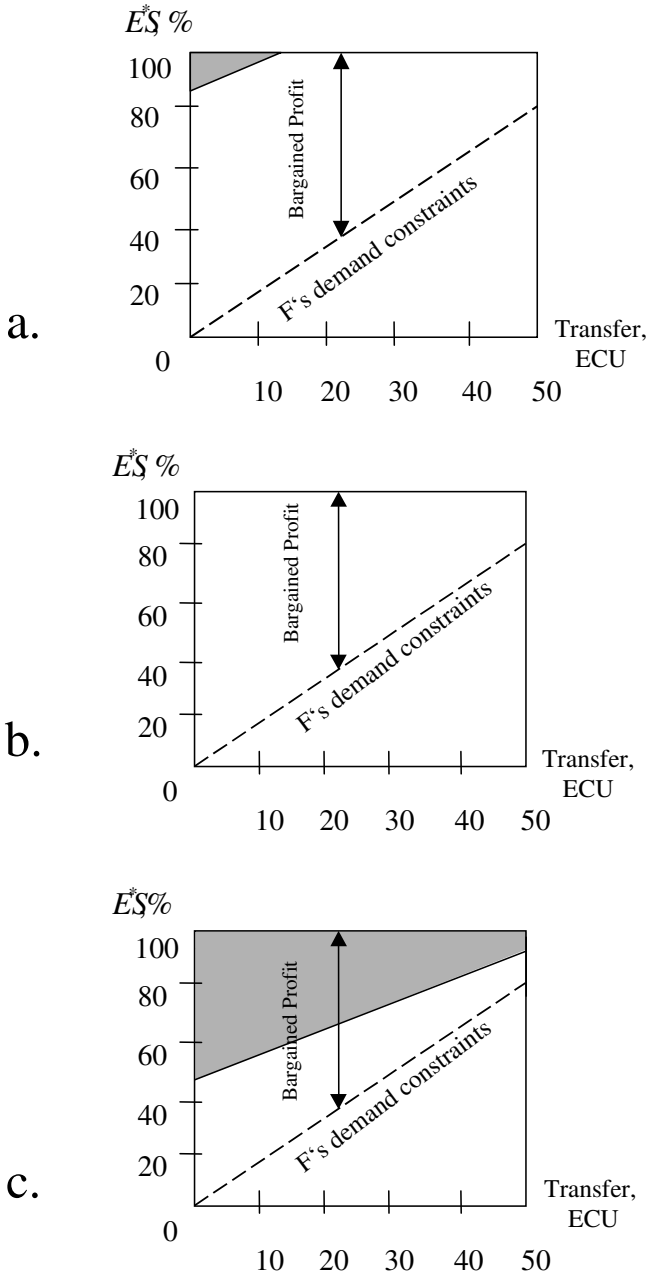

Figure 3.2: Expected division of the joint surplus according to the experimental parameters: a. Chapter 2's prediction (see Figure 2.3); b. Standard Theory; c. Fairness Theory. The shaded area represents the employee's share.

Fairness Theory Prediction (FT). If the employer is fair and loyal and believes that the employee is fair as well, then depending on the size of the transfers she can offer the employee a part of the profit. In other words, she can demand less than 100% of the joint surplus. On the other hand, if the employee believes that the employer is fair, he demands a smaller part of the surplus if the transfer is big, and a bigger part if the transfer is small. Thus, we expect that demands of employers will increase with the size of the transfer and employees' demands will decrease. In other words, we expect that players will coordinate on the division of the joint surplus, $\mathrm{E}S^* = 58\frac{1}{3}$, taking into account the amount of the transfer $w_1 = \{0, 10, 20, 30, 40, 50\}$. Namely, they will share equally $(-0 + 58\frac{1}{3})$ if the transfer is $w_1 = 0$; $(-10 + 58\frac{1}{3})$ if the transfer is $w_1 = 10$; $(-20 + 58\frac{1}{3})$ if the transfer is $w_1 = 20$; etc. Hence, the bargained part of the profit will be decreasing in the size of the transfer (see Figure 3.2c). Therefore, the expected profit of a fair employer in session 2, with $r = 0$ is

$$\text{Expected Payoff}_F = \frac{1}{6}\sum \frac{-w_{1,i}\theta + ES^*}{2} = \frac{1}{6} \times \frac{1}{2} \times [58 + (-10 \times 0,75 + 58,3) + (-20 \times 0,75 + 58,3) + (-30 \times 0,75 + 58,3) + (-40 \times 0,75 + 58,3) + (-50 \times 0,75 + 58,3)] = 19,7.$$

If we account for the actual agreement rate, 78%, it reduces to

$$\text{Expected Payoff}_F = 15,42.$$

The expected payoff of a fair employee if $r = 0$ is

$$\text{Expected Payoff}_E = Ew_1 + \frac{1}{6}\sum \frac{-w_{1,i}\theta + ES^*}{2} + Ew_2 = 25 + \frac{1}{6} \times \frac{1}{2} \times [58,3 + (-10 \times 0,75 + 58,3) + (-20 \times 0,75 + 58,3) + (-30 \times 0,75 + 58,3) + (-40 \times 0,75 + 58,3) + (-50 \times 0,75 + 58,3)] + 41,6 = 86,4.$$

Correcting for the actual agreement rate, we end up with

Uniform $[0, 100]$, we calculated the probability that F will become the most productive firm at the second period with $\theta = \frac{3}{4}$; the expected value for the joint surplus equals to $\mathrm{E}S^* = 58\frac{1}{3}$; the employee's second period salary in case F stays in the market at the second period is $\mathrm{E}w_2 = 41\frac{2}{3}$, and $\mathrm{E}p_{(2)} = 0$ otherwise (see Chapter 2, Appendix 1).

[12] We use the approach suggested by Huck et al. (2004).

Expected Payoff$_E = 67, 34$.

Analogously, we make the same calculations for session 1 with $r = 0, 2$ and session 3 with $r = -0, 2$. Expected payoffs of the players in session 1 are

Expected Payoff$_F = 13, 9$

Expected Payoff$_E = 65, 9$.

Expected payoffs of the players in session 3 are

Expected Payoff$_F = 16, 8$

Expected Payoff$_E = 68, 3$.

3.3 Results of the Experiment

Our main interest is the players' demand decisions, i.e., their ability to coordinate on the division of the future profit (risky joint surplus). Therefore, Figure 3.4 and Table 3.2 contain our main results. However, before analyzing the main outcome of the experiment, let us first present one interesting observation.

Allowing for two kinds of demand – "Maximal demand" and "Minimal demand" – gives us compatibility of a large number of demands. Most of the minimal demands turned out to be compatible. Figure 3.3 shows that the 3rd quartile of the low demands sum is approximately equal to 100% through all sessions. It basically means that at least 75% of the demands were compatible. This reasoning is supported by the table 3.2, where the rate of agreement is almost the same throughout all sessions and equal to 78%.

Another important observation is that the behavioral pattern is in clear contradiction to the standard economic prediction. However, it is well in line with the prediction based on the fairness theory. Firm players demand less than 100% and employee players demand more than 0% of the joint surplus. This means that F-players let E-players earn some part of the profit even at

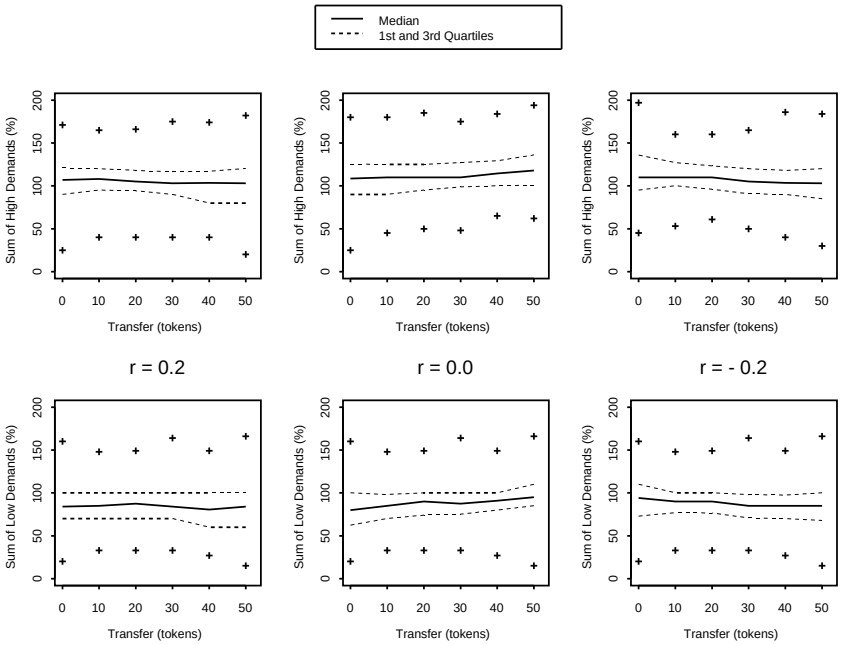

Figure 3.3: Compatibility of the demands for E- and F-players in each session.

the risk of making losses themselves. Even though it is vitally important to demand everything for themselves, they do not follow this strategy. Moreover, the demand curves of the players skewed in different directions, which is predicted by the fairness theory (the bold lines in Figure 3.4). The employer has an upward sloping demand whereas the employee shows downward slopping. The employer's median demand clearly increases in the transfer and is higher than her demand constraints in almost all cases. For the employee this is the other way around. The median demand decreases in the transfer and is almost always lower than the employer's demand constraints.

Table 3.1 shows the correlation between the players' demands and transfers. As the fairness theory predicts, the demand of the firms is positively correlated with the transfers while the worker's demand is negatively correlated. For the firm, this correlation is highest in session 2 when it reaches

	Session 1		Session 2		Session 3	
Demand	Maximal	Minimal	Maximal	Minimal	Maximal	Minimal
Firm	0,208	0,225	0,493	0,507	0,251	0,201
Worker	-0,325	-0,306	-0,230	-0,303	-0,487	-0,498

Table 3.1: Correlation of the demands and the transfers for F- and E- players.

a value of 0,5. In sessions 1 and 3 it is slightly higher than 0,2. For the employee we observe the highest correlation in session 3, where it reaches a value of -0,5. In the first and second sessions it is approximately -0,3.

Since the demand decisions were made by players independently, the form of the demand curve also tells us that F-players expect E-players to be fair and loyal, as to demand less when the transfer is big. At the same time, the fact that workers demand something different from zero means they expect to be treated fairly. Moreover, 74% of the worker's demands are lower than 50%, and most of them are lower than the firm's demand constraint. Basically, workers take into account the fact that there is less room to make big demands on the future surplus if the current transfer is high. Therefore, they adjust their demands by demanding less when the transfer is big and more when the transfer is small. This means that they are ready to be fair and loyal in the case of fair treatment. These observations support our expectation that the worker is taking into account the demand constraint of the firm ($U^F \geq 0$) when deciding upon the demand, and therefore adjusts his demand downward.

Table 3.2 provides our main descriptive statistics about the payoffs of both players for all three sessions. As it was predicted theoretically, the payoffs of those players who were assigned to the F role are lower than the payoffs of the E-players. However, the fact that the real average payoff is positive means that even under such "tough" conditions experienced by the F-players, there is still a very high probability to finish the game without losses. This experimental observation supports the theoretical prediction about the positive effects of renegotiation via profit sharing.

Moreover, according to the prediction of the fairness theory, we observe a tendency to equal division with respect to the bargaining set $-\theta w_1(1 +$

	Firms:			Employees:		
	Session 1	Session 2	Session 3	Session 1	Session 2	Session 3
Cost parameter r	0.2	0	-0.2	0.2	0	-0.2
Agreement rate	78.6%	77.7%	78.6%	78.6%	77.7%	78.6%
Min	-59.2	-31.4	-32.2	10.7	21.2	5.9
1st. Quartile	-1.9	0.0	0.0	64.0	51.4	59.4
Median	0.0	4.3	5.1	85.2	74.9	83.6
2nd. Quartile	19.9	34.0	28.5	107.9	103.0	107.3
Max	90.0	99.0	108.0	195.5	158.0	156.9
Average payoff	4.6	14.9	11.0	67.9	61.2	65.2
Expected payoff(FT)	13.9	15.4	16.8	65.9	67.3	68.3
Expected payoff(ST)	27.9	30.8	33.7	51.9	51.9	51.9

Table 3.2: Distribution of the payoffs obtained by F- and E- players, in ECU (tokens).

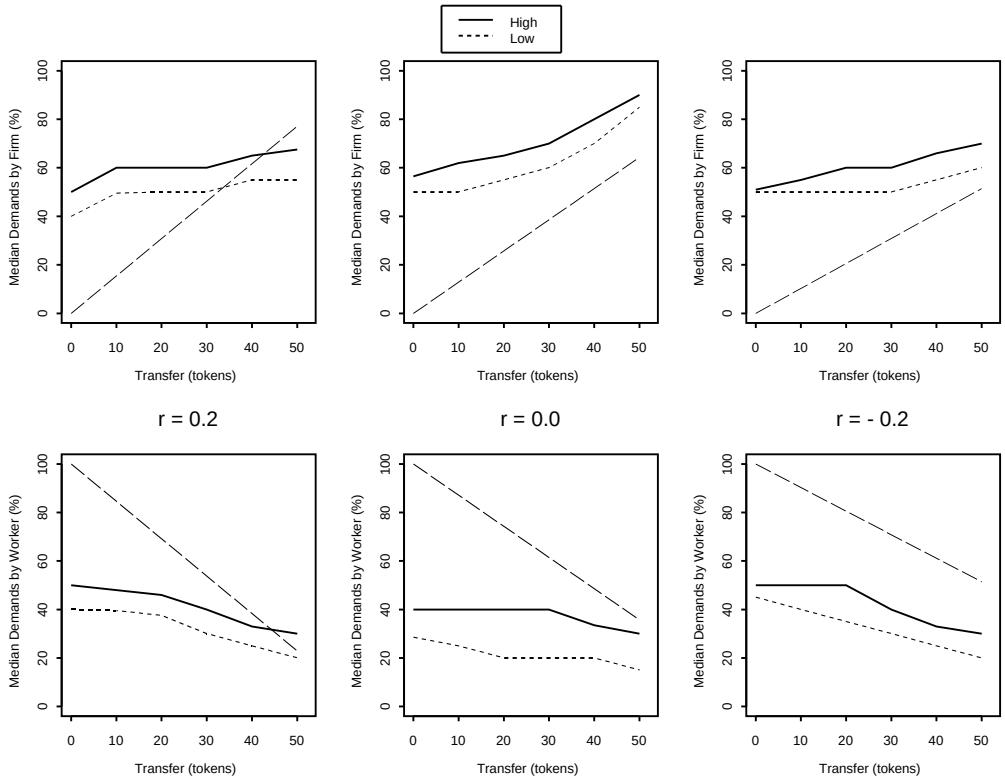

Figure 3.4: Median maximal and minimal demands made by F- and E-players in each session. The straight dashed line represents F's demand constraint.

	Firms:			Employees:		
	Session 1	Session 2	Session 3	Session 1	Session 2	Session 3
Real average payoff	4.6	14.9	11.0	67.9	61.2	65.2
Predicted payoff (FT)	13.9	15.4	16.8	65.9	67.3	68.3
Significance, p-values	0.000	0.095	0.006	0.526	0.125	0.495

Table 3.3: Wilcoxon signed rank test on equality of real average payoff and payoff predicted by FT.

$r) + ES^*$. We used the nonparametric Wilcoxon signed ranks test to check whether the division was in fact equal. Using data on employer demands for every value of the transfer $\{0, 10, 20, 30, 40, 50\}$, we first checked whether the demanded share of the F-players is equal to that left for E-players (see Figure 3.2c and Figure 3.4). Then we did the same for the demands of the E-players.

Significant equality between demanded shares of the surplus are mostly observed in the second and the third sessions. This gives clear evidence that whatever the transfer is, the division of the future surplus has a strong tendency to be equal. However, it is obvious that for the subjects it was easier to coordinate in the second session, where $r = 0$ (see Table 3.4 and Table 3.5, Appendix 2).

Apart from the results above, the expected payoffs predicted by the fairness theory are much closer (sometimes they almost coincide) to the real average payoffs of the players. The Wilcoxon signed ranks test confirms that there is no significant difference between the numbers (see Table 3.3).

3.4 Concluding Remarks

This work contributes to the literature on the wage bargaining between employer and employee. Using a laboratory experiment, we examine bargaining over deferred benefits given fixed transfers from the employer to the employee. The experiment begins with the players deciding on the part of the profit they demand for themselves. In a strategic way, they specify their demands for every possible value of the transfer. An important feature of

our model is that the players face different kinds of uncertainty during the game. First, it is not exactly clear which value of the transfer will be realized. Second, the size of the surplus is random. Therefore, they are supposed to make decisions taking this uncertainty into account.

Our main interest was to see how the players coordinate on the profit division under uncertainty. Namely, we ask whether the standard theory or the newly developed fairness theory explains players behavior better. We find clear evidence that players mainly try to coordinate on the fair division of the joint surplus, taking into account the transfer from one player to the other. In the noncooperative structure of the game, players behave rather fairly and cooperatively, expecting the same kind of behavior from their fellow players. Our results show that for the employer and the employee the payoffs predicted by the fairness theory are very close to the real payoffs obtained in the experiment. In most cases, there is no significant statistical difference between them.

Although our results show that players have a tendency to cooperate and hence support the fairness theory instead of the standard theory, we have to be careful when generalizing these results for at least two reasons. First, it is not easy to apply the behavior of one person to a whole firm. Obviously, one of the reasons why corporate governance exists is to take this fact into account. As a result, big organization, as a firm or a company, can behave in a different, more selfish and pragmatic way. Second, even though we believe that experimental results elicit the basic (so to say fundamental) incentives, which drive the behavior of economic agents, still the incentive structure and, what is even more important, the interaction of different kinds of incentives (like pecuniary and non-pecuniary) are not quite clear. For instance, it is not obvious what the behavior of the players would be if we included non-monetary compensation or social norms in the game, which in reality also play an important role in such kind of interactions. Among others, these issues are somewhat considered in the following chapters.

Appendix 1

Instruktionen

Allgemeine Instruktionen

Guten Tag. Vielen Dank, dass Sie an dieses Experiment teilnehmen. Für Ihr rechtzeitiges Erscheinen bekommen Sie vorab 2,50 Euro. Wenn Sie diese Instruktionen vorsichtig lesen und sich an die Regeln des Experiments halten, können Sie mehr dazu verdienen. Wie viel Geld Sie am Ende des Experiments bekommen hängt von Ihren eigenen Entscheidungen und von den Entscheidungen anderer Teilnehmer ab. Alle Teilnehmer haben ganau dieselben Instruktionen bekommen.

Im Laufe des Experiments sprechen wir nicht von Euro sondern von ECU (Experimental Currency Unit). 60 ECU sind 1,00 Euro wert.

Die Kommunikation mit anderen Teilnehmern ist während des Experiments nicht gestattet. Haben Sie Fragen, melden Sie sich bitte per Handzeichen. Wir kommen dann zu Ihnen an den Platz und beantworten Ihre Frage. *Bitte stellen Sie Fragen nicht laut.*

Das Befolgen dieser Regeln ist sehr wichtig. Wenn Sie sich nicht daran halten, müssen wir Sie leider von der weiteren Teilnahme an diesem Experiment und der Auszahlung ausschliessen.

Gleich am Anfang des Experiments bekommen Sie die Rolle eines X-Teilnehmers bzw. eines Y-Teilnehmers zugewiesen. Diese Rolle bleibt während des gesamten Experiments unverändert.

Das Experiment besteht aus 20 Perioden. In jeder Periode interagiert je ein X-Teilnehmer mit einem Y-Teilnehmer.

- Die ersten 10 Perioden dienen nur als Übung (ohne Auszahlung). Während dieser Übungsperioden interagiert ein X-Teilnehmer immer mit demselben Y-Teilnehmer.
- Im Gegensatz dazu sind die letzten 10 Perioden mit tatsächlichen Auszahlungen verbunden. In jeder dieser 10 Perioden interagiert ein X-Teilnehmer mit einem neuen Y-Teilnehmer (ein und dieselbe Person wird nicht mehr als einmal getroffen).

Jede Periode besteht aus 2 Teilen:

1. Im ersten Teil wird ein “Gewinn” und ein “Transfer” vom Computer generiert.

2. Im zweiten Teil treffen die Teilnehmer ihre Entscheidungen.

Obwohl die Auszahlung eines Teilnehmers davon abhängt, welche Rolle (X bzw. Y) er innehat, müssen beide Teilnehmer-Typen identische Entscheidungsformulare ausfüllen. Welche Entscheidungen jeder Teilnehmer in jeder Periode treffen muss, und wie die Auszahlungen ermittelt werden, wird Ihnen im weiteren erklärt.

Erster Teil

(Computer)

1. Gewinn

Am Anfang jeder Periode werden vom Computer zwei Grössen automatisch bestimmt: P1 und P2. Diese Grössen werden den Teilnehmern erst am Ende der Periode mitgeteilt, nachdem Sie Ihre Entscheidugen getroffen haben.
Die erste Nummer P1 kann zwichen 0 und 100 liegen, während die zweite Nummer P2 zwischen 0 und 200 liegen kann. In anderen Worten sind

$$0 < P1 < 100 \quad \text{und} \quad 0 < P2 < 200.$$

- Falls $P2 \geq P1$ ist, dann gibt es einen **Gewinn**, und zwar

  $\text{Gewinn} = P2 - P1.$

- Falls $P1 > P2$ ist, dann gibt es **keinen Gewinn**, was bedeutet, dass

  $\text{Gewinn} = 0.$

Beispiel
Ist $P2 = 140,2$ und $P1 = 80,1$, so ist der Gewinn $= 140,2 - 80,1 = 60,1$.
Wenn $P2 = 78,5$ und $P1 = 80,1$, dann ist der Gewinn $= 0,0$.

2. Transfer

Die Höhe eines **Transfers** (in ECUs) wird auch nach dem Zufallsprinzip vom Computer bestimmt. Welche Rolle diese Transfer in der Auszahlungen der Teilnehmer spielt, erfahren Sie am Ende der Instruktionen.
Es gibt sechs Werte, die alle gleich wahrscheinlich sind:

Transfer $= \{0, 10, 20, 30, 40, 50\}$ ECUs.

Zweiter Teil

(Teilnehmer)

Anforderungen

Ohne die Höhe des Gewinns oder des Transfers zu wissen, müssen beide Teilnehmer bestimmen, wie der eventuelle Gewinn aufgeteilt werden soll.

Dafür müssen beide Teilnehmer **gleichzeitig** zwei Prozent-Werte angeben (und zwar für jeden möglichen Transfer):

1. Eine **höhere Anforderung**, und

2. Eine **Mindestforderung**.

Eine Anforderung bezeichnet den Prozentsatz des Gewinns den der jeweiliger Teilnehmer für sich beansprucht. Da die Anforderungen ohne Kenntnis des vom Computer ausgewählten Transfers bestimmt wird, muss diese Entscheidungen für jeden möglichen Transfer getroffen werden.
Diese Anforderungen werden in den Zellen der folgenden Tabelle auf dem Bildschirm eingegeben:

Falls der Transfer gleich diesem Betrag ist...	0	10	20	30	40	50
meine höhere Forderung (% des Gewinns):						
meine Mindestforderung (% des Gewinns):						

1. Falls die Summe der höheren Forderungen beider Teilnehmer nicht mehr als 100% ist, dann sind die **höheren Forderungen kompatibel**.

2. Wenn die höheren Forderungen nicht kompatibel sind, dann wird überprüft, ob die **Mindestforderungen kompatibel** sind, d.h., ob die Summe der Mindestforderungen nicht mehr als 100% beträgt.

3. Sind sowohl die Summe der höheren als auch die der Mindestforderungen grösser 100%, dann sind die Forderungen **nicht kompatibel**.

Was die Kompatibilität bzw. nicht Kompatibilität für die Auszahlungen der beiden Teilnehmern beduetet, wird im weiteren erklärt.

Auszahlungen

Die Auszahlungen des X- und des Y-Teilnehmers hängen von den Ergebnissen der beiden Teilen ab:

1. Computer-Ergebnisse:
   - Wie gross der Gewinn ist
   - Wie gross der Transfer ist
2. Entscheidungen der Teilnehmer:
   - Kompatibilität der höheren bzw. Mindestforderungen

Insbesondere:

- Der "Transfer" wirkt auf die Auszahlungen beider Teilnehmern nur wenn ihre höheren oder die Mindestforderungen kompatibel sind.
- Wenn die Forderungen nicht kompatibel sind, dann verschwindet auch der aufzuteilende Gewinn.
- Falls die höheren oder die Mindestforderungen beider Teilnehmern kompatibel sind, dann bekommt jeder Teilnehmer die von ihm gestellt Forderung aus dem Gewinn.
- Ausserdem bekommt der Y-Teilnehmer den kleinsten Wert von $P1$ und $P2$ als zusätzliche Auszahlung, falls die höheren oder die Mindestforderungen kompatibel sind.

Aus den oben genannten Regeln ergeben sich die folgende Auszahlungskonstellationen:

1. Falls keine der beiden Forderungen (höheren bzw. Midestforderungen) kompatibel sind, dann bekommen beide Teilnehmer Null:

   Auszahlung von $X = 0$,

   Auszahlung von $Y = 0$.

2. Falls die höheren oder die Mindestforderungen kompatibel sind, aber der Gewinn gleich Null ist ($P1 < P2$):

   Auszahlung von $X = 0$

   Auszahlung von Y = [Transfer] + $P2$.

3. Falls die höheren Forderungen kompatibel sind, und der Gewinn positiv ist ($P2 \geq P1$):

   Auszahlung von X = – [0,8 × Transfer] + [Gewinn × höhere Forderung von X],

   Auszahlung von Y = [Transfer] + [Gewinn × höhere Forderung von Y] + $P1$.

4. Falls nur die Mindestforderungen kompatibel sind, und der Gewinn positiv ist ($P2 \geq P1$):

   Auszahlung von X = – [0,8 × Transfer] + [Gewinn × Mindestforderung von X],

   Auszahlung von Y = [Transfer] + [Gewinn × Mindestforderung von Y] + $P1$.

Bitte beachten Sie: Wenn der Transfer einen Effekt hat, dann ist dieser Effekt für den X-Teilnehmer negativ bzw. für den Y-Teilnehmer positiv.
Am Ende jeder Periode erfahren Sie auf ihrem Bildschirm, welche Gewinn- und Transfer-Werte der Computer ausgewählt hat, und wie Sie und der andere Teilnehmer, mit dem Sie in dieser Periode interagiert haben, sich entschieden haben. Die daraus resultierenden Auszahlungen werden Ihnen ebenfalls mitgeteilt.

Beispiele

Stellen Sie sich vor, dass ein X-Teilnehemer die folgende Entscheidungen getroffen hat:

	Falls der Transfer gleich diesem Betrag ist...	0	10	20	30	40	50
X:	meine höhere Forderung (% des Gewinns):	34	82	97	54	70	96
	meine Mindestforderung (% des Gewinns):	18	50	90	50	61	96

Der Y-Teilnehemer, mit dem er in dieser Periode interagiert, hat seinerseits die folgende Entscheidungen getroffen:

Y:	Falls der Transfer gleich diesem Betrag ist...	0	10	20	30	40	50
	meine höhere Forderung (% des Gewinns):	96	91	16	24	22	4
	meine Mindestforderung (% des Gewinns):	95	50	12	20	16	1

Seien $P1 = 40$ und $P2 = 120$ die vom Computer ausgewählte Grössen.

Dann ist der Gewinn $= 120 - 40 = 80$.

Die jeweiligen Auszahlungen der beiden Teilnehmern sind,

- falls der Computer einen Transfer = 10 bestimmt:

  Auszahlung des X-Teilnehmers = -0,8×10 + [80 ×50%] $= -8 + 40 = 32$

  Auszahlung des Y-Teilnehmers $= 10 + [80 \times 50\%] + 40 = 10 + 40 + 40 = 90$

- falls der Computer einen Transfer = 40 bestimmt:

  Auszahlung des X-Teilnehmers =0,8×40 +[80 × 70%] $= -32 + 56 = 24$

  Auszahlung des Y-Teilnehmers $=40 + [80 \times 22\%] + 40 = 40 + 17,6 + 40 = 97,6$

- falls der Computer einen Transfer = 0 bestimmt:

  Auszahlung des X-Teilnehmers =0

  Auszahlung des Y-Teilnehmers =0

Seien $P1 = 90$ und $P2 = 40$ die vom Computer ausgewählte Grössen.

Dann ist der Gewinn $= 0$.

Die jeweiligen Auszahlungen der beiden Teilnehmern sind,

- falls der Computer einen Transfer = 30 bestimmt:

  Auszahlung des X-Teilnehmers = 0

  Auszahlung des Y-Teilnehmers = 30 + 40 = 70

- falls der Computer einen Transfer = 20 bestimmt:

  Auszahlung des X-Teilnehmers = 0

Auszahlung des Y-Teilnehmers = 0.

Bitte bleiben Sie während der Dauer des gesamten Experiments an Ihrem Platz und sprechen Sie nicht mit anderen Teilnehmern. Wenn Sie Fragen haben, melden Sie sich bitte per Handzeichen.

Appendix 2

Transfer	0	10	20	30	40	50
Maximal Demand						
Average share of the firm	62.3%	49.3%	42.9%	33.2%	26.6%	21.1%
Average share of the worker	52.7%	37.6%	32.0%	28.7%	22.32%	14.82%
Significance, p-value	0.0008	0.0006	0.0003	0.1078	0.0910	0.0010
Minimal Demand						
Average share of the firm	49.0%	45.4%	35.5%	25.7%	18.3%	16.9%
Average share of the worker	50.0%	41.5%	39.4%	36.3%	30.1%	20.4%
Significance, p-value	0.5663	0.2091	0.0368	0.0000	0.0000	0.1480

Table 3.4: Session 2. Minimal and Maximal demands of the firm. Wilcoxon signed rank test on equality of the shares.

Transfer	0	10	20	30	40	50
Maximal Demand						
Average share of the firm	55.2%	45.0%	34.9%	27.2%	23.8%	2.95%
Average share of the worker	44.7%	41.9%	40.0%	37.8%	35.1%	33.0%
Significance, p-value	0.0004	0.2156	0.0344	0.0040	0.0001	0.0000
Minimal Demand						
Average share of the firm	71.8%	60.15%	50.4%	40.0%	29.7%	18.3%
Average share of the worker	28.1%	26.8%	24.5%	21.9%	19.3%	17.3%
Significance, p-value	0.0000	0.0000	0.0000	0.0000	0.0003	0.1700

Table 3.5: Session 2. Minimal and Maximal demands of the worker. Wilcoxon signed rank test on equality of the shares.

Chapter 4

Commitments and Provision of Deferred Compensation

This chapter extends our analysis of deferred compensation provision to one more behavioral dimension. It explains how deferred compensation bargaining outcome depends on the behavior of the bargaining parties. Namely, it shows that mutual commitments to the cooperative kind of behavior significantly affect the provision of deferred compensation. This is due to bankruptcy risk, which plays an important role in deferred-payment arrangements.

Although the risk of bankruptcy is a well-recorded phenomenon in the financial literature[1], it is not, however, thoroughly studied in the framework of labor economics, in particular with respect to the compensation structures. Nevertheless, as discussed above, the risk of bankruptcy or other financial default is an important issue that goes through all deferred compensation profiles, i.e. that they might never become real money (Tauber and Levy, 2002).[2] Several authors have paid attention to this issue though. The works by Lazear (1979, 1998), Diamond and Mirrlees (1985), Merton (1985), Curme and Kahn (1990), Orr (1998), Askildsen and Ireland (2003a,b), as well as a recent work by Friebel and Matros (2005), highlight the impact of "firm failure probability" on the "delay-payments contract". This important aspect, however, has still not been sufficiently analyzed in the bargaining framework.

[1] See, e.g., Dichev (1998) for appropriate references.

[2] See Section 4.1.1.

Apart from the mentioned works by Askildsen and Ireland (which were sofar unfairly overlooked), this matter received hardly any attention. Therefore, one of the main tasks of the present work is to somewhat extend this research direction and to attract attention to such a particularly important bargaining issue.

In order to focus the bargaining model on the compensation structure, we deviate from the traditional collective bargaining framework – which normally includes firm-union bargaining over compensation (i.e., wages) and employment – and concentrate on the individual, employer-employee compensation bargaining.[3] In this context, we explore factors which influence the compensation structure and, in particular the level of deferred payments. In the manner of Askildsen and Ireland (2003a,b) we show that deferred compensation "bargaining outcome" does not depend only on the "bargaining power" (as in the standard models). Alternatively, keeping the line set about by the new literature stream, we demonstrate how the shares of the base wage and the deferred compensation may vary depending on the individual behavior of the parties in the agreed-upon compensation package. More precisely, while the size of the base salary (cash payments) depends rather on the bargaining power of the parties, the amount of the deferred compensation is to a great extent determined by the bankruptcy risk as well as by the parties' behavior. As a result, the central issue of this chapter is the effect of possible bankruptcy, a company's efforts to avoid/prevent it and a worker's efforts to find a new job on the compensation structure and bargaining process. We explicitly specify here different effort levels of the parties as their behavior, and interpret the results in these terms.

Before the formal description in Section 4.2, problems with deferred compensation provision are outlined in Section 4.1. Section 4.3 compares the outcomes from two different bargaining structures. Conclusions and summary are made in Section 4.4.

[3]Using works of Curme and Kahn (1990), Askildsen and Ireland (2003a,b) as a starting point and following author's arguments, we not only augment their modelling approach, but also show how they may be viewed from the individual bargaining perspective.

4.1 With Pensions in View

In most industrial economies during the last two decades the generation of working people has become remarkably older. This has dramatically stressed the canonical types of pension arrangements. For instance, in a defined benefit scheme, the payments made to the pensioners are taken from the younger people. If the ratio of former to latter rises, the payments rise respectively (Allen et al., 1976; Freeman, 1985; Tauber and Levy, 2002). To diminish a possible distress of such pension types, some countries allow for tax benefits, e.g.: The worker's pension payments might be tax free; firms might be given a favorable tax status for organizing and supporting private schemes; contributing a part of the profit investment in pensions are normally tax free; any other pension schemes outlays normally also have tax advantages (Freeman, 1985; Tauber and Levy, 2002; Encyclopedia, 2006). Such measures are aimed at creating additional incentives for companies to contribute to this kind of private pension arrangements. In exchange for the favorable tax treatment, authorities "typically" prevent using pension capital until vesting (Allen et al., 1976; Freeman, 1985; Tauber and Levy, 2002; Encyclopedia, 2006).

Private funded pensions also have one very risky side effect however. Namely, "personal pension schemes" as well as within-firm pension plans are normally "defined contribution" plans (Tauber and Levy, 2002; Encyclopedia, 2006). As a result, no third part can credibly promise payments, and the workers have to take the risk of a possible loss themselves, i.e., the savings might be lost (Curme et al., 1990; Lazear, 1995, 1998; Orr, 1998; Tauber and Levy, 2002). Recent financial scandals and bankruptcies of seemingly stable companies provide representative examples for understanding the risk of deferred compensation profiles. In this context, the Enron crash is an allegory now, with its approximate 20,000 employees who lost billions in their pensions plans, while top executives in Enron's administration were selling their stocks (see, e.g., Cocco, 2001; Blackburn, 2002; Mason et al., 2002).

> The staff saw their retirement investments disappeared because their pension schemes were invested into Enron's stock, which collapsed from over $85 to

> under $1 in one year. Enron workers found themselves over-exposed to the company's risks as their contributions to pension schemes were matched with Enron's stock. (BBC News, 10 January, 2002)

Enron's pension problems, however, are not unique. Employee Benefits Research Institute reports that, many other firms invest monetary contributions from their employees into stocks (EBRI Report, 2002 Vol. 23, No.1). For example, companies such as General Motors Corp. (with about 650,000 pensioners) and Ford Motor Co. (with about 300,000 pensioners) are experiencing the results of a damp stock market, and facing negative returns for their pension investment funds. The steel corporation LTV with its long lasting bankruptcy filing story put 200,000 pensioners, who have earned their pensions for decades, in trouble.

In the next section we summarize the above reasoning in a formal model of employer-employee bargaining over a compensation structure, which includes deferred payments, individual behavior and the risk of bankruptcy.

4.2 Model

4.2.1 Basic Structure

In the model[4] we consider two stages. In the first stage an employer (she) pays a wage w to a worker (he), and in the second stage – a deferred compensation D. While production in the first stage is normalized to zero, production in the second stage is given by Q.[5] Deferred payment in the second stage depends on whether the employer survives (i.e., does not go bankrupt), which happens with probability p. We assume that the employer can exert effort e, to increase her probability of survival, with the cost of efforts given by $\varphi(e)$. Functions $p(\cdot)$ and $\varphi(\cdot)$ are such that $p' > 0$, $p'' < 0$ and $\varphi' > 0, \varphi'' > 0$. The worker, on the other hand, knowing that bankruptcy is possible, can

[4]The model is based on the works by Askildsen and Ireland (2003a,b) and incorporates models by McDonald and Solow (1981), Nickell and Andrews (1983), Curme and Kahn (1990).

[5]This and the previous assumptions are made for convenience and do not affect the results.

invest some search efforts, s, to find a better job, and increase his second stage outside option $w_0(s)$, with $w_0' > 0$ and $w_0'' < 0$, at costs of $f(s)$, $f' > 0$ and $f'' > 0$.[6] For consistency we assume that $D \geq w_0(s), \forall s$. Hence, we can define the expected utilities of the employer and the worker for two stages as

$$U_F = p(e)(Q - D) - w - \varphi(e) \tag{4.1}$$

$$U_W = w + p(e)u(D) + (1 - p(e))w_0(s) - f(s).$$

At the first stage in the model, the employer and the worker bargain about possible employment. It is important to stress here that parties bargain over all individual parameters (w, D, e, s). If the parties fail to agree, then the firm obtains zero profit. The worker, on the contrary, receives zero in the first stage, but can exert efforts to find a job in the second stage, resulting in an expected conflict payoff equal to $w_0(s) - f(s)$. Note that the worker will choose the best possible choice of effort, $\widetilde{s} = \arg\max_s w_0(s) - f(s)$, i.e.,

$$w_0'(\widetilde{s}) = f'(\widetilde{s}) \tag{4.2}$$

with resulting conflict payoff,

$$d_W = w_0(\widetilde{s}) - f(\widetilde{s}).$$

Therefore, we ultimately define the workers's expected utility as[7]

$$U_W = w + p(e)u(D) - p(e)w_0(s) + \Delta w_0(s) + \Delta f(s) \tag{4.3}$$

where

$$\Delta w_0(s) = [w_0(s) - w_0(\widetilde{s})]$$

$$\Delta f(s) = [f(\widetilde{s}) - f(s)].$$

[6]Efforts e and s can be observed as the costs of the firm for business risk assessment (or e.g, "additional" contributions "to fulfill [firm's] obligation and avoid bankruptcy" Merton, 1985) and as time which the worker spends to look for a job, respectively.

[7]To focus on the effect of bankruptcy, we neglect an explicit case when the employment relation can be terminated otherwise, however implicitly it is included via s.

In this structure the worker is risk neutral concerning his base wage and risk averse with respect to deferred compensation. In other words, the worker is assumed to become risk averse with time. We take the assumption that $u(\cdot)$ has following properties: $u' > 0, u'' < 0, u(0) = 0, u'(0) > 1$.[8]

4.2.2 Bargaining

For labor relations, the economic literature defines two main models of bargaining. In these models either all parameters are bargained (efficient bargaining: See, e.g., McDonald and Solow, 1981), or just a part of them ("right-to-manage" bargaining: See, e.g., Nickell and Andrews, 1983). If some parameters are excluded from the process of bargaining (in the standard literature it is usually employment), the parties determine them by themselves later.

In the manner of Askildsen et al. (2003b) we use these classical bargaining models in the current framework to differentiate between two cases: When parties "commit" to their actions and when they do "not commit". In the efficient bargaining setting all parameters of the model are jointly agreed-upon by the bargainers. In other words, all possible actions of the players are contracted and parties firmly commit to them. In the "right-to-manage" setting, the effort levels e and s, are left out. They are separately defined by the parties after w and D have been bargained.

In what follows we first derive a reference solution for the parameters in question – the Pareto-optimal solution. Then, an efficient bargaining solution is defined. The "right-to-manage" setting brings up the rear.

Pareto-Optimal Solution

In order to proceed with Pareto-optimal solution, we first define a joint surplus of the firm and the worker with the following equation[9]

[8]The form of $u(\cdot)$ means that elders are loss averse: Suffer significantly from income shortcoming, whereas insignificantly content with overflow of income (see Askildsen and Ireland, 2003a,b).

[9]Here it must be emphasized that the surplus maximizing outcome does not have to be efficient and optimal from the society's viewpoint. This statement comes from the definition of the joint surplus (4.4), and utility functions (4.1) and (4.3)(see e.g., Booth, 1995).

$$S(D,e,s) = U_F + U_W = p(e)[Q - D + u(D) - w_0(s)] - \varphi(e) + \Delta w_0(s) + \Delta f(s). \tag{4.4}$$

Maximizing (4.4) with respect to (D, e, s), yields in turn

$$\begin{aligned} D^* : u'(D^*)p(e) &= p(e) \Rightarrow u'(D^*) = 1 && (4.5)\\ e^* : \frac{\varphi'(e^*)}{p'(e^*)} &= Q - D^* + u(D^*) - w_0(s^*) && (4.6)\\ s^* : \frac{f'(s^*)}{w_0'(s^*)} &= 1 - p(e^*). && (4.7) \end{aligned}$$

Note, that in the Pareto solution the degree of worker's risk aversion determines the amount of deferred compensation (4.5). In (4.6) the optimal level of e^* makes the marginal costs of the firm efforts, relative to the resulting increase in the survival probability, equal to the survival return (this follows from the definition of the joint surplus). Finally, the last equation yields an intuitive result. The optimal level of worker's efforts to find an alternative job depends on the firm's efforts to survive: The higher efforts the firm exerts to survive, the lower incentives the worker has to look for another job or, in other words, to shirk.

Efficient Bargaining

After maximizing the joint surplus, we continue with efficient bargaining, which gives an exact division of the surplus. We use the cooperative Nash bargaining procedure to define the bargaining outcome. The bargaining problem is set up in the traditional form (B, d), where B is the set of feasible agreements (bargaining set)

$$B = \{(U_F, U_W) : U_F + U_W \leq S\},$$

and $d = (d_F, d_W)$ are the disagreement payoffs. Agreement in our setting implies different combinations of (w, D, e, s) while disagreement would yield the utility pair $d = (0, w_0(\widetilde{s}) - f(\widetilde{s}))$. Taking into account that the difference

between the worker's agreement and his disagreement payoffs is

$$w + p(e)[u(D) - w_0(s)] + \Delta w_0(s) + \Delta f(s)$$

the Nash Bargaining solution with asymmetric bargaining power

$$f_\alpha^N(B, d) = \underset{(U_W, U_F) \in B}{argmax} (U_F)^{1-\alpha} \cdot (U_W)^\alpha \tag{4.8}$$

has the following form

$$\underset{(U_W, U_F) \in B}{argmax} [p(e)(Q-D) - w - \varphi(e)]^{1-\alpha} [w + p(e)[u(D) - w_0(s)] + \Delta w_0(s) + \Delta f(s)]^\alpha.$$

First order condition for wage w (see Appendix 1) yields

$$w^* = \alpha[p(e)(Q - D) - \varphi(e)] + (1 - \alpha)[p(e)[w_0(s) - u(D)] - \Delta w_0(s) - \Delta f(s)]. \tag{4.9}$$

The wage w^* turns out to be a convex combination of the part of the employer's and the worker's expected gains. After plugging w^* into the utility functions of the parties, it logically yields a convex division of the joint surplus between players

$$U_W^* = \alpha[p(e)[Q - D + u(D) - w_0(s)] - \varphi(e) + \Delta w_0(s) + \Delta f(s)] \Rightarrow$$

$$U_W^* = \alpha S(\cdot) \tag{4.10}$$

and

$$U_F^* = (1 - \alpha)[p(e)[Q - D + u(D) - w_0(s)] - \varphi(e) + \Delta w_0(s) + \Delta f(s)] \Rightarrow$$

$$U_F^* = (1 - \alpha) S(\cdot). \tag{4.11}$$

This result means that, given the current setting, the Pareto-optimal values D^*, e^*, and s^* also in the individual bargaining framework do not depend on the bargaining power (see also Askildsen et al., 2003b). On the other hand, the bargaining power explicitly enters the wage equation, see (4.9). The value

of deferred compensation, D, therefore can be affected by bargaining power indirectly. More precisely in case if

$$|\alpha[p(e)(Q-D)-\varphi(e)]| < |(1-\alpha)[p(e)[w_0(s)-u(D)]-\Delta w_0(s)-\Delta f(s)]|$$

in (4.9), deferred compensation as well as worker's total utility might be reduced. Specifically, from (4.9) we can derive that

$$\hat{\alpha} = \frac{p(e)[w_0(s)-u(D)]-\Delta w_0(s)-\Delta f(s)}{p(e)[w_0(s)-u(D)]-\Delta w_0(s)-\Delta f(s)-[p(e)(Q-D)-\varphi(e)]}$$

for $w = 0$. This yields the following

1. If $\alpha \geq \hat{\alpha}$ then $w \geq 0$,
2. If $\alpha < \hat{\alpha}$ then $w < 0$.

The second case means that if worker's bargaining power is small, a firm might find a mechanism not only to reduce his wage but also his total utility, possibly via reducing deferred compensation in (4.3). Since this case is rather ruled out in the standard literature, we assume it away, staying for the rest of the work with case 1.

Right-To-Manage Bargaining

It is assumed in the efficient solution, that all parameters of the model could be agreed, bargained and contracted. Individual efforts are though, relatively difficult to observe, hence to contract. For this reason in the "right-to-manage", model players first bargain over contractable variables – w and D – and then choose efforts individually to maximize their own gains without taking into account effects on the joint surplus. We assume that the employer is the first one who chooses her efforts, e. After observing the efforts of the employer, the employee chooses his efforts, s.

Using backward induction, we first start with individual effort choices. Maximization of utility functions, (4.1) and (4.3), over efforts yields the fol-

lowing first-order conditions

$$\overline{e} : \frac{\varphi'(\overline{e})}{p'(\overline{e})} = Q - \overline{D} \tag{4.12}$$

$$\overline{s} : \frac{f'(\overline{s})}{w_0'(\overline{s})} = 1 - p(\overline{e}). \tag{4.13}$$

The effort of the firm (4.12) depends on the contracted level of deferred compensation, while the level of the worker's effort (4.13) to find a job depends on the firm's level of efforts. Therefore, at the bargaining stage both players know that their efforts will depend on the level of *deferred compensation*, but not on the *base wage*.

Having these facts in mind, we can now rewrite the expression for joint surplus (4.4) in the following form

$$S(D) = p[e(D)](Q - D + u(D) - w_0[s(D)]) - \varphi[e(D)] + \Delta w_0[s(D)] + \Delta f[s(D)].$$

First-order condition for D (see Appendix 1) yields the following inequality

$$\overline{D} : u'(D) > 1. \tag{4.14}$$

Using the same cooperative Nash bargaining procedure (4.8) results in the wage level equals the following

$$\overline{w} = \alpha(p(\overline{e})(Q - \overline{D}) - \varphi(\overline{e})) + (1 - \alpha)(p(\overline{e})[w_0(\overline{s}) - u(\overline{D})] - \Delta\overline{w}_0(s) - \Delta\overline{f}(s)) \tag{4.15}$$

where

$$\Delta\overline{w}_0(s) = [w_0(\overline{s}) - w_0(\widetilde{s})]$$

$$\Delta\overline{f}(s) = [f(\widetilde{s}) - f(\overline{s})].$$

Finally, having obtained equilibrium parameters for both settings, we can run a comparative analysis to see how they reflect the behavior of the bargaining parties.

4.3 Comparative Analysis

In this section we compare the outcomes of both efficient bargaining and "right-to-manage" settings. However, bearing in mind that the former is rather a hypothetical setting, we summarize our results with respect to the latter.

We first show that in the efficient bargaining settings the employer exerts higher effort to increase the firm's surviving probability

$$e^* > \overline{e}. \tag{4.16}$$

Lemma 3 *The employer has higher incentives to invest additional efforts into deferred compensation realization if she is forced by the binding contract.*

Proof. We can compare (4.6) and (4.12), where e^* and $\overline{e}$, solve the following equations

$$\frac{\varphi'(e^*)}{p'(e^*)} - \frac{\varphi'(\overline{e})}{p'(\overline{e})} = (u(D^*) - D^*) + (\overline{D} - w_0(s^*)) > 0.$$

The assumption about functional form of $u(\cdot)$ gives a positive sign for $u(D^*) - D^*$. The positive sign of $\overline{D} - w_0(s^*)$ is given by the earlier assumptions, $\overline{D} > w_0(s^*)$. Finally, taking into account functional form of $p(\cdot)$ and $\varphi(\cdot)$, we have $e^* > \overline{e}$. ■

As to the worker's efforts, they vary in three different states. We show this in the following, very intuitive lemma.

Lemma 4 *While an unemployed worker has incentives to exert the highest possible level of efforts to find a new job, an employed worker, who is not restricted by a binding contract, spends only a small part of his efforts to look for a new employment opportunity. The smallest amount of efforts is exerted by a worker who is employed and committed not to shirk,*

$$\widetilde{s} > \overline{s} > s^*. \tag{4.17}$$

Proof. First, if the worker stays *unemployed* in the case of disagreement

(4.2), he exerts the highest level of efforts to find a job

$$\frac{f'(\widetilde{s})}{w_0'(\widetilde{s})} = 1.$$

Second, if the worker is employed and at the same time *does not commit* to his employer (4.13), his efforts to find a new job are lower compared to the case of being unemployed. This follows from comparing (4.2) and (4.13), as well as functional form of $f'(\cdot)$ and $w_0'(\cdot)$

$$\frac{f'(\widetilde{s})}{w_0'(\widetilde{s})} = 1 > \frac{f'(\overline{s})}{w_0'(\overline{s})} = 1 - p(\overline{e}) \Longrightarrow$$

$$\widetilde{s} > \overline{s}.$$

The third state is when the worker is employed and *does commit* to the contract (4.7). In this case the worker exerts the lowest possible efforts

$$\frac{f'(\overline{s})}{w_0'(\overline{s})} = 1 - p(\overline{e}) > \frac{f'(s^*)}{w_0'(s^*)} = 1 - p(e^*).$$

This last inequality follows from lemma 3 and $p(e^*) > p(\overline{e})$, as well as functional form of $f'(\cdot)$, $w_0'(\cdot)$, and $p(\cdot)$. Therefore, $\overline{s} > s^*$. Summarizing the result from all inequalities, we end up with $\widetilde{s} > \overline{s} > s^*$.■

In the end, we come to the last part of the analysis - the compensation structure. Let us see how the compensation structure looks in the cases when the employer and the worker cooperate and do not cooperate (i.e., commit/not commit). Considering the values of the deferred compensation in (4.5) and (4.14) and given the concave form of the risk aversion function we can derive

$$D^* > \overline{D}. \tag{4.18}$$

To see now how the wage changes, recall that it represents a type of convex combination. Therefore, to make the analysis easier, we compare equations (4.9) and (4.15) part by part

$$p(e^*)(Q - D^*) - \varphi(e^*) < p(\overline{e})(Q - \overline{D}) - \varphi(\overline{e})$$

and

$$p(e^*)[w_0(s^*)-u(D^*)]-\Delta w_0^*(s)-\Delta f^*(s) < p(\overline{e})[w_0(\overline{s})-u(\overline{D})]-\Delta \overline{w}_0(s)-\Delta \overline{f}(s),$$

as a result we obtain

$$w^* < \overline{w}. \tag{4.19}$$

The above described results can be summarized in the following proposition.

Proposition 1 *In the absence of cooperation and commitments ("right-to-manage" bargaining) the employer exerts less effort to prevent bankruptcy ($\overline{e} < e^*$) compared to the cooperative case (efficient bargaining). At the same time, the worker increases his effort to find an alternative job ($\overline{s} > s^*, w_0'(\overline{s}) > w_0'(s^*)$), which is restrained by higher cash payments ($w^* < \overline{w}, D^* > \overline{D}$).*

The intuition is as following. When the employer is not constrained by a contract, she behaves disregarding the interests of the worker. At the same time a non-constrained worker ignores the interests of the employer. As a result, the prospects for deferred compensation to be materialized become rather vague. Instead, the increase in both worker's base wage as well as his opportunity-cost wage compensates such a loss.[10]

At last comes the question, "to commit or not to commit"? In the same manner as in Askildsen et al. (2003b), the answer is rather ambiguous. Even if some effective way to commit existed, the decision of parties would be rather dependent on their gains. For example, comparing worker's utility, while switching from one bargaining setting to the other, we see that it can change in either direction.

$$U_W^* = w^* + p(e^*)u(D^*) + (1-p(e^*))w_0(s^*) - f(s^*)$$

$$\overline{U}_W = \overline{w} + p(\overline{e})u(\overline{D}) + (1-p(\overline{e}))w_0(\overline{s}) - f(\overline{s}).$$

[10]This is in line with Merton (1985), Askildsen et al. (2003a,b), and rather contradicts to Curme et al. (1990) who say that "since workers will discount the end payment by the failure probability", deferred payment has to increase. Two contradictory views are, however, reconciled by Merton (1985), who remarks that the workers might "receive compensation for [the] risk in the form of either a higher first-period wage or larger promised future benefits".

Within the current structure of the model it is quite difficult to say in which case the the gains enhancing the utility of the worker are higher. For example, although the wage and outside option values are higher in the "non-commitment case", the deferred compensation is higher and effort costs are lower in the "commitment case". As a result without further specification of the parameters in question, it is quite difficult to make any judgements about parties incentives to commit or not to commit.

4.4 Conclusions

Although the presented framework is rather a reinterpretation and extension of the existing bargaining models, e.g., McDonald et al. (1981), Nickell et al. (1983), based on the approach of Askildsen et al. (2003a,b), including views of Diamond et al. (1985), Merton (1985), Curme et al. (1990), it helps us to illustrate how the standard bargaining approaches can be useful to understand a number of aspects related to the individual bargaining. In our context, this exercise provides an interesting perspective on the relationship between bargaining, risk and individual behavior as well as on the trade-off between base wage and deferred payments.

In the chapter, we have shown how deferred compensation bargaining outcome may depend on the behavior of the bargaining parties. Here we define *behavior* as different effort levels of the bargaining sides. For the firm it was effort to avoid bankruptcy, for the worker – to find new job. The model's outcome shows that players change their individual efforts depending on the type of the contractual constraints (i.e, bargaining structure). Specifically, the commitments limit the freedom of the parties' behavior. E.g, the worker is most active on the labor market when he has no commitments to the employer, which according to the model, can be compared to the unemployment case. In general, according to this structure, what matters is the cooperative type of behavior of the parties. Such modelling approach provides not only interesting insights into the relation between compensation structures and firm-worker behavior, but also allows to integrate the topic of deferred compensation and bankruptcy risk into the individual bargaining framework.

Appendix 1

Derivation of (4.9).

We define the set of feasible wages by

$$W := \{w > 0 : (U_W, U_F) \in B\}.$$

Therefore, we can rewrite the maximization problem (4.8) in the following form

$$\begin{aligned} \ln[f_\alpha^N(B,d)] &= \underset{w\in W}{argmax}(1-\alpha)\ln[p(e)(Q-D)-w-\varphi(e)] + \\ &+ \alpha\ln[w+p(e)[u(D)-w_0(s)]+\Delta w_0(s)+\Delta f(s)]. \end{aligned}$$

The logarithmic problem yields

$$\begin{aligned} 0 &= -\frac{1-\alpha}{p(e)(Q-D)-w-\varphi(e)} \\ &+ \frac{\alpha}{w+p(e)[u(D)-w_0(s)]+\Delta w_0(s)+\Delta f(s)} \\ &= -(1-\alpha)[w+p(e)[u(D)-w_0(s)]+\Delta w_0(s)+\Delta f(s)] \\ &+ \alpha[p(e)(Q-D)-w-\varphi(e)], \end{aligned}$$

which can be rearranged with respect to w

$$\begin{aligned} w &= (\alpha-1)[p(e)[u(D)-w_0(s)]+\Delta w_0(s)+\Delta f(s)] \\ &+ \alpha[p(e)(Q-D)-\varphi(e)] \\ &= \alpha[p(e)(Q-D)-\varphi(e)] \\ &+ (1-\alpha)[p(e)[w_0(s)-u(D)]-\Delta w_0(s)-\Delta f(s)]. \end{aligned}$$

Derivation of inequality (4.14).

In order to derive (4.14), let us first, using (4.12) and (4.13), to rewrite the joint surplus of the players for the case of "right-to-manage" in the following

form

$$\begin{aligned} S(D) &= p[e(D)][Q - D + u(D)] + (1 - p[e(D)])w_0[s(e(D))] - \varphi[e(D)] \\ &- f[s(e(D))] - (w_0(\tilde{s}) - f(\tilde{s})). \end{aligned}$$

Taking into account that $w_0(\tilde{s}) - f(\tilde{s})$ drops out, first order condition results in

$$\begin{aligned} \frac{\partial S}{\partial D} &= p'(e)e'(D)(Q - D + u(D)) + p(e)(-1 + u'(D)) + w_0'(s)s'(e)e'(D) \\ &- p'(e)e'(D)w_0(s) - p(e)w_0'(s)s'(e)e'(D) - \varphi'(e)e'(D) - f'(s)s'(e)e'(D). \end{aligned}$$

To reduce the equation we employ (4.12)

$$\begin{aligned} \frac{\partial S}{\partial D} &= p'(e)e'(D)u(D) + p(e)(-1 + u'(D)) + w_0'(s)s'(e)e'(D) \\ &- p'(e)e'(D)w_0(s) - p(e)w_0'(s)s'(e)e'(D) - f'(s)s'(e)e'(D). \end{aligned}$$

After rearranging we can write the equation in the following form

$$p'(e)e'(D)[u(D) - w_0(s)] + s'(e)e'(D)[w_0'(s)(1 - p(e)) - f'(s)] = p(e)(1 - u'(D)) \tag{4.20}$$

and employing (4.13)

$$s'(e)e'(D)[w_0'(s)(1 - p(e)) - f'(s)] = 0.$$

To see that the right-hand side of (4.21) is negative, note that $e'(D) < 0$ follows from (4.12)

$$\frac{\varphi'(\overline{e})}{p'(\overline{e})} = Q - D \Longrightarrow D = Q - \frac{\varphi'(\overline{e})}{p'(\overline{e})},$$

$$\begin{aligned} e'(D) : dD &= -\frac{\partial D}{\partial e}de + \frac{\partial D}{\partial Q}dQ \Longrightarrow \\ dD &= -\frac{\varphi''(e)p'(e) - \varphi'(e)p''(e)}{[p'(e)]^2}de \Longrightarrow \end{aligned}$$

$$\frac{de}{dD} < 0.$$

As a result equation (4.20) has a form

$$\underset{-}{p'(e)e'(D)}[\underset{-}{u(D)} - w_0(s)] = \underset{+}{p(e)}(1 - \underset{+}{u'(D)}).$$

For $p(e)(1-u'(D)) < 0$ to be true, the condition $u'(\overline{D}) > 1$ has to be fulfilled. Finally we have $u'(\overline{D}) > u'(D^*)$. Taking into account the form of $u(\cdot)$, this means $D^* > \overline{D}$.

Chapter 5

Group Behavior and Wage Delays

We have discussed in previous chapters how a firm and a worker bargain over deferred compensation. We have also shown that the firm may use deferred compensation as a retention mechanism to keep high-skilled personnel. Although the relation of deferred compensation to low-skilled workers is somewhat similar, there is a crucial difference. Namely, the anomalous form of deferred compensation may appear in their labor contracts without bargaining. This chapter therefore continues the discussion started in the previous chapters and adds one more behavioral dimension to this research. It explains how the absence of a firm's commitments and contract enforcement in the geographic areas characterized by low-skilled labor may create the non-contracted form of deferred compensation – wage arrears: Wage delays/debts accumulated for a number of periods (e.g. months, years).

In the standard literature wage arrears are normally seen as a financial "adjustment" tool for the firms experiencing solvency stress. This work employs however another concept which interprets wage arrears as a type of group "behavior within local communities" (Earle, Spicer and Sabirianova, 2004; Earl and Sabirianova, 2004). In particular, referring to the effects of group behavior, the current chapter augments the theory framework and models the rationale and conditions for the firms to renege on the contracted

agreements and illegally to delay/deferre wage payments. It also stresses the function of social norms in the development of such a socially inefficient type of behavior. This approach allows us to incorporate in the economic analysis some sociological and psychological aspects of human behavior, and helps to understand how the society and markets affect individual "managerial decisions" regarding compensation policy.

The group behavior and social norms framework has lately attracted a lot of attention. Recent literature in this field offers interesting insights into the behavior of economic agents and provides new interpretations for phenomena that were previously explained mainly from standard economic perspectives.[1] Usually, this approach yields a multiple equilibria outcome. This work is not an exception in this sense. So far there is no clear consensus on the appropriate equilibrium selection criteria, though. For this reason, we derive the Bayes-Nash equilibrium of the random-utility extension of the game, as incorporated in the notion of Quantal Response Equilibrium (McKelvery and Palfrey, 1995), and take its limit as noise tends to zero in order to solve the problem of equilibrium selection in our deterministic game.

Finally, the problems with wage arrears were especially evident in many post-Soviet countries during the transition period, and still remain an issue for a number of them. First studies of wage arrears appeared around a decade ago and mostly analyzed the Russian and the Ukrainian labor markets. We illustrate therefore the current study using examples and empirical investigations made for these countries.

The structure of this chapter is as follows. In the next Section we review literature and two existing alternative explanations for wage arrears appearing: The standard and the behavioral approaches. On the ideas of the behavioral approach we build in Section 5.2 the initial theoretical model. In Section 5.3 we present a perturbed game (model) and equilibrium selection method. Summary of the work and conclusions are made in the last section.

[1]See, e.g., Huck, Kübler and Weibull (2003) for an explanation of social efficiency from the social-norms perspective; for survey see, e.g., Elster (1989); for initial theory explanation see Ackerlof (1980, 1997).

5.1 Wage Arrears: Alternative Views

The hard time of the "transition" period in the post-Soviet countries has been characterized not only by drastic falls in "living standards", but also by a very specific trait: Extensive "non-payment of wages". In the mid-nineties, the wage arrears in the Commonwealth of Independent States (CIS) came practically to about 10 billion USD (ILO Newsletter 2-96).

In Russia and Ukraine the topic of wage arrears was particularly alarming.[2] Wage non-payments in Ukraine have expanded over many "industries" and almost every part of the country (Gryshyna, 2001). According to the results of the Ukrainian Enterprise Labour Flexibility Survey, in 1999, up to 80% of all enterprizes stated some problems with wage payments. Public sector economy (e.g., education, social security) was more affected than private sector (i.e, "pension arrears" had reached 500 millon USD)[3]. However in both sectors the problem was equally severe (Standing and Zsoldos, 2001).

The picture looked similarly grave also in Russia. The wage debt amounted to about 8 billion USD in 1998 (Earle and Sabirianova, 2002; Earle, Spicer et al., 2004). "Around two-thirds of employees reported" wage arrears, "with an average delay of 4.8" months (Earle, Spicer et al., 2004). Of those about 60% were in industry, 19% in agriculture, 14% and 8% in construction and in transport respectively (ILO Newsletter 2-96). In the same manner like Ukraine, the state reneged on its payment duty. People working in the public sector, for instance, as well as retired people were not paid during a number of months (in some cases even years). The extent of wage arrears therefore had taken almost an "epidemic" size. However, it was "*...clearly in contradiction with the International Labor Organization's Convention No. 95 on the Protection of Wages, which stipulates that wages should be paid on a regular basis and not be subject to delay once this basis has been fixed by legislation. Both the Russian and the Ukrainian governments had ratified*

[2]Unfortunately, the case of wage arrears is not limited to the CIS countries. The economies of most of the "post-Soviet block" countries were affected by wage arrears. Poland, Bulgaria, Rumania - to name just a few (however, wage arrears are less often observed in CEE countries, see e.g., Alfandari et al., 1996). Moreover, countries in different parts of the world like Italy or China also have experienced wage arrears.

[3]See e.g., report USAID 1999, "Pension Reform in Ukraine", www.usaid.gov.

this Convention and implemented a new Law on the Protection of Wages" (ILO Newsletter 2-96).

As explained by the same ILO Newsletter 2-96, the wage arrears may stem from a constellation of different reasons: The downturn of "demand", and as a result, the decline of "production"; the "debts" created within industries, as well as monetary compensation replaced with "barter". Another important reason is an unbalanced and onerous tax system. Under inefficient "taxation", companies not only failed to run the restructuring, but also were not able to fulfill their financial obligations, including paying both salaries as well as "social contributions". Hence, the state authorities could not pay "public" workers and "pensioners". Furthermore, wage arrears seem to have been used as a governmental instrument of "inflation" regulation.[4] Additionally, the poorly managed economy "liberalization", as well as the monopsonistic position of big companies on the local labor markets significantly aggravated the problem of wage non-payments.[5] All these problems made firms not only use the "standard" cost adjustment mechanisms (e.g., wage reduction, dismissing), but also the postponement of wage payments.

5.1.1 Standard Approach

A big stream of empirical studies made during the last decade considers wage arrears as a "dominant form of labor market adjustment" (see e.g., Layard and Richter, 1995; Alfandari and Schaffer, 1996; Lehmann, Wadsworth, and Acquisti, 1999; Desai and Idson, 2000; and review in Earle, Spicer, and Sabirianova, 2004).[6] More precisely, this literature regards wage arrears rather as an "appropriate" mechanism even in spite of its "illegitimate nature". Earle, Spicer et al. (2004), who define this approach as a "neoclassical", explain the

[4] "*Wage arrears significantly increased in Ukraine in early 1996, after the signature of a macroeconomic memorandum which aimed at controlling the inflation before the introduction of the new national currency, the Hryvnia (...)*" (ILO Newsletter 2-96).

[5] See Gryshyna (2001) for detailed analysis of the wage arrears determinants in Ukraine.

[6] The literature also gives some other explanations to why firms may engage in wage arrears (e.g., Alfandari and Schaffer (1996) say that wage arrears, in a "perverse" way, help to obtain "tax deferrals", or "lobby the government for subsidies"). Those, however, are not supported in the literature as main preconditions for the wage arrears existence (see e.g., Lehmann et al., 1999).

positive view on wage arrears by their ability to "increase wage flexibility", which in turn, reduces "unemployment".

In the same vein, the use of wage delays for the employers, can be somewhat justified. First of all, the application mechanism of wage arrears is easy: "Employers do not need to [*re*]negotiate" the labor contracts with their workers – wage arrears are implemented by the firm without bargaining (Earle, Spicer et al., 2004). In addition, interesting "efficiency wage type considerations" arguments can be found in Lehmann et al. (1999). The authors imply that standard wage reduction may induce "productive members of [firm's] workforce" to quite more than wage arrears. For the firm it might therefore be more reasonable to decide to delay. The next plausible argument is interwoven with the previous one. Specifically, the argument can be a retention (or "attachment") effect, which wage arrears have as a non-contracted form of deferred compensation (see Friebel and Guriev, 2005; Lazear, 2003). In other words, wage arrears may help a firm to keep workers to overcome bankruptcy (i.e. if the worker leaves he also loses the chance to receive his delayed wage). Finally, Alfandari et al. (1996), as well as Lehmann et al. (1999) indicate that wage arrears may make workers be a financing source (i.e.,"assistance") for the firm, because "difficulties in obtaining bank credit (...) are associated with arrears". Again, one can argue that according to this perspective wage arrears can also be justified. Since the information asymmetry between an employer and a worker is lower than between an employer and an outside creditor, the worker may have higher incentives to finance the employer, or simply "trades wage arrears for continued employment" (see Lehmann et al., 1999; Core and Guay, 2001).[7] More generally, wage arrears in the employer's context, are rather associated with those firms, which experience differen economic troubles.

If the reasons for firms to use wage arrears instead of wage cuts can be explained, then for workers it hardly can be the case. The standard approach therefore says that workers would rather "oppose this practice". The approach focuses mainly on "two" "responses" to wage decrease: "[Q]uits and

[7]See also for more extensive discussion and examples e.g., Gryshyna (2001); Earle, Spicer et al. (2004).

strikes" (Earle, Spicer et al., 2004). Specifically, Earle, Spicer et al., 2004 hypothesize that workers' "reaction to wage" delays should be similar to their reaction to "wage cuts" – turnover and strikes increase in the "amount of wage arrears".[8] As a result, following the assumptions and hypothesis made in the literature we can summarize that: First, poorly performing firms are "more likely" to end up in wage non-payments than well performing firms; and second, the wage delays seem to have the same effect on worker's behavior as standard "wage reductions" (Earl, Spicer et al., 2004).

However, this does not always seem to be the case. First of all, there is almost no evidence of extensive quitting. For instance in Ukraine, despite the 40% slowdown in production, the level of registered unemployment remained relatively constant, i.e. around 4.5% (UEPLAC, 1999).[9] The situation regarding strikes is similar. The number of strikes compared to the extend of wage arrears was remarkably small. Only in 1998-99 and only in the eastern part of the country did few strikes take place. The biggest manifestation was a protest march of mine workers from Doneck to Kiev (Freedomhouse, Survey 1999). They had average wage delays of several years.

Finally, Earl, Spicer and Sabirianova (2004), in their empirical analysis of data from the Russian Federation, found considerable wage arrears also in profitable firms (e.g., "the mean arrears among the 70" "top (...) growing firms" was around 3 months). The authors presented an empirical analysis, which showed that managers' and workers' "behavior" regarding wage delays is significantly driven by "local labor market arrears", which "under some conditions" might be recognized as a "legitimate practice", while being "formally outside the scope of the law".

5.1.2 Behavioral Approach

As it was discussed above, standard economic theory somewhat explains the origins and prerequisites of wage delays. However, Earle, Spicer and Sabirianova (2004) argue that wage arrears may have an "independent dynamic".

[8] See also, e.g., Farber (1994).

[9] See also for more general and extensive discussion Lehmann et al. (1999).

In other words, enterprizes that perform well also use wage arrears. While studying wage arrears in Russia, the authors introduced the notion of "neighborhood effects" (Earl and Sabirianova, 2004). They show that the "environment" is a crucial factor that influences the behavior of both firms and workers. In contrast to the standard perspective that views wage arrears as an "illegitimate" "flexible contracting mechanism", the authors suggest considering wage arrears from an "institutional" (or behavioral, in our terms) perspective, examining this practice as a "legitimate" kind of group or "community" behavior. This approach raises a relevant question: "Under" which circumstances may "wage arrears" be viewed as "legitimate practice"? The authors argue that the "answer to this question depends" to a great extent "on how legitimacy is defined".

In our framework the line of arguments may appear as the following. According to Scott (2003),"legitimacy is a property of a situation or behavior that is determined by a set of social norms as correct or appropriate". Gächter and Fehr (2000) define social norms as "behavioral regularities based on a socially shared belief". Consequently, "legitimacy" might be less determined by strict written rules, but rather depends on the individual idiosyncratic perception of reality, or "a set of constitutive beliefs" (Svensson, 2004). Beliefs, in their turn, are governed by social interactions[10], social environment, group behavior etc. (Gächter and Fehr, 2000). Therefore, in any particular case "individual" agents or "societal pressure groups" can be "convinced" (via changing beliefs) that "certain practices" are "legitimate" (Svensson, 2004). Such a metamorphosis of believes may lead to the acceptance of practices – their "societal legitimacy" (Tolbert et al., 1983). More precisely, Earl, Spicer et al. (2004) point out that "legitimization of an organizational practice takes place" in "two" steps. First, "in order to survive", some "organizations" take on a "practice" which is economically determined as "appropriate", "necessary" and "efficient" (Meyer and Rowan, 1977; Tolbert et al., 1983). Afterwards, when the organizational practice turns out to be accepted by a certain "number" of organizations, i.e, when it is recognized

[10] *"... Berger and Luckman (1967) (...) argue that social reality is a human construction created through interaction"* (Scott, 2003, p.117).

to be "appropriate and a necessary component of" efficiency, other organizations are subject to "considerable pressure" to integrate the practice into their "formal structure". In this manner, organizations show that they are behaving on commonly accepted values "in a proper and adequate manner" (Meyer and Rowan, 1977; Tolbert et al., 1983). Therefore, the later "adoption" of the practice may "fulfill" rather "symbolic" task and "may have little or no effect" on the factual "efficiency" of the organization (Tolbert et al., 1983). When the "adoption process" goes on, primary efficiency considerations become less important for the expansion of the practice in society. Over time the practice becomes more "independent" and "increasingly taken for granted" and considered by all "stakeholders" as a *correct* or "*appropriate*" form of the "social" behavior (Meyer and Rowan, 1977; Zucker, 1977; Tolbert et al., 1983). In other words the practice is transformed into legitimate "outside the scope of the law" (Earle, Spicer et al., 2004).

Following the structure of these arguments, we come back to wage arrears. It should be clear now, that as an organizational practice, wage arrears may appear rather as a result of firms' group (i.e., conformity) behavior, than a as a necessary financial adjustment tool to cope with the consequences of negative economic conditions. Furthermore, Earle and Sabirianova (2004) and Earle, Spicer and Sabirianova (2004) present empirical evidence of how the conformity behavior (i.e.,"neighborhood effects") of different firms on the market influences the individual "managerial behavior". More precisely, the authors presume that by observing the behavior of the "relevant reference groups", managers may gain not only from the practice itself, but also from the extent to which it is conformed within the market.[11] *"The cumulative adoption of a practice within a community therefore provides an important signal to managers that a practice is considered a legitimate form of organizational practice that can be used with few adverse consequences"* (Earle, Spicer et al., 2004, p.15).

In the labor relation framework, such a reference group includes not only other managers, but also workers. The workers decision making, in turn, also

[11]See, e.g., Adams (1963), Pollis (1968) for the interesting basic and initial discussion on the social comparison, reference groups and reference outcomes.

has an important behavioral aspect. Specifically, the industrial sociology and psychology as well as behavioral economics stress that "relative payoffs" influence worker's opinion, judgements, and behavior. Agell and Lundborg (1995) and Bewley (1998), for example, show that "relative income considerations" to a great extent define compensation structure in companies.[12] In wage arrears context, such arguments lead to the following inference: *"If the majority of people with whom workers come into contact experience wage arrears, then the less likely that any individual worker will consider his or her own experience to be outside the norm of accepted behavior"* (Earl, Spicer et al., 2004, p.16). The workers' incentives for any kind of workplace grievance behavior might be therefore subject to the average wage payments in the market. Earl, Spicer and Sabirianova find a strong empirical support for this reasoning and say that *"...the more that the practice of wage areas is legitimized as an appropriate way of conducting business within a community, then the more likely that managers will use this practice and the less likely employees will oppose it through actions such as quitting (exit) and striking (voice)"* (2004, p.11). In our context, the "individual behavior" of a manager will be driven by the managers' and workers' group behavior on the market, hence decreasing "manager's costs of wage" non-payments. In the next chapter we summarize the above reasonings in the formal model of "managerial" and market behavior based on the behavioral approach and models developed by Encinosa et al. (1997), Huck et al. (2003) and Earle and Sabirianova (2004).

5.2 Model

5.2.1 General Framework

Let us consider a homogeneous labor market with $i \in I = \{1, ..n\}$ firms. At the end of the working period (week, month, etc.) a simple kind of moral hazard problem arises. The manager of the firm i, possibly violating a labor contract, unilaterally decides upon the wage payment to her single worker. In

[12] See Fehr and Schmidt (1999) for extensive discussion and survey.

particular, the manager determines which fraction $\alpha_i \in [0,1]$ of the promised wage w to pay and which part $(1-\alpha_i)$ to delay.

Wage delays provide the manager with the "benefits" and entail costs as well (i.e., monetary payoff and loss, respectively). We denote the benefits by $b(\alpha_i)$, with $b'(\cdot) \leq 0$ (more delay, e.g., reduces the expense of financing on the capital market). We also define the costs[13] as $c(\alpha_i, \overline{\alpha}_{-i})$. The costs depend on the level of α_i and the average payment on the market without firm i, $\overline{\alpha}_{-i}$ (i.e., group behavior).

The manager is a risk neutral profit maximizer. Her payoff depends not only on the wage she pays but also on the average market payments.

$$\pi_i = b(\alpha_i) - c(\alpha_i, \overline{\alpha}_{-i}). \tag{5.1}$$

We assume here that (see details in the next section)

$$\frac{\partial c(\alpha_i, \overline{\alpha}_{-i})}{\partial \alpha_i} < 0, \frac{\partial c(\alpha_i, \overline{\alpha}_{-i})}{\partial \overline{\alpha}_{-i}} > 0, \frac{\partial^2 c(\alpha_i, \overline{\alpha}_{-i})}{\partial \alpha_i \partial \overline{\alpha}_{-i}} < 0 \tag{5.2}$$

if $\alpha_i < \overline{\alpha}_{-i}$, and $c_{\alpha_i} = c_{\overline{\alpha}_i} = c_{\alpha_i \overline{\alpha}_i} = 0$ otherwise. The costs are decreasing in α_i, because wage payments reduce workplace grievance behavior. On the other hand, the costs are increasing in $\overline{\alpha}_{-i}$, because the increasing market payments make the costs of wage delaying higher.[14]

The manager then maximizes

$$\max_{\alpha_i} \pi_i = b(\alpha_i) - c(\alpha_i, \overline{\alpha}_{-i})$$

with the FOC

$$b'(\alpha_i) = \frac{\partial c(\alpha_i, \overline{\alpha}_{-i})}{\partial \alpha_i}. \tag{5.3}$$

Let us define the inverse of the function b' as B, with $B(b'(\alpha_i)) = \alpha_i$, and let us label $\frac{\partial c(\alpha_i, \overline{\alpha}_{-i})}{\partial \alpha_i} = c'(\alpha_i, \overline{\alpha}_{-i})$. Using this we can rewrite the FOC as a fixed

[13]The decision not to pay what was promised brings about costs for the manager, e.g. increased "turnover", "strikes", shirking, loss of reputation (Earl and Sabirianova, 2004).

[14]Note the last inequality in (5.2) means that the marginal effect of the increase in firm's wage payment is weaker (stronger) when the average market payment increases (decreases). See, e.g., Encinosa et al. (1997), Hehenkamp et al. (2006).

point equation in α:[15]

$$\alpha_i = B(c'(\alpha_i, \overline{\alpha}_{-i})) \;\; s.t. \;\; \alpha_i = \overline{\alpha}_{-i} =: \alpha \tag{5.4}$$

and

$$\alpha = B(c'(\alpha, \alpha)) \tag{5.5}$$

We assume here that functions $c(\cdot)$ and $b(\cdot)$ are such that a fixed point always exists.

In the next section, we analyze this general framework in more detail using a specific form of the payoff function, which includes preferences for compliance with the social norm *to pay the whole promised wage*.

5.2.2 Example With the Social Norm

In line with the literature discussed in the previous section, let us consider the delayed part of the wage $(1 - \alpha_i)w$ as a "financial assistance" (possibly forced) from the worker, which pays back to the manager with interest rate r. Thus, we can define the manager's benefits as

$$b(\alpha_i) = (1 - \alpha_i)wr.$$

As far as the costs are concerned, following (5.1), (5.2) and $c''_{\alpha_i} \geq 0$ we make two assumptions about specific form of the cost function. The *reference dependence* assumption makes note of the fact that the manager's payoff is affected by the deviation from a socially accepted norm of payment, s. Therefore the reference dependence in general form we define as $(\max\{s - \alpha_i, 0\})^2$.

The *salience assumption* suggests that the manager's compensation policy costs are contingent on the group behavior of other managers on the market. More precisely, $\overline{\alpha}_{-i}$, representing the average wage payment on the market, measures the degree of deviation from group behavior within a mar-

[15] This can be justified, e.g., by (5.3) and symmetry of the firms (i.e., wage payments), $\alpha_i = \overline{\alpha}_{-i}, \forall i$.

ket, $\overline{\alpha}_{-i}(\max\{s-\alpha_i,0\})^2$.[16]

It is easy to see that this satisfies assumption (5.2)

$$\begin{aligned} c_{\alpha_i} &= \begin{cases} -2\overline{\alpha}_{-i}(s-\alpha_i)<0 & , \text{ if } s>\alpha_i \\ 0 & , \text{ if } s\leq\alpha_i, \end{cases} \\ c_{\bar{\alpha}_{-i}} &= \begin{cases} (s-\alpha_i)^2>0 & , \text{ if } s>\alpha_i \\ 0 & , \text{ if } s\leq\alpha_i, \end{cases} \\ c_{\alpha_i\bar{\alpha}_{-i}} &= \begin{cases} -s+\alpha_i<0 & , \text{ if } s>\alpha_i \\ 0 & , \text{ if } s\leq\alpha_i. \end{cases} \end{aligned}$$

Hence, assuming that the social norm is *to pay the whole promised wage*, $s=1$, without loss of generality, we define the following specific form of the cost function[17]

$$c(\alpha_i,\overline{\alpha}_{-i})=\overline{\alpha}_{-i}(\max\{1-\alpha_i,0\})^2,$$

and the payoff function of the manager in the simple form is

$$\pi_i=(1-\alpha_i)wr-\overline{\alpha}_{-i}(1-\alpha_i)^2. \tag{5.6}$$

As the framework of the model requires, the costs of the manager decrease in α_i, $c'_{\alpha_i}\leq 0$, and increase in $\overline{\alpha}_{-i}$, $c'_{\bar{\alpha}_{-i}}\geq 0$. This means that in general, engaging in wage arrears is costly for the manager. However, the manager's gain (loss) from wage delays increases (decreases) if the rest of the firms use wage arrears as well. Therefore, the manager chooses α_i to maximize her payoff and solves

$$\max_{\alpha_i\geq 0}\ \pi_i=(1-\alpha_i)wr-\overline{\alpha}_{-i}(1-\alpha_i)^2. \tag{5.7}$$

[16]In other words, the manager's costs or disutility of paying a lower wage than promised is an increasing function of the other managers' payments. Therefore $\overline{\alpha}_{-i}$ represents a simple version of some function $f(\overline{\alpha}_{-i})$, which is continuous and strictly increasing; e.g., the more wage others pay, the more costly it is to deviate. On the other hand, if a firm's payments are higher than social norm, s, costs of the firm are equal to 0. For a more detailed discussion and examples see e.g. Encinosa et al. (1997), Hehenkamp et al. (2006).

[17]No additional insight can be gained by allowing for more general functional forms.

This yields

$$\alpha_i = \begin{cases} 1 - \dfrac{wr}{2\overline{\alpha}_{-i}} & , \quad \text{if} \quad \overline{\alpha}_{-i} > 0 \\ 0 & , \quad \text{if} \quad \overline{\alpha}_{-i} = 0. \end{cases} \tag{5.8}$$

Taking into account the restriction $\alpha_i \in [0, 1]$, the reaction function is given as

$$\alpha_i = \max\left\{1 - \frac{wr}{2\overline{\alpha}_{-i}}, 0\right\}. \tag{5.9}$$

Hence, each managers's payment is nonlinear in the average market payments. We concentrate here on symmetric Nash equilibria, assuming that there is no difference in managers' behavior. In this case the level of wage payments for every manager will be equal to the average market payments, $\alpha_i = \overline{\alpha}_{-i}$. Taking into account a wage w and an interest rate r, all respective Nash equilibria in this structure will be defined by the fixed-point equation

$$\alpha = \max\left\{1 - \frac{wr}{2\alpha}, 0\right\} \tag{5.10}$$

or

$$\alpha = \begin{cases} 1 - \dfrac{wr}{2\alpha} & , \quad \text{if} \quad \alpha > \dfrac{wr}{2} \\ 0 & , \quad \text{otherwise.} \end{cases}$$

In a symmetric Nash equilibrium, every equilibrium payment level is a fixed point α, and the other way around. Solving the fixed point equation for α yields three equilibria[18]

$$\alpha_1^* = 0, \quad \alpha_2^* = \frac{1 - \sqrt{1 - 2wr}}{2}, \quad \alpha_3^* = \frac{1 + \sqrt{1 - 2wr}}{2}. \tag{5.11}$$

The observed multiple equilibria can be described by low, medium, and high levels of wage payment. The first equilibrium defines low or zero payment of wages.[19] The second equilibrium gives an intermediate level of wage

[18]Notice $\alpha_1^* < \alpha_2^* < \alpha_3^* \leq 1$.

[19]It is important to notice that this equilibrium coincides with the hypothetical equilibrium in which social norm and community behavior are not included into the model. Intuitively, the manager always prefers to withdraw the whole wage if he has no costs, see equation (5.6).

payments. The third equilibrium yields high or full[20] payment of wages. The last two equilibria are different from zero and exist if and only if $wr < \frac{1}{2}$. Otherwise, only one equilibrium, $\alpha_1^* = 0$, exists. Of these three equilibria, just the two marginal equilibria are stable in a dynamic setting, when the manager changes her payment in relation to the average market payments. We first show this analytically, and then – graphically.

To start with, using (5.9) we define $\alpha^{'}$ as

$$\alpha^{'} = \begin{cases} \dfrac{wr}{2\alpha^2} & , \quad \text{if} \quad \alpha > \dfrac{wr}{2} \\ 0 & , \quad \text{if} \quad \alpha < \dfrac{wr}{2}. \end{cases} \tag{5.12}$$

For α_1^* it is clear that

$$\alpha^{'} \mid_{\alpha_1^*} = 0 < 1 \tag{5.13}$$

To verify the second equilibrium and to show that it is unstable, we substitute α_2^* into (5.12)

$$\alpha^{'} \mid_{\alpha_2^*} = \frac{wr}{2\alpha_2^{*2}} > 1 \tag{5.14}$$

which can be written as

$$\frac{wr}{2}\left[\frac{1}{(1-\sqrt{1-2wr})/2}\right]^2 > 1$$

rearranging the inequality, we obtain

$$\frac{wr}{\sqrt{1-2wr}(\sqrt{1-2wr}-1)+wr} > 1.$$

Given that $\sqrt{1-2wr}-1 < 0$, we see the condition to be fulfilled. This shows the the instability of the equilibrium. The third equilibrium, after making similar verification, proves to be stable with

$$\alpha^{'} \mid_{\alpha_3^*} = \frac{wr}{2\alpha_3^{*2}} < 1 \tag{5.15}$$

[20] If $r = 0$.

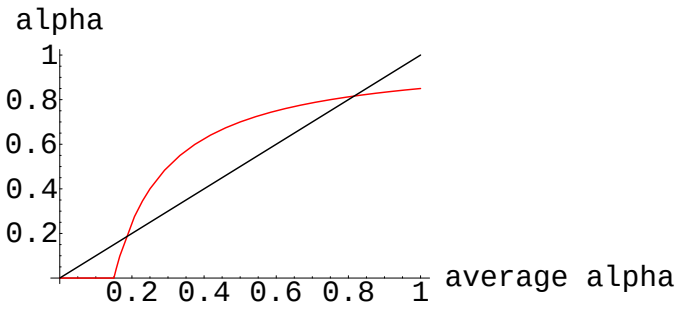

Figure 5.1: Reaction function for $w = 1$ and $r = 0,3$.

or

$$2wr - \sqrt{1 - 2wr} - 1 < 0.$$

The example in Figure 5.1 demonstrates the reaction function and the three equilibria. The equilibria lie on the intersections of the function with the diagonal. From the picture it is also clear that both marginal equilibria are stable in the dynamic context. Any change around the medium-payment equilibrium, is followed by significant shifts in the direction of one of the stable equilibria. The important "technical" insight of the model therefore is that wage payments might also depend on the average (i.e., group) payments of all firms on the market, and not necessarily completely on the financial situation.

The multiple equilibria outcome raises the issue of equilibrium selection, i.e. how the system may shift from one equilibrium to another. The simulation in Figure 5.1 shows also that to leave the basin of attraction of the zero payment equilibrium requires that only a small part of firms start paying wages. The adaptive dynamics will afterwards bring the whole system to the stable high payment equilibrium.[21] On the other hand, the system may leave

[21] As an anecdotic illustration, during the Ukraine's presidential elections of 2004, in order to support the "progovernment candidate", most of the public workers were paid their wage debts – that made private companies pay the back wages too (see e.g., Copsey, 2005).

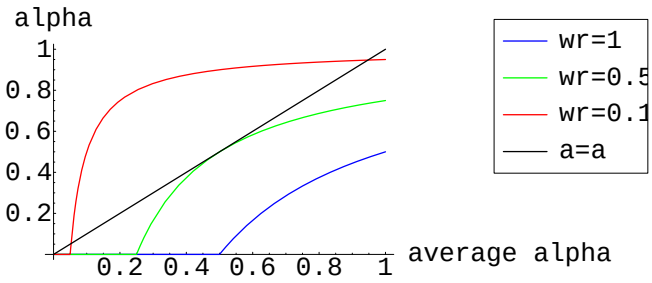

Figure 5.2: Possibility of different equilibria with changing interest rate and wage. Two dimensional representation.

a high payment equilibrium if a number of significant players on the labor market stop paying (see also Earle and Sabirianova, 2004).

Figure 5.2 demonstrates that an increase in wage shifts the reaction function downwards. Thus, wages of a different size imply different equilibrium levels of non-payment. In other words, workers with higher wages are imposed to a higher risk of not being paid, or being paid less than promised. Therefore, fixing wage payments at some minimum level may somewhat moderate the problem.

At the same time, wages can not be paid in time if the financial market provides managers with the high interest rate on short term deposits.[22] The same example in Figure 5.2 can also illustrate how the regulation of the financial market may resolve the problem of non-payment. A decrease in the interest rate not only shifts the reaction function upwards but also changes the number of equilibria as well as cuts down the manager's benefits from wage withdrawal. This makes the high payment equilibrium the only stable equilibrium in the system.

An additional interesting insight into the relation between all variables in question provides a three dimensional representation of the reaction function,

[22]The highest level of wage arrears in the post-Soviet countries occurred in the mid-nineties. This period is also marked by a boom of the so-called "quick money" investment funds, financial pyramids, which promised up to 100% monthly returns.

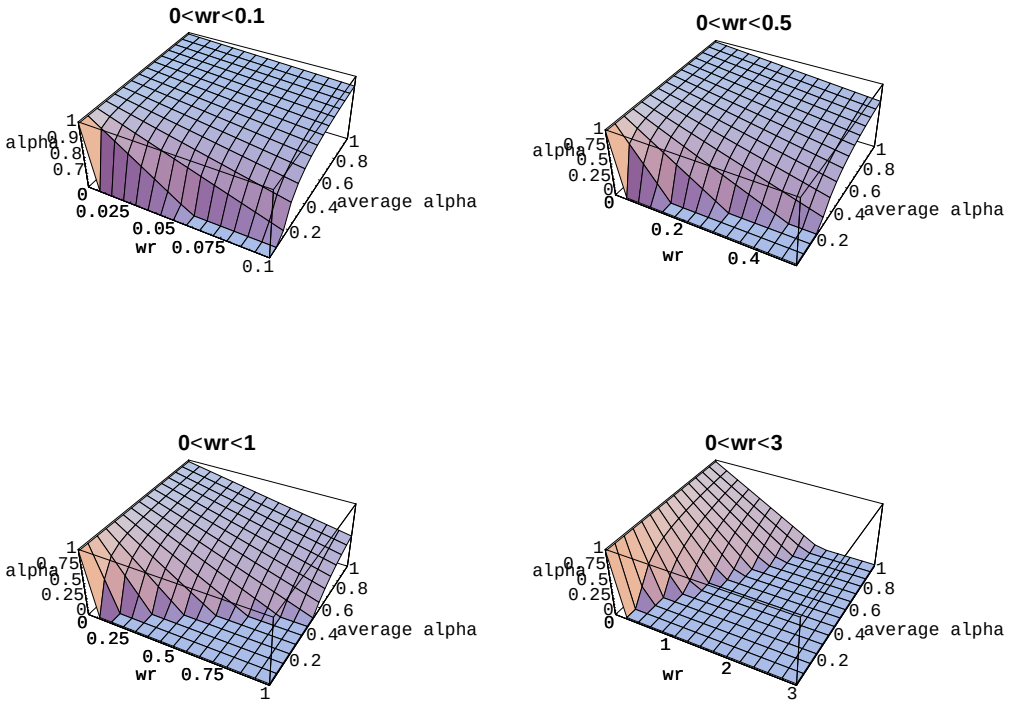

Figure 5.3: Possibility of different equilibria with changing interest rate and wage. Three dimensional representation.

Figure 5.3. Alon with the dimensions already depicted in Figure 5.2, that is $(\alpha_i, \overline{\alpha}_{-i})$, we draw one more, $(\alpha_i, \overline{\alpha}_{-i}, wr)$. We can see now how changing the upper limit of wr from 0,1 to 3, gives different perspectives on functional relations. The lines stretching on the picture from South to North are our reaction functions for different levels of wr drawn in the two dimensional Figure 5.2. For the high level of wr they are simply straight lines, which define a zero level of wage payment. Apart from this discussion, the following section sets forth a formal method of equilibrium selection in the given framework.

5.3 Equilibrium Selection

In this section we present the zero-noise limit of the Quantal Response Equilibrium in the perturbed game as an equilibrium selection device for the original, deterministic case. Due to the work of McKelvey and Palfrey (1995), Quantal Response Equilibrium (QRE) concept has become popular during the last decade. As T. Palfrey defined it himself, the concept "*...lies at the junction of econometrics, game theory, laboratory experiments, and numerical computation (...). One interpretation of QRE also places the concept in the category of behavioral economics, as it is often referred to as a boundedly rational version of Nash equilibrium*" (Palfrey, 2006, p.308).

The QRE roots from Harsanyi (1973) type of games with randomly distributed payoffs.[23] Referring to "*...the stochastic models of individual discrete choice one could rationalize 'errors' in QRE by assuming that players had privately observed payoff disturbances, producing a game of incomplete information*" (Palfrey, 2006, p.310). According to T.Palfrey, the term "quantal response equilibrium" itself stems from the statistics, which applied the term of "quantal choice" with respect to "stochastic models of discrete choice".

The version of QRE, which we use in the present work called Logit QRE.[24] It grounds on the "Logit choice model". In this model "the stochastic choice probabilities are proportional to exponentiated expected payoffs" (Palfrey 2006). For example[25], when a player faces m options, the choice probability $Pr(x_i)$ – "probability of selecting a particular decision" x_i – "is proportional to an exponential function of the associated expected payoffs" $\pi(x_i)$

$$Pr(x_i) \propto \frac{\exp(\pi(x_i)/\lambda)}{\sum\limits_{j=1,..,m} \exp(\pi(x_j)/\lambda)}, i = 1, ..., n,$$

where the "error parameter" λ, defines the sensitivity of choice probabil-

[23] "Individual payoff perturbations" were applied by Harsanyi (1973) to refine "mixed-strategy equilibria". It represents a standard approach to "equilibrium selection", a research direction started by Nash (1953) and continued by Selten (1975) (see, e.g., Harsanyi and Selten, 1988; Güth and Kalkofen, 1989; and for reference Gonzalez, 2005).

[24] Due to its tractability and relatively simple interpretation, this model is most often used in the literature.

[25] See Goeree and Holt, 1999.

ities regarding payoffs. As λ "goes to infinity, all choice probabilities are equal", without taking into account "payoff differences", although insignificant "payoff differences" will have significant consequences when λ "goes to zero". Goeree and Holt (1999, 2000) show that its "continuous analog" is

$$f(x) \propto \exp(\pi(x)/\lambda),$$

where, $f(x)$ is the population density. In equilibrium the "choice density defines the expected payoffs", which consequently "define the choice density". Alternatively, the logit equilibrium is a "fixed point" where the "*belief* density" has to be equal to the "choice density". McKelvey and Palfrey (1995) show the existence of this fixed point equilibrium for games with a "finite number of decisions" (Goeree and Holt, 1999; Goeree et al., 2006).

5.3.1 The Perturbed Game and Naive Expectations

First, consider the modified version of our original game (5.6), in which manager's payoff function is subject to random perturbation, $\varepsilon(\cdot)$ (i.e., the payoff function includes an additive noise process).

Second, for the sake of tractability, we restrict the analysis in the modified version to the two-players case. Namely, there are two firms, indexed by $i = A, B$. Each firm has employed a fixed amount of labor to do a specific production task. Let w_i denote the wage firm i has promised to pay to its workers after performing their tasks.[26] After all workers have finished their task, each firm can decide whether to fully pay the promised salary, or just a fraction of it. Firm i's (subjectively expected) payoff is now given by

$$\pi(\alpha_i, \beta_i) = (1 - \alpha_i)w_i - \beta_i(1 - \alpha_i)^2 + \varepsilon(\alpha_i), \tag{5.16}$$

where $\alpha_i \in [0, 1]$ is the fraction of the wage that firm i chooses to pay, and $\beta_i \in [0, 1]$ is the fraction of wage that firm i *believes* firm $-i$ is choosing to pay its own employees.[27] The term $\varepsilon(\cdot)$ is assumed to be an iid Extreme

[26] We omit here the interest rate r for simplicity.

[27] Note, in the previous section $\overline{\alpha}_{-i}$ defines *how the rest of the firms behave* on the

Value random process with stationary mean and variance λ^2. Given firm $i's$ belief about the other firm's wage payment, and given the distributional assumptions $\varepsilon(\cdot)$, Resnick and Roy (1991) have shown that with probability one, there is a unique value of α_i maximizing (5.16). We denote with $F(\alpha)$ the probability that such optimal choice of α_i is less than or equal to $\alpha \in [0,1]$. In particular, from the viewpoint of an outside observer, probability density of firm i choosing any specific payment level $\alpha \in [0,1]$ (conditional on β_i), following Ben-Akiva et al. (1985), is a probability distribution function whose density $f(\alpha|\beta_i)$ is the continuous version of the logit choice model:

$$f(\alpha|\beta_i) \propto \exp\left\{\frac{1}{\lambda}\left[(1-\alpha)w_i - \beta_i(1-\alpha)^2\right]\right\}. \tag{5.17}$$

By completing the square and factoring out all terms in the exponential that do not depend on α, one can re-express (5.17) as[28]

$$\begin{aligned} f(\alpha|\beta_i) &\propto \exp\left\{-\frac{\beta_i}{\lambda}\left[\alpha - \left(1 - \frac{w_i}{2\beta_i}\right)\right]^2\right\} \\ &= \exp\left\{-\frac{1}{2\sigma^2}\left(\alpha - \mu\right)^2\right\}, \end{aligned} \tag{5.18}$$

which is a univariate truncated normal distribution function with a location parameter $\mu = 1 - \frac{w_i}{2\beta_i}$ and scale parameter $\sigma^2 = \frac{\lambda}{2\beta_i}$. From (5.18), it is clear that the choice of α_i depends on what firm i believes the other firm is going to do. In particular, under mild regularity conditions (i.e., $\sigma^2 = const$ when $\lambda \to \infty$), it is easy to see that $\mu \to -\infty$ as β_i becomes smaller. Similarly, $\mu \to 1 - \frac{w_i}{2}$ as β_i approaches 1. On the other hand, as the variance of the random process $\varepsilon(\cdot)$ vanishes, the density $f(\alpha|\beta_i)$ becomes more and more concentrated on the value $\alpha_i = 1 - \frac{w_i}{2\beta_i}$, which is the *reaction function* in the deterministic utility framework (5.9).

market. In the current section this assumption gives us an additional advantage. Namely, when we talk about beliefs, it is quite reasonable to assume that for any player it is easier to think of what would be the average behavior of market participants instead of guessing an individual behavior of every participant. Therefore in this section, without any loss of generality, we introduce believes β_i and consider only two participants $i = A, B$.

[28] See Anderson et al. (1998).

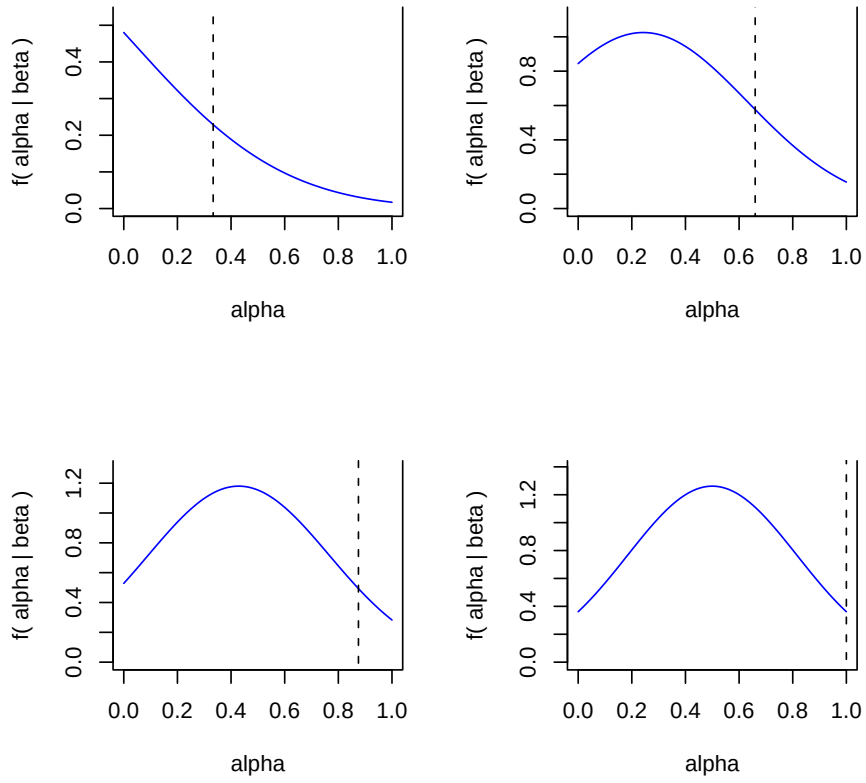

Figure 5.4: Probability density function characterizing the choice of α_i. Naive expectations equilibrium.

The behavioral pattern resulting from (5.18) is depicted in Figure 5.4 assuming $w_i = 1$ and $\lambda = 0.2$. Each panel in Figure 5.4 is the truncated normal distribution from a different value of β_i (indicated by a vertical dotted line). Notice that the density $f(\alpha|\beta_i)$ is always unimodal, with the most likely value of α_i predicted by the model lying always to the left of β_i. Moreover, whereas $f(\alpha|\beta_i)$ has an interior mode if $\beta_i > \frac{w_i}{2}$, it is monotonically decreasing on $[0, 1]$ if $\beta_i \leq \frac{w_i}{2}$.

To summarize, the logit-choice function $f(\alpha|\beta_i)$ describes the likely behavior of firm i conditional on β_i: For each arbitrary belief that firm i may entertain about behavior of the other firm, it gives the probability density

function, with which an external observer may predict the choice of α_i. This approach is also sometimes called a *naive expectations* equilibrium.

5.3.2 Rational Expectations

In the previous section we have demonstrated a simple kind of behavioral prediction given by the naive expectations equilibrium. However, in order to make a more sensible prediction regarding α_i, we have to impose additional restrictions on the formation of beliefs, β_i. Restricting beliefs usually relies on the so-called *rational expectations* equilibria. "A rational expectations equilibrium" for a two-player game "with a random utility specification yields the Logit Quantal-Response Equilibrium" (McKelvey and Palfrey, 1995).[29] Therefore, in what follows we rely on QRE, which imposes rational expectations. In particular, under the assumption of common knowledge and symmetry of (5.16), we assume that, in equilibrium, beliefs are equal to the actual expected value of the other firm's choice:[30]

$$\beta_i = \mathsf{E}\alpha.$$

Thus, β_i is the result of solving the recursive functional equation

$$\beta_i = \int \alpha f(\alpha|\beta_i) d\alpha.$$

Although it is not possible to obtain a closed solution for β_i, its value can be obtained numerically for different parameter constellations (λ, w_i). Moreover, regarding (5.18) it is clear that $f(\alpha|\beta_i) > 0$ for all $\alpha \in [0, 1]$, it must also be the case that $0 < \beta_i < 1$, i.e., extreme beliefs cannot be sustained in equilibrium.

[29] See Gonzalez et al. (2005).

[30] This reference "solution" may let us to define "the parameters of the underlying" payoff "function" by assuming "that primitive beliefs and beliefs about" payments are "correct", and it is "common knowledge" (Gonzalez et al., 2005).

5.4 Concluding Remarks

In this work we focus on the group behavior and social norms framework in the labor economics context. Under scrutiny is the manager, who reneging on the contractual agreements, decides which part of the wage to pay and which part to delay. We introduce a social norm *to pay the whole promised wage* which moderates manager's behavior by decreasing the gains if she pays less than the norm's level. Such setting also demonstrates that interaction of the social norm and group behavior either alleviates the manager's losses or magnifies them. This interplay, in its turn, brings about different equilibrium levels of wage payment. Different equilibrium levels mean that the equilibrium "to pay", the equilibrium "not to pay" and the intermediate payment equilibrium, are all theoretically possible. The simulation illustrated in figure 5.1 reveals that there might be a significant increase/decrease in payments despite insignificant changes in average market payments. The outcome gives a possibility for a dynamic payment consideration since, for example, it might only need a small number of firms that start paying to leave the low payment equilibrium. In short, the analysis demonstrates how the group behavior affects individual actions.

Finally, by extending the analysis to the perturbed game in which preferences are subject to a noisy process, we have shown that subjective beliefs about what other people do can dramatically affect individual behavior. Our model therefore makes probabilistic predictions about paying behavior, which is positively correlated with subjective beliefs about what others do. This holds even if each player acts deterministically (i.e., always choosing the best response to the expected behavior of others). Moreover, although arbitrary beliefs can sustain all kinds of rationalizable equilibrium behavior, the imposition of rational expectations can effectively identify a unique Bayes-Nash equilibrium. In spite of its obvious lack of realism, this assumption is useful as a benchmark for selecting among the various equilibria that result in the deterministic (i.e., unperturbed) game.

Summary and Conclusions

Putting the finishing touch on the thesis at hand, we find it useful to summarize the topic and somewhat to evaluate the results of the work. As mentioned in the introduction, it is only in the past couple decades that deferred compensation has been taken by labor economists into closer consideration. Lazear (1990) remarked that, the studying of this compensation form was earlier a realm of financial specialists who mainly considered different "forms of deferred compensation" as a "tax-free saving" routine. According to his arguments, despite the importance of the financial facet of the issue, the "labor-oriented aspects" of deferred arrangements have to be analyzed and "understood".

In the present research, therefore, our main purpose has been to shed new light on some important labor economic aspects of deferred compensation provision. More precisely, we wanted a better understanding of the issues related to labor contracts and the provision of deferred compensation. The specific focus was the implication of the bargaining activities between firms and workers for deferred payments. In contrast to the canonical literature, we concentrated here on bargaining at the individual level, which allowed us to focus on the trade-off between cash and deferred compensation within the compensation structure. This approach let us not only address the problems in question using standard economic techniques, but also employ the methods of experimental economics in order to provide a new perspective on the behavioral as well as psychological aspects related to deferred compensation. The important feature of our work was that we defined the risk notion as a fundamental issue that goes through the deferred compensation plans (Tauber et al., 2002). Risk in our framework implies that an employer may,

e.g., go bust and, as a consequence, deferred payments may never be paid. For this reason we introduce the risk concept into bargaining over deferred compensation and analyze this framework in chapters 2 through 4. Additionally, chapter 5 shows how an anomalous form of deferred compensation may appear without bargaining. The following summary demonstrates in more detail the dimensions where we have managed to develop our initial ideas.

Chapter 2 introduces our theoretical model of bargaining over deferred compensation. It also gives the understanding of deferred compensation as a retention mechanism. We analyze here an employer-employee relationship affected by liquidity constraints. More specifically, we examine the circumstances under which an employee with reduced salary decides either to stay with or to leave an employer who faces financial constraints. Our model predicts a bargaining outcome and shows that it is possible to renegotiate the initial contract substituting current payments with deferred payments in order to keep the employee and to try to avert bankruptcy.

In chapter 3 we used a laboratory experiment to illustrate our theoretical model of deferred compensation bargaining developed in chapter 2. Our main interest was to see how the parties coordinate on the division of deferred benefits in the uncertain environment and whether our theoretical model gave a good prediction. The result obtained in the experiment only partly reflects the standard (selfish) theory prediction. Therefore, to explain our results we include some psychological aspects of human behavior into the discussion. In particular, we assume that along with pure economic preferences, people possess some social ones, namely, preferences for fairness and inequality aversion. As a result we find that in the noncooperative structure of the game, players in the laboratory behaved rather fairly and cooperatively, expecting from their fellow players a similar kind of behavior.

As a next step, chapter 4 continues the line of arguments and shows to which extent the cooperative type of behavior affects the provision of deferred compensation. Particularly, we consider the firm's efforts *to avoid* bankruptcy and the worker's efforts *(not) to shirk* to play an important role in deferred payment arrangements. We concentrate on how the potential bankruptcy and parties' behavior can affect the trade-off between base

payment (wage, salary) and deferred compensation (pensions, stock options, etc.). The results provide an interesting perspective on the relationship between bargaining and individual behavior as well as on the trade-off between cash and deferred payments.

Finally, the last chapter 5 explains how some anomalous forms of deferred compensation may appear without bargaining: We focus here on wage arrears. In contrast to the standard views on wage arrears, the chapter employs here the theory that interprets wage arrears through behavioral context. In particular, we examine how group behavior and social norms can determine the size of wage payments. The approach brings about a solution concept, different from the standard economic perspectives, allowing for several degrees of wage payments in equilibrium. Furthermore, we derive a sequence of quantal response equilibria (QRE) of the game with noisy payoffs. Such QRE can be interpreted as an equilibrium selection device for the original game as the payoff-variance vanishes.

As we can see, the thesis at hand addresses the issue of deferred compensation in a broad and flexible framework. Nevertheless, some limitations of the work should still be mentioned. First of all, in the context of modelling, we have to accept the restrictions of the Principal-Agent paradigm, which is used in the most of the thesis at hand. More specifically, our bargaining models are mainly limited to the individual behavior of *small number of agents*, basically just to two. Hence, in order to say more about collective bargaining (which is another common bargaining framework), the structure of our analysis has to be slightly changed. Furthermore, it would have been also difficult to go further without defining the *bargaining structure*. In this context, the analysis of bargaining within asymmetric information framework, however, is very complicated. For this reason, there is no clear common consent among scholars on which equilibrium notion should be chosen.[31] According to Salanie (1997), the Principal-Agent framework is, therefore, a tool that helps to somewhat overcome these impediments. It offers, e.g. either to allocate "all bargaining power to one" of the parties, or to consider bargaining within the framework of symmetric information. Such an approach

[31]See for more details Osborne et al. (1990), Binmore et al. (1992), and Salanie (1997).

allows for simpler analysis, yet it is clear that bargaining in reality is far more intricate. More generally, we have to accept that the Principal-Agent framework is rather an "extreme" and therefore frangible "theoretical modelling" approach (Salanie, 1997).[32] Another important issue worth mentioning is using the experimental approach in chapter 3. In spite of the numerous publications with experiments in recent years, the approach itself still stays very contradictional for a few reasons. The most frequently mentioned reasons are related to a "potential subject pool bias", a small "number of observations", and the "validity" of the experimental results (see e.g., Falk and Fehr, 2003). Keeping these limitations in mind, we still use the experiment in the current work and justify it with the arguments of Falk and Fehr (2003).[33] Among the biggest advantages of economic experiments, authors name the possibility to "control" over parameters, which otherwise would be overlooked.

Finally, throughout the thesis we have used a general term *deferred compensation* and mentioned only secondary its more specific appellations like options, pensions, etc. Although this approach helped us to concentrate on the common properties of different delayed-compensation arrangements, it is clear that they can be unified only to a limited extent. A lot of deferred compensation profiles are the product of the "arm's-length bargaining" between management and employees (Allen et al., 1976; Tauber et al., 2002; Bebchuk et al., 2004). Therefore we consider the results of the current work rather as a generalization at the theoretical level. From this perspective, the logical extension of the research would be to consider in more detail the differences between the specific forms of deferred compensation both at theoretical and empirical levels. In general, giving answers to some important questions, the thesis suggests that there is a number of issues that have not yet been examined in the literature. It is clear that more studies are needed in order to better understand the role of deferred compensation in labor contracts. The interrelation of seniority and compensations, therefore, represents an important and challenging issue for further research.

[32]See more on Principal-Agent paradigm, e.g., Sappington (1991), Salanie (1997), Laffont and Martimort (2002).

[33]In this work authors broadly discuss and justify using economic experiments in labor economics.

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Ich versichere, daß ich diese Dissertation selbständig verfaßt habe. Bei der Erstellung der Arbeit habe ich mich ausschließlich der angegebenen Hilfsmittel bedient. Die Dissertation ist nicht bereits Gegenstand eines erfolgreich abgeschlossenen Promotions- oder sonstigen Prüfungsverfahrens gewesen.

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