

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)*

Over the past several decades, public attention to compensation arrangements of all possible types has dramatically increased. This tendency has been also shared by the deferred compensation arrangements. 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 (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. Among the most commonly observed are pensions, insurance, shares, and stock options. Practically all deferred compensation schemes have one specific trait: Their expected benefits depend on the success of the firms, risk taking attitude, and the fact that the employees remain attached to the firm

in the future. There is, therefore, a common trouble with all deferred payments, namely, that they may never materialize. Firms may default on their deferred compensation plans. A firm can reduce benefits by moving from one compensation scheme to another; avoid deferred liabilities through bankruptcy and firing employees, or simply by reneging on its promises (Askildsen et al., 2003a). Recent corporate and accounting scandals, followed by striking bankruptcies where rank-and-file employees lost their retirement income, illustrate this (e.g., Enron, United Airlines). These scandals have promoted a wave of activities aimed, among other things, at reforming the corporations' codex of conduct. Of these, the issues related to deferred compensation took the central role.

At the same time, while there are many reasons why companies have been so successful over the last two decades, it is no coincidence that the upswing has occurred at the peak of the shift in pay from cash to deferrals. In stark contrast to the situation 20 years ago, when, for example, most executives were rather paid like bureaucrats and behaved like bureaucrats, modern executives are much more likely to be paid like owners and behave like owners (Hall et al., 2003). In other words, it is difficult to exaggerate how much deferred compensation has changed corporate governance. But has the change been for better or for worse? The long term effect of deferred compensation on employment relations stays 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 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.

Indeed, bargaining over a contract with deferred payment involves a com-

plicated trade-off between deferred compensation and cash payments. However, the standard firm-union bargaining literature¹ – being mostly elaborated when the biggest component of compensation was cash in the form of salaries and bonuses – does not pay attention to the issues related to deferred compensation provision. Now the compensation structure is different. Many compensation plans to a great extent include either long-term or short-term deferred payments. Bargaining *per se*, therefore, should 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 to address the problems in question using standard economic techniques, but also to 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 economics²: Employer - employee relations, contract structure, and organizational behavior are inherently economic issues which should be addressed using economic tools, rather than psychological and sociological tools.

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

²See Lazear (1995).

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 the broad sense, the term deferred compensation defines all arrangements by which the payment to employees for past or ongoing work is postponed. The deferral involved may be short time or long time one, for example until retirement. Therefore in the literature deferred compensation plans are often referred to as a *seniority pay*.

Seniority Pay. Scientists have long noticed that wages increase with time. The standard interpretation for this correlation stems from the human capital model, which hypothesizes that workers become more experienced, and therefore enhance their productivity with age. As a result, they are paid more compared to the past periods. Another explanation for the positive correlation between seniority and wage increase was put forth in the 80s (see e.g., Lazear, 1979, 1981³; Hutchens, 1989). This approach argues that, if it is costly to monitor workers, seniors receive wages which are above their Marginal Revenue Product (MRP). Alternatively, younger workers are compensated less than their MRP (McConnell and Brue 1992, Cahuc and Zylberberg 2004). As Lazear (1995) states, this kind of payment scheme is to some extent very similar to a piece rate.⁴ He says, that a worker is compensated on the basis of his/her performance. There are two differences between them, though. First, the evaluation period for delayed-payments compensation schedules is usually longer compared to the evaluation period

³In these works, the deferred compensation mechanism was first discussed.

⁴For more details on piece rate pay see e.g., Gibbons (1987), Lazear (2000), Carmichael and MacLeod (2000), Gneezy and Rustichini (2000).

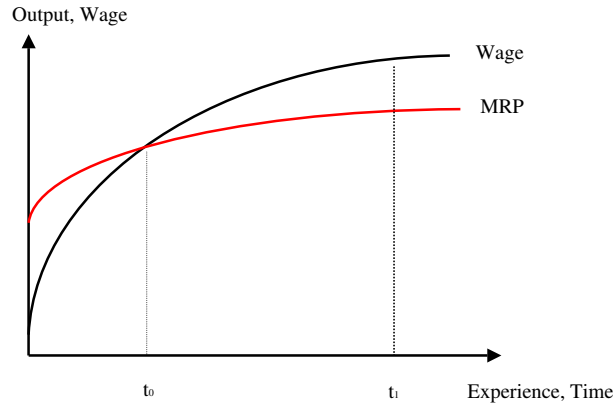


Figure 1.1: Deferred compensation profile (*Source: Lazear, 1998*).

in piece rate pay. Generally, the interval can be a year or even a number of years. For this reason, using a deferred compensation profile may be compared to using a piece rate where the evaluation period is very long and observations are scattered. Lazear, therefore, 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 major difference between deferred plans and piece rates, as stated by Lazear, is that the employment relations must exist to have the deferred benefits realized. In case of piece rate pay the worker's past performance is rewarded without being contingent upon future employment. Conversely, for deferred compensation profile, the worker must stay with the firm and the firm must exist so that the rewards for good performance in the past could be paid. A typical deferred compensation profile is illustrated in Figure 1.1. Note that although the wages of the workers are less than MRP in the beginning of their career, they rise above it in the later periods of tenure.

Incentives & Retention. The reason why a firm and its workers come out with a *deferred payment scheme* is that both parties can benefit from such arrangement.⁵ From the firm’s point of view, this pay scheme may be the most convenient way to deter shirking when controlling is expensive (*incentive role*). The worker is restrained from shirking because finding out and dismiss would mean that he/she might lose the accrued seniority pay. Therefore, the worker would rather work diligently to stay employed and acquire the deferred benefits: Earnings above his/her marginal product. Deferred pay can also reduce employee turnover (*retention role*). Workers who leave their jobs forfeit the rights to obtain deferred benefits (McConnell and Brue 1992). From the worker’s point of view it might be even preferable to have the increasing wage profile, e.g., as a form of compulsory saving, or as an sign of career advance.⁶

Finally, the reduction of principal-agent problems, brought about by the deferred payments arrangement, increases the worker productivity. The productivity rise is, in turn, provides additional gain, allowing the firm and workers to increase their earnings. Basically, 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, in the long run, allow higher income (McConnell et al. 1992, Cahuc et al. 2004).

⁵See Lazear (1979).

⁶See, e.g. Frank and Hutchens (1993). 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/her wealth to allocate to current consumption and how much to invest for future consumption, see e.g. Merton (1978).

Promises and Risk of Bankruptcy. The deferred compensation scheme shown in figure 1.1, is basically 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 law (McConnell et al. 1992, Cahuc et al. 2004).⁷ In contrast to explicit contract, which is enforced by third party, implicit contract is self-enforcing. In the manner that 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. (Allen et al., 1976, p.352)

Consequently, one important drawback of deferred compensation agreements is that employee has not much confidence that the employer will be financially able to comply with promises made, when the performance date arrives. Therefore the *risk concept* is possibly the most essential perspective that cuts through all deferred compensation profiles. Risk in this case

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

specifies that an employer may become bankrupt and, as a consequence, expected gain will be lost (Tauber and Levy, 2002). Such risk insignificant for big employers. However, small companies (e.g., start-ups) very often use deferred payment arrangements (i.e., stock options) to attract and retain qualified personnel.⁸ At the same time, paraphrasing Lazear (1998), if business conditions turn bad, any firm may end up going bankrupt, defaulting on its promises to workers. He says that even large firms cannot take into account all exogenous factors that might cause the bankruptcy. The employees, therefore, must have some assurance that the deferred rewards will finally be paid. At least, they have to have some confidence and trust in the employer's liability before accepting tempting but risky financial promises.⁹ Lazear puts it 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, on the other hand, must care about his/her reputation in order to be willing to engage into an arrangement that may exist much longer than the factual time of worker's employment. A good contract – though of no small account – can not, by itself, help to prevent possible future conflicts. Although the parties would not purposely contract for a hypothetical lawsuit, many agreements (especially those of long continuance) end up in court. Trust, honesty and good faith then, may be equally valuable as the accurately prepared document (Tauber and Levy, 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 with the

⁸This is because deferred payment, or the promise to provide it, requires no cash.

⁹Not risky promises might be too expensive for employers to give.

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 treatise through four consequent steps. First, we introduce a theoretical model of bargaining over deferred compensation. Second, we complement the model with 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 looks as following:

Chapter 2 introduces our modelling approach.¹⁰ 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 a well-known theoretical question, but also appears to not always be consistent with many empirical studies), the retention justification has not yet received much attention, however it is consistent with many of the facts. Therefore, in this chapter we offer more theoretical facts and shed additional light on deferred compensation and its retention role.

¹⁰This chapter is also issued as a working paper Gonzalez, L. and Gurtoviy, R.: 2004, How Much to Pay in Cash? Employee Retention via Stock Options. Max-Planck-Society, working papers series (24).

More specifically, we analyze employer-employee relations affected by liquidity constraints and salary reduction. We examine the circumstances under which employees involved in these forms of adjustment decide either to stay with or leave an employer who faces financial constraints. The main interest is the optimal combination of cash and deferred compensation (stock options, equities, etc.) 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 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-payments arrangements, as well as other compensations based on firm performance, may help companies to design payment schemes that will retain workers who are facing fluctuating market wages, especially if the costs of employee turnover are high. 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 see that, we implement bargaining over a compensation package which consists of deferred compensation and immediate cash payment (base wage). As a result, parties bargain over deferred benefits taking into account some fixed 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). We provide additional experimental evidence suggesting that powerful non-pecuniary motives also shape the behavior of people in the 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 future behavior affect the provision of deferred compensation. This is true due to the role that bankruptcy risk plays in delayed-payments arrangements.

In order to outline risk concept in deferred compensation arrangements, we use pensions as a specific example and discuss how bankruptcy can affect the delivery of pensions: We outline the background and provide some real life examples. While defining the bargaining model and explaining its assumptions, we demonstrate how it encompasses the classical models of firm-union bargaining to tie up commitments and the provision of deferred compensation. We adjust the approach suggested by Askildsen et al. (2003a,b) to consider bargaining process at the individual level (employer-employee), and to include parties' behavior. The approach allows to show how the risk of bankruptcy can affect the trade-off between base payment (wage, salary) and deferred compensation (pensions, stocks, insurance, etc.). Although it is well established in the literature on bargaining that wage provision depends on the distribution of bargaining power, it can be shown that in the case of bargaining over deferred compensation, commitments from both parties to

the cooperative kind of behavior generally play more important role.

The results provide interesting insights into the relation between the provision of deferred compensation and the role of commitments. Basically, they show that it is not bargaining power *per se*, but also commitments of parties which make the bargaining power be efficient. 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 lack of commitments, contract enforcement, and payment discipline may create the non-contracted form of deferred compensation – wage arrears, the late or non-payment of wages.

A large stream of empirical studies made in the 90s explains wage arrears as a flexible way for firms to decrease labor costs while experiencing negative economic shocks. In this chapter, however, we follow the alternative approach that views wage arrears through their acceptance as a form of group behavior within local communities (see Earl et al., 2004). We extend the framework which demonstrates how socioeconomic environments can affect individual managerial decisions concerning wage delays. In particular, referring to the effects of group behavior, we offer a model to analyze the motives of firms not to pay their employees for the work they have performed. We also stress the role of social norms in the incidence of wage delays.

The main result 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 and that it is only a matter of social processes to bring the firm into one of these equilibria. The analysis also demonstrates how group behavior affects individual choices. Apart from creating economic incentives, it also shapes different social frameworks, which in their turn influence individual behavior. As a second step in this chapter, we apply a Random Utility Approach to select among multiple equilibria, which are normal outcomes 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

Although punctual payment of wage obligations is a standard part of most employment relationships in developed economies, instances of unpaid, delayed, deferred, or reduced wages may occur in firms under financial stress, e.g., firms about to shut down, start-up companies with severe liquidity constraints, or firms with bankrupt debtors (Earle and Sabirianova, 2002). Urged by cash constraints, firms seek to renegotiate the labor contracts and design compensation schemes that allow to defer their payment obligations. *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 of the possible solutions is to substitute a claim on the firm's future profits for current payments. This may help not only to avert bankruptcy but also to prevent employees from leaving their jobs until recovery of liquidity takes place.

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 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 a lack of 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.

Indeed, non-vested stock option grants are one of the most practiced forms of deferred compensation for high-skilled employees. Oyer (2004) and Oyer et al. (2005) say that whereas any form of delayed-payments arrangements makes employees be reluctant to quit, stock options are most convenient in this case: If stocks and markets are correlated, stock options help to keep employees' deferred compensation equal to their outside options. 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 firms issue stock options not only to top executives, but also to all high-skilled employees (Oyer and Schaefer, 2005). Moreover, quite a few authors (e.g., Core and Guay, 2001) observe a greater use of employee options in firms facing financial constraints. Although employees are not always the cheapest source of credit for a firm facing cash constraints, other stock option effects of make this practice common. In particular, equity payments may motivate employees to exert a higher effort, improve a firm's ability of to attract skilled employees and help to retain them. If the motivational (or incentive) role of stock options is a well-studied theoretical issue, the attracting-retention role of stock options has not yet received enough attention, however is consistent with many of the facts. 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 keep employees from leaving their firms when their outside options rise. Therefore, this kind of equity compensation can be used in companies where human capital has a particular value; in companies with cash constraints, high financial needs, and difficulties with attracting credits.

In the empirical literature, the retention role of stock options has already attracted some attention. For instance, according to Oyer (2004), stock options and other forms deferred compensation arrangements 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 wages change grow (fall down) rapidly; if costs of replacing personnel and turnover are high; and if the economy conditions change fast.

Oyer's (2004) approach basically says that firm has mainly three possible

strategies to form its compensation policy. First, the firm can renegotiate compensation package always when 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, this, in turn, makes them be "attached" to the firm even if the outside opportunities get better (Chang, 2001).

The latter case is the focus of this work. Although the topic is somewhat 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.

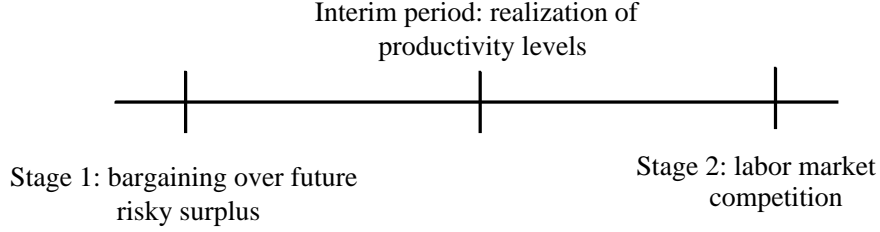


Figure 2.1: Time sequence of the game.

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).¹ 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

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

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

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

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 $\mathcal{L} = \{1, \dots, n\}$) 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, \dots, 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.² 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 ³ 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

²For instance, this is usual practice in the production of software and consulting services.

³Firm F may or may not exist in stage 2, depending on whether the employee E was retained or not.

employee's opportunity-cost salary,⁴

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

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 Ew_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 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 $w_2 = \max \{p_F, p_{(2)}\}$, and any stock options (i.e., the share of the second stage profits) held by

⁴The 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.

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

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

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

$$EU^F = E[U_1^F + U_2^F] = E[-\alpha w_1(1 + r) + b(\alpha)S^*]$$

and

$$EU^E = E[U_1^E + U_2^E] = E[\alpha w_1 + w_2 + (1 - b(\alpha))S^*],$$

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, $\Delta E w_2$ (see expression (2.4)), are both not transferable to the firm. This means that the total expected utility of the firm is constrained by⁵

$$EU^F \leq ES^* - \alpha w_1(1 + r)\theta, \quad (2.2)$$

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

⁵In 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, $b(\alpha)ES^* \leq ES^*$.

most productive firm) in stage 2, and

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

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

The *limited liability assumption*, $EU^F \geq 0$, 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 ($EU^F > 0$), 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

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

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 $\beta(\alpha) = 0$.⁶

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, Ew_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):

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

Hence,

$$\Delta Ew_2 \equiv E(w_2|1) - E(w_2|0) > 0 \quad (2.4)$$

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

⁶Note 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.

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 $d = (d^E, d^F) = (E(w_2|k=0), 0)$ is the conflict payoff. Taking into account the *nontransferability* and *limited liability* assumptions, and defining $\tilde{U}^j \equiv E(U^j - d^j)$, $j = E, F$, we have

$$B_\alpha = \left\{ (\tilde{U}^E, \tilde{U}^F) : \tilde{U}^E + \tilde{U}^F \leq ES^* + \Delta Ew_2 + \beta(\alpha), \tilde{U}^F \leq ES^* - \alpha w_1(1+r)\theta \right\}.$$

Then the Nash bargaining solution with symmetric bargaining power

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

results in the following two cases :

1. Internal solution:

$$\tilde{U}_{int}^E = \tilde{U}_{int}^F = \frac{ES^* + \Delta Ew_2 + \beta(\alpha)}{2}, \quad (2.5)$$

implying

$$b(\alpha)_{int} = \frac{1}{2} + \frac{\Delta Ew_2 + \alpha w_1(1 + (1+r)\theta)}{2ES^*};$$

2. Corner solution:

$$\tilde{U}_{cor}^E = \Delta Ew_2 + \alpha w_1, \quad \text{and} \quad \tilde{U}_{cor}^F = ES^* - \alpha w_1(1+r)\theta \quad (2.6)$$

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

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

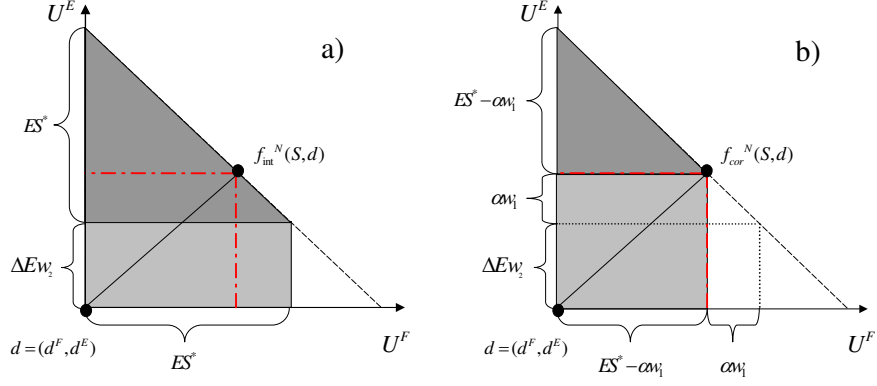


Figure 2.2: Nash bargaining solution for $\beta(\alpha) = 0$ ($r = r^*$). The shaded area is the bargaining set: a) Cash payments are equal to zero; b) Cash payments are equal to αw_1 .

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 \tilde{U}_{int} turns into \tilde{U}_{cor}

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

To put it differently

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

The solution, therefore, can be summarized by the compensation schedule⁷

⁷Note, it is easy to show that $\frac{1}{2} + \frac{\Delta E w_2 + \alpha w_1(1 + (1 + r)\theta)}{2ES^*} \leq 1, \forall \alpha \in [0, \alpha^*]$.

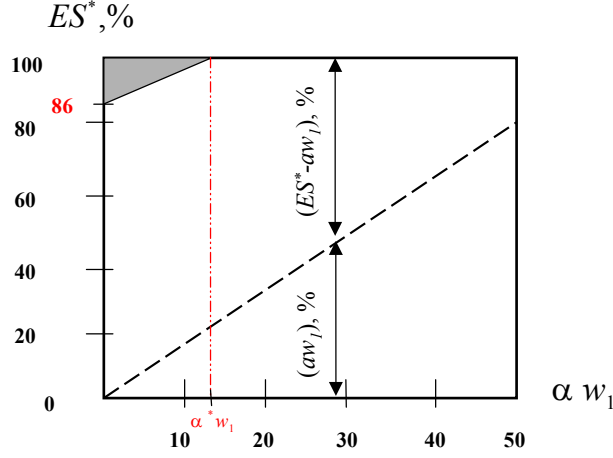


Figure 2.3: Predicted bargaining outcome according to the example parameters. The shaded area represents the employee's share.

$$b^*(\alpha) = \begin{cases} \frac{1}{2} + \frac{\Delta Ew_2 + \alpha w_1(1 + (1+r)\theta)}{2ES^*} & , \text{ if } \alpha \in [0, \alpha^*] \\ 1 & , \text{ otherwise.} \end{cases} \quad (2.7)$$

In order to illustrate our bargaining solution numerically, we construct the example depicted on Figure 2.3.⁸ 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

⁸The example is calculated according to the following parameters: $n = 1$, $p_F \sim \text{Uniform}[0, 200]$ and $p_1 \sim \text{Uniform}[0, 100]$; 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 $ES^* = 58\frac{1}{3}$; the employee's second period salary in case F stays in the market at the second period is $Ew_2 = 41\frac{2}{3}$, and $Ep_{(2)} = 0$ 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).

section discusses the bargaining outcome and its implication for retention in more detail.

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, $(1 - b^*(\alpha))ES^*$, 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

$$(1 - b^*(\alpha))ES^* \geq \alpha w_1,$$

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 first stage cash (αw_1) or as a second stage part of the profit $((1 - b^*(\alpha))ES^*)$. 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.

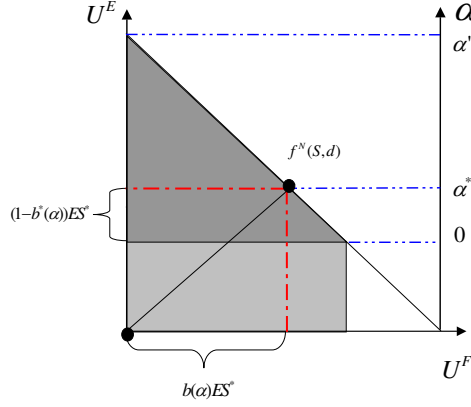


Figure 2.4: Different α in relation to the bargaining set.

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 $r > r^*$).⁹ Also, from equation (2.6), it is readily evident that cash payments higher than $\alpha^* w_1$ always decrease the firm's expected utility.¹⁰ 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 by $b^*(\alpha)ES^*$. It is straightforward to show that, for all values $\alpha \in [0, \alpha^*]$ the *limited liability assumption* holds

$$b(\alpha)ES^* \geq \alpha w_1(1+r)\theta, \quad (2.8)$$

⁹This and the following result we obtain as long as the firm's limited liability constraint is not binding ($EU^F > 0$).

¹⁰We neglect the case $r \leq -1$.

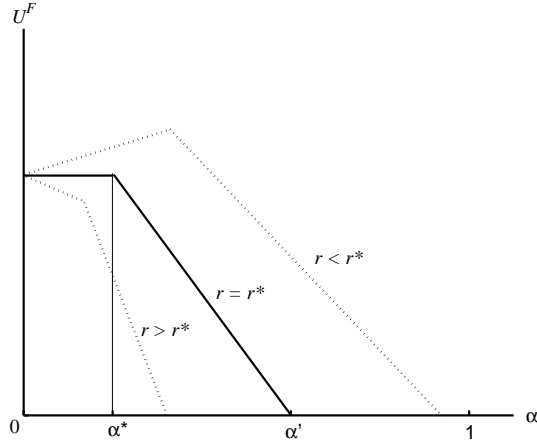


Figure 2.5: Firm's expected utility as a function of α .

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

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

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 (stock options), in order to prevent him from leaving.

The optimal combination of cash and deferred compensation derived in our 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 that results from F being able to bid for E in the labor market). 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 “*external*” 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 “*internal*” 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* $\text{Uniform}(0, P)$ 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 $\lim_{n \rightarrow \infty} \theta = 1 - \frac{P}{P_F}$.

To calculate the expected value of profits, ES^* , 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,

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

We now calculate the expected value of the employee's opportunity-cost wage, given that renegotiation succeeds, $E(w_2|k=1)$. 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 $Y_c \sim \text{Binomial}(n, \frac{x}{P})$. 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

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

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 compensation as well as some other performance based compensation may help companies to design payment schemes that can retain workers facing fluctuating market wages, especially if the costs of employee turnover are high.

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 for assumption, 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 Fishbacher 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 growing part of economic literature.

In essence, this chapter provides additional experimental evidence, suggesting that powerful non-pecuniary motives also shape 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) remarked that there is a great body of factual and experimental evidence which indicates a significant part of people exhibiting social preferences: Fairness, reciprocity, spitefulness, 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, depending on the situation, that relevant reference agents may be colleagues in the firm, relatives, partners, neighbors, etc. Following the way of research, suggested by the authors, we pick out one type of social preference that is particularly important for our study – the preference for fairness.

In Fehr and Schmidt (1999, 2003), the authors make a scrupulous survey and give many examples, which show that people are more socially fair than is usually assumed in the standard self interest models: People pay their taxes truthfully (e.g., Riedl and Tyran, 2003), vote (e.g., Aldrich, 1997), become members of unions and protest movements, or work honestly without considerable monetary incentives (e.g., Rehder, 1990).

The same survey says that in the labor relation framework there is also a lot of evidence indicating 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 controlled bargaining experiments, demon-

strating that a considerable part of the people does not care only about material payoffs but also take into account the fairness of payoff distribution (e.g., Güth and Tietz, 1990; Roth, 1995).¹

There are a number of papers that formalize the concept of fairness. First type of fairness models is classified as the equity models (see, e.g. Fehr and Schmidt, 1999, and Bolton and Ockenfels, 2000). These models are based on the assumption that fairness intentions are not behaviorally influential (*outcome-oriented models*). Second type of models (see, e.g. Rabin, 1993, Falk and Fishbacher, 2006) credits fairness intentions a central role (*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

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 said to be inequality averse if he/she does not accept payoffs that are viewed as unfair. According to Fehr and Schmidt (1999), such a point of view is based on a kind of 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.

¹For more extensive discussion and examples on fairness see Fehr and Schmidt, 1999, 2003.

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

³Falk 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).

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. The assumptions about reference outcome and reference groups for the experiment we make therefore taking into account the arguments made above. Paraphrasing Fehr et al. (1999) and Fehr et al. (2002), in the laboratory the subjects are equal, they do not know anything about each other, and they are allocated to different roles in the experiment by chance. Therefore, in this case it is possible to assume that the reference group is group of subjects playing against each other while the reference outcome is given by the egalitarian outcome. As far as 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 (in material terms) compared to the other players in 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 combination 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 given different transfers. These transfers occur before uncertainty concerning the size of benefits is realized. In the real world such 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 divers evidence of fair behavior and inequality aversion already constitute a part of the experimental literature, we present some new results with respect to how players coordinate in the world of uncertainty and risk. Moreover, we show the explanatory power 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 similar case. The authors note that in Nash's "demand game", two players simultaneously state their demands. 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 obtain an outcome that is consistent with cooperative bargaining solution, Nash introduces 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 as a way to reflect the risk which the employer has over her profit, it plays basically the same role as in the Nash's model (see Section 3.2.3 for

⁴See 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.

further details). The next section explains our experimental setting in full.

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 $60 \text{ ECU} = 1,00 \text{ Euro}$). 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).

⁵Taking 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.

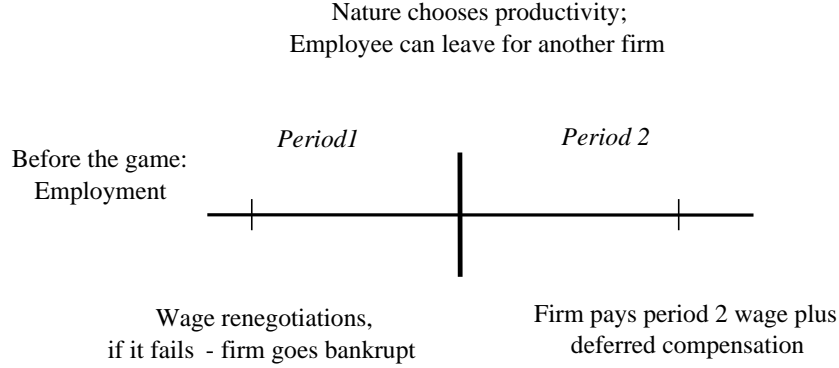


Figure 3.1: Timing of the model.

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 on top of the second period salary. The future profit (joint surplus) becomes available in the second period only 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,%”, \bar{d}_j , and a “Minimal Demand,%”, \underline{d}_j .⁷ At the beginning of every round each 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(%), \bar{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

⁶Since 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.

⁷In order to allow some additional level of coordination between players, two kinds 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).

⁸While 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.

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., $\bar{d}_F + \bar{d}_E > 100\%$ 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., $\bar{d}_F + \bar{d}_E \leq 100\%$ or $\underline{d}_F + \underline{d}_E \leq 100\%$), but the surplus is equal to zero ($p_F < p_{(1)}$):

$$\text{Payoff}_F = 0$$

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

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

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

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

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

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

⁹In 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.

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

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 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

In the following we derive the theoretical predictions for our experimental game. First, we shortly present the economic prediction based on the assumption that it is common knowledge that all players are selfish and rational, followed by the predictions based on the recently developed fairness theories.

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.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

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

¹⁰To 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.

¹¹Given the parameters of the experiment: $n = 1$, $p_F \sim \text{Uniform } [0, 200]$ and $p_1 \sim \text{Uniform } [0, 100]$, 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 $ES^* = 58\frac{1}{3}$; the employee’s second period salary in case F stays in the market at the second period is $Ew_2 = 41\frac{2}{3}$, and $Ep_{(2)} = 0$ otherwise (see Chapter 2, Appendix 1).

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

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

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

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

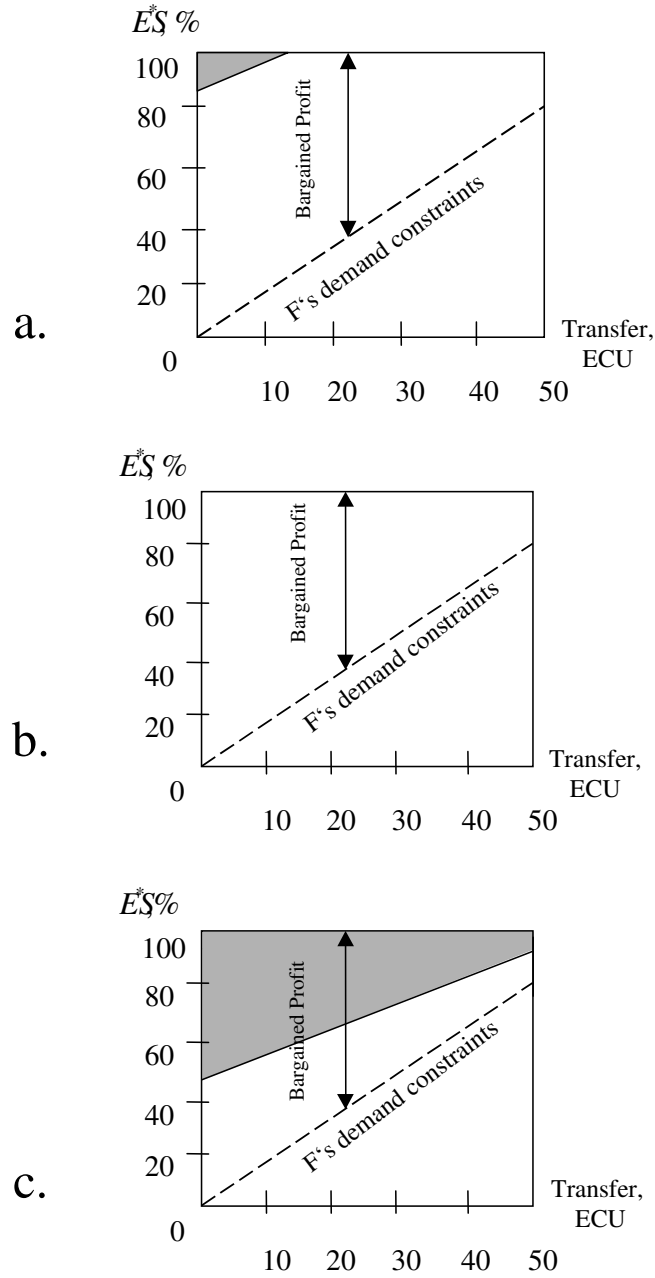


Figure 3.2: Expected division of the joint surplus according to the experimental parameters: a. Chapter 2's prediction (see Figure 2.3); b. Standard Theory; c. Fairness Theory. The shaded area represents the employee's share.

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, $ES^* = 58\frac{1}{3}$, 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

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

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

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

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

Correcting for the actual agreement rate, we end up with

$$\text{Expected Payoff}_E = 67, 34.$$

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

$$\text{Expected Payoff}_F = 13, 9$$

$$\text{Expected Payoff}_E = 65, 9.$$

Expected payoffs of the players in session 3 are

$$\text{Expected Payoff}_F = 16, 8$$

$$\text{Expected Payoff}_E = 68, 3.$$

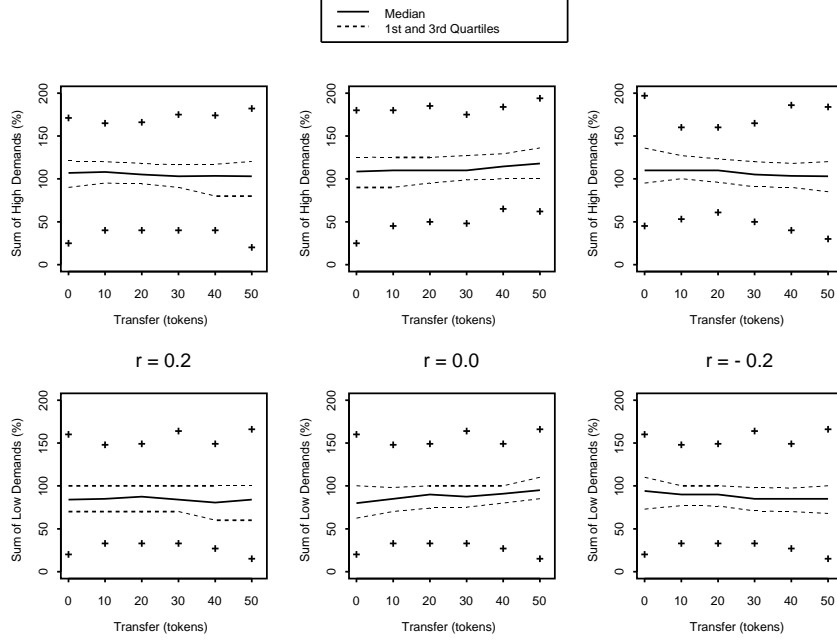


Figure 3.3: Compatibility of the demands for E - and F -players in each session.

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

Demand	Session 1		Session 2		Session 3	
	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.

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 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 sloping. 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 corre-

lated. For the firm, this correlation is highest in session 2 when it reaches 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

	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) .

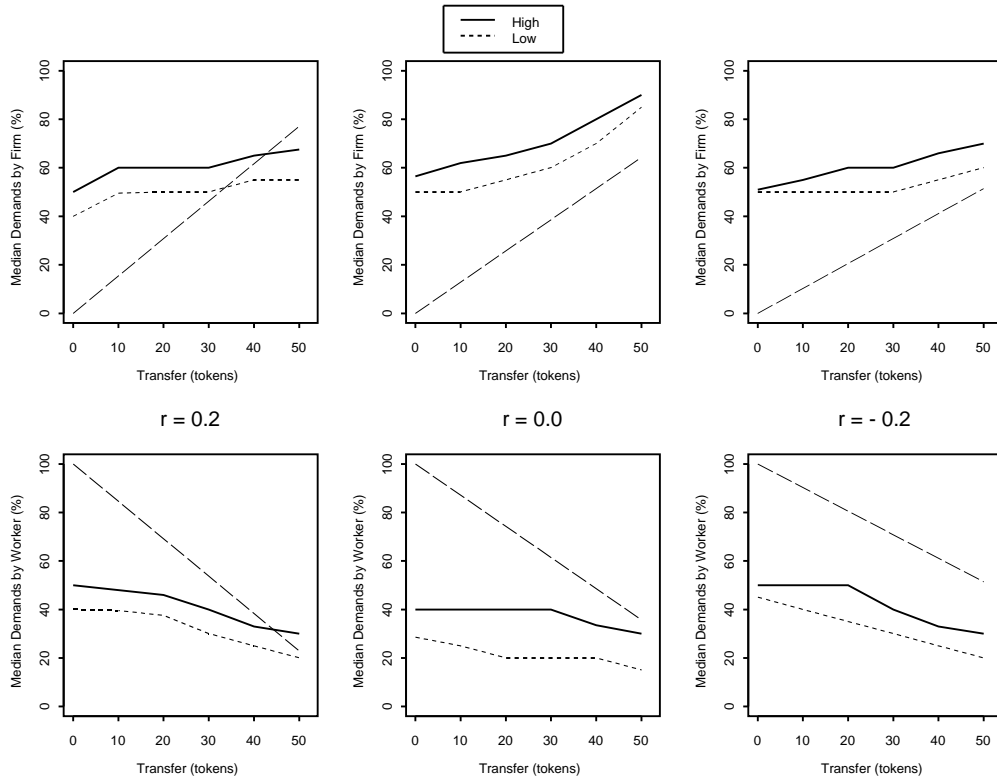


Figure 3.4: Median maximal and minimal demands made by F - and E -players in each session. The straight dashed line represents F 's demand constraint.

	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.

a tendency to equal division with respect to the bargaining set $-\theta w_1(1 + r) + ES^*$. 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 genau 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 Entscheidungen getroffen haben.

Die erste Nummer $P1$ kann zwischen 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:

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

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 bedeutet, 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. Mindestforderungen) 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 $Y = [\text{Transfer}] + P2$.

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

Auszahlung von $X = - [0,8 \times \text{Transfer}] + [\text{Gewinn} \times \text{höhere Forderung von } X]$,

$$\begin{aligned} \text{Auszahlung von } Y = & \quad [\text{Transfer}] \quad + [\text{Gewinn} \times \text{höhere Forderung von } Y] \\ & + P1. \end{aligned}$$

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

$$\begin{aligned} \text{Auszahlung von } X = & - [0,8 \times \text{Transfer}] + [\text{Gewinn} \times \text{Mindestforderung von } X], \\ \text{Auszahlung von } Y = & \quad [\text{Transfer}] \quad + [\text{Gewinn} \times \text{Mindestforderung von } Y] \\ & + P1. \end{aligned}$$

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

	Falls der Transfer gleich diesem Betrag ist...	0	10	20	30	40	50
Y :	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:

$$\text{Auszahlung des } X\text{-Teilnehmers} = -0,8 \times 10 + [80 \times 50\%] = -8 + 40 = 32$$

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

- falls der Computer einen Transfer = 40 bestimmt:

$$\text{Auszahlung des } X\text{-Teilnehmers} = 0,8 \times 40 + [80 \times 70\%] = -32 + 56 = 24$$

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

- falls der Computer einen Transfer = 0 bestimmt:

$$\text{Auszahlung des } X\text{-Teilnehmers} = 0$$

$$\text{Auszahlung des } Y\text{-Teilnehmers} = 0$$

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:

$$\text{Auszahlung des } X\text{-Teilnehmers} = 0$$

$$\text{Auszahlung des } Y\text{-Teilnehmers} = 30 + 40 = 70$$

- falls der Computer einen Transfer = 20 bestimmt:

$$\text{Auszahlung des } X\text{-Teilnehmers} = 0$$

$$\text{Auszahlung des } Y\text{-Teilnehmers} = 0.$$

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 future behavior efficiently affect the provision of deferred compensation. This is due to bankruptcy risk that plays an important role in deferred-payment arrangements.

Although the risk of bankruptcy is a well recorded phenomenon in the financial literature¹, 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 perspective that cuts across all deferred compensation profiles, i.e. that they might never become a real money (Tauber and Levy, 2002).² Several authors have paid attention to this issue, though. The works

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

²See Section 4.1.1.

by Curme and Kahn (1990), Lazear (1998), Orr (1998), Askildsen and Ireland (2003a,b), as well as a recent work by Friebe and Matros (2005), highlight the impact of a firm's probable failure on the propensity to offer delayed payments compensation schemes. This important aspect, however, has still not been sufficiently analyzed in the bargaining framework. Apart from the mentioned works of Askildsen and Ireland (which were so far unfairly overlooked), the attention to this matter is hardly paid. Therefore, one of the main tasks of the present work is somewhat to extend this research direction and to attract attention to this 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

The interesting issue is then what determines the compensation structure and, in particular the level of deferred payments. In line with 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, we demonstrate that although the compensation package can be agreed upon, the shares of the base wage and the deferred compensation in it may vary depending on the behavior of the parties. While the size of the wage depends rather on the bargaining power of the parties, the value of the deferred compensation is determined by the commitments of the parties to their behavior. As a result, the main focus of this chapter is the effect of possible bankruptcy, a company's efforts to avoid it and a worker's efforts

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

to find a new job on the compensation structure as an outcome from the bargaining.

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

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. To diminish a possible pressure on such pension arrangements, some countries allow for some 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 nearly always tax free; any other pension schemes outlays normally also have tax advantages. 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, 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. 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 fully or partly be lost). Recent financial scandals and bankruptcies of seemingly stable companies provide representative examples for understanding the risk of within-firm savings. In this context, the Enron crash is an allegory now, with its 20,000 employees who lost billions of dollars in their pensions plans after having been prevented by the company from selling Enron's shares.

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. According to the Employee Benefits Research Institute, many more large companies, where the stock is widely used, match employees' monetary contributions with company stock. 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, bringing negative returns for pension investments. The steel corporation LTV (with 200,000 pensioners) has filed bankruptcy, and if their request to shut down is fulfilled, then workers who have earned their pensions by decades will be 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 model⁴ 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 , on top of a second stage wage payment, which is normalized to zero. 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 (e.g. does not go bankrupt, etc.), 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 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

$$U_F = p(e)(Q - D) - w - \varphi(e) \quad (4.1)$$

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

In the model the employer and the worker bargain at the beginning of the first stage about possible employment. It is important to stress here that

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

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

⁶Efforts e and s can be observed as the costs of the firm for selecting out risky projects and as time which the worker spends to look for a job, respectively.

parties bargain over all individual variables (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, $\tilde{s} = \arg \max_s w_0(s) - f(s)$, i.e.,

$$w'_0(\tilde{s}) = f'(\tilde{s}) \quad (4.2)$$

with resulting conflict payoff,

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

Therefore, we ultimately define the workers's expected utility as⁷

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

where

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

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

In our structure the worker is risk neutral in terms of his current wage and risk averse with respect to deferred compensation. In other words, the worker is assumed to have risk aversion increasing with age. We assume $u(\cdot)$ to have following properties: $u' > 0, u'' < 0, u(0) = 0, u'(0) > 1$.⁸

⁷To 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 .

⁸The form of $u(\cdot)$ means that elders are loss averse. They have a significant loss from not having enough income, while there is only a small gain from having an income higher than they actually need. See, e.g., Askildsen and Ireland (2003a,b).

4.2.2 Bargaining

For labor relations, the economic literature defines two main models of bargaining. In these models either all relevant variables are determined cooperatively via bargaining (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 variables are excluded from the process of bargaining (in the standard literature it is usually employment), the firm determines them unilaterally thereafter.

We use these classical bargaining models in our framework to differentiate between two cases: When parties commit to their actions and when they do not commit. In the efficient bargaining setting all relevant parameters of the model are jointly determined by the firm and the worker. In other words, all variables are contracted and parties credibly commit to them. In the “right-to-manage” setting, the effort levels e and s , are left out. They are unilaterally 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 equation⁹

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

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

$$D^* : u'(D^*)p(e) = p(e) \Rightarrow u'(D^*) = 1 \quad (4.5)$$

$$e^* : \frac{\varphi'(e^*)}{p'(e^*)} = Q - D^* + u(D^*) - w_0(s^*) \quad (4.6)$$

$$s^* : \frac{f'(s^*)}{w'_0(s^*)} = 1 - p(e^*). \quad (4.7)$$

Note, that in the Pareto solution the relative 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 an additional unit of 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.

⁹Here it must be emphasized that the surplus maximizing outcome does not have to be efficient and optimal from the society's viewpoint as a whole. This statement comes from the definition of the joint surplus (4.4), and utility functions (4.1) and (4.3). This surplus can be considered as the gain from the firm's existence (Booth, 1995).

Efficient Bargaining

After maximizing the joint surplus, we continue with efficient bargaining, which gives an exact distribution of the surplus between the parties. 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 $d = (0, w_0(\tilde{s}) - f(\tilde{s}))$. 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

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

has the following form

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

Maximizing it with respect to the wage w (see Appendix 1), we obtain

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

The wage w^* turns out to be a convex combination of the firm's and worker's expected gains. Substituting w^* into the utility functions of the parties yields in turn

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

$$U_W^* = \alpha S(D, e, s) \quad (4.10)$$

and

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

$$U_F^* = (1 - \alpha)S(D, e, s), \quad (4.11)$$

This result means that the Pareto-optimal values D^* , e^* , and s^* also in the individual bargaining framework do not depend on the distribution of bargaining power. For this reason, the efficient-bargaining solution is Pareto optimal for any value of α . Only the wage alone shows the distribution of the actual bargaining power

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

The value of deferred compensation, D , however, 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. More precisely 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 relevant variables could be verified, 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

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

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

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 *current wage*.

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

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

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

$$\bar{D} : u'(D) > 1. \quad (4.14)$$

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

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

where

$$\Delta \bar{w}_0(s) = [w_0(\bar{s}) - w_0(\tilde{s})]$$

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

Finally, for the “right-to-manage” setting, the equilibrium values of the parameters $(\bar{e}, \bar{s}, \bar{D}, \bar{w})$ are given by equations (4.12), (4.13), (4.14) and (4.15), respectively.

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

$$e^* > \bar{e}. \quad (4.16)$$

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

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

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

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

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,*

$$\tilde{s} > \bar{s} > s^*. \quad (4.17)$$

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

$$\frac{f'(\tilde{s})}{w'_0(\tilde{s})} = 1.$$

Second, if the worker is employed and at the same time *does not commit* to his future behavior (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 $w'_0(\cdot)$

$$\frac{f'(\tilde{s})}{w'_0(\tilde{s})} = 1 > \frac{f'(\bar{s})}{w'_0(\bar{s})} = 1 - p(\bar{e}) \implies$$

$$\tilde{s} > \bar{s}.$$

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

$$\frac{f'(\bar{s})}{w'_0(\bar{s})} = 1 - p(\bar{e}) > \frac{f'(s^*)}{w'_0(s^*)} = 1 - p(e^*).$$

This last inequality follows from lemma 3 and $p(e^*) > p(\bar{e})$, as well as functional form of $f'(\cdot)$, $w'_0(\cdot)$, and $p(\cdot)$. Therefore, $\bar{s} > s^*$. Summarizing the

result from all inequalities, we end up with $\tilde{s} > \bar{s} > s^*$. ■

Finally, we come to the last important part of our study - the compensation structure. Let us see how the compensation structure looks in the case when the employer and the worker commit to their behavior and when they do not commit. Considering the values of the deferred compensation in (4.5) and (4.14) and from the concavity of the risk aversion function we can derive

$$D^* > \bar{D}. \quad (4.18)$$

To see now how the wage changes, recall that it is a convex combination of the employer's and the worker's expected gains. Therefore, to make the analysis easier, we compare equations (4.9) and (4.15) part by part

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

and

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

as a result we obtain

$$w^* < \bar{w}. \quad (4.19)$$

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

Proposition 1 *In the non-commitment case (“right-to-manage” bargaining) the employer exerts less effort to survive ($\bar{e} < e^*$) compared to the commitment case (efficient bargaining). At the same time, the worker increases his effort to find an alternative job ($\bar{s} > s^*$), and prefers immediate payment ($w^* < \bar{w}, D^* > \bar{D}$).*

The intuition is as following. When the employer is not constrained by a contract, she behaves without taking into account the interests of the worker. As a result, the deferred compensation is paid with less probability. Consequently, the decrease in the deferred compensation is substituted for the increase in the current wage.

At last comes the question, “to commit or not to commit”? The answer is rather ambiguous.¹⁰ Even if some effective way to commit existed, the decision of parties would be rather dependent on their utilities. For example, comparing employer’s utility, while switching from one bargaining setting to the other, we see that it can change in either direction.

$$U_F^* = p(e^*)(Q - D^*) - w^* - \varphi(e^*)$$

$$\bar{U}_F = p(\bar{e})(Q - \bar{D}) - \bar{w} - \varphi(\bar{e})$$

In the first term, the probability of surviving is higher in the case of efficient solution. However, net profit is higher in the “right-to-manage” case. The wage is also higher in the latter, whereas costs of efforts are higher in the former. Therefore, if $\bar{U}_F > U_F^*$, the employer would not agree to contract on efforts. Similar arguments lead to the same conclusion in the case of the worker.

4.4 Conclusions

In this 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

¹⁰In the same manner as in Askildsen et al. (2003a,b)

it was effort to avoid bankruptcy, for the worker – to find new job. The model's outcome shows players changing their efforts depending on the level of individual commitments. This result provides interesting insights into the relation between compensation structures and firm-worker behavior.

Namely, what matters is whether the firm and the workers are able to commit to their future behavior. In other words, it is not bargaining power *per se*, but also commitments of parties which make the bargaining power be efficient. This inference, supports the hypothesis that companies which operate in the more stable niches of business and have the higher probability of success, good performance and reputation, can offer their workers a compensation structure with the bigger part of deferred payments. On the contrary, companies which are engaged into risky adventures have to compensate the risk with higher level of base wage.

Although the presented framework is rather a reinterpretation and extension of the existing bargaining models, it helps us to illustrates 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 as well as on the trade-off between base wage and deferred payments.

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

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

Solving the logarithmic problem for w

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

we obtain

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

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

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

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

$$\begin{aligned} \frac{\partial S}{\partial D} &= p'(e)e'(D)(Q - D + u(D)) + p(e)(-1 + u'(D)) + w'_0(s)s'(e)e'(D) \\ &\quad - p'(e)e'(D)w_0(s) - p(e)w'_0(s)s'(e)e'(D) - \varphi'(e)e'(D) - f'(s)s'(e)e'(D). \end{aligned}$$

To simplify this FOC we can use (4.12)

$$\begin{aligned} \frac{\partial S}{\partial D} &= p'(e)e'(D)u(D) + p(e)(-1 + u'(D)) + w'_0(s)s'(e)e'(D) \\ &\quad - p'(e)e'(D)w_0(s) - p(e)w'_0(s)s'(e)e'(D) - f'(s)s'(e)e'(D). \end{aligned}$$

After rearranging we can write the equation in the following form

$$p'(e)e'(D)[u(D) - w_0(s)] + s'(e)e'(D)[w'_0(s)(1 - p(e)) - f'(s)] = p(e)(1 - u'(D)) \quad (4.20)$$

and following (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)

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

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

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

As a result equation (4.20) has a form

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

$\begin{matrix} & - & & + & & + \end{matrix}$

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

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 lack 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 accumulated for a number of periods (e.g. months, years).

The standard literature on wage arrears mainly considers this practice as a method of financial adjustment under liquidity constraints and difficult economic conditions. We follow here the alternative theory that explains

wage arrears as the form of group behavior within local communities (Earl et al., 2004). In particular, referring to the effects of group behavior, we explain the motives of the firms not to pay for the work performed by their employees. We also stress the role of social norms in the prevalence and tenacity of wage non-payments. This framework allows us to understand how community behavior affects managerial decision concerning wage delays.

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 (McKelvey 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 problem of late and non-payments was especially pronounced in many of the post-Soviet countries during the transition period and is still an issue for a number of them. The investigation of wage arrears began in the mid-nineties. The analysis was primarily carried out for the Russian Federation and the Ukraine. Therefore, we illustrate our study using examples and empirical investigations made in these countries.

The structure of this chapter is as follows. In the next Section we review literature and two alternative explanations for the existence of wage arrears: The standard and the behavioral approaches. On the base of the behavioral

¹See, e.g., Huck, Kübler and Weibull (2003) for an explanation of social efficiency from the social-norms perspective; for general survey see, e.g., Elster(1989).

approach in Section 5.2 we develop our theoretical model. In Section 5.3 we present a perturbed game and equilibrium selection method. Summary of the work and conclusions are made in the last section.

5.1 Wage Arrears: Alternative Views

The hard time of 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 total wage debt in the Commonwealth of Independent States (CIS) came practically to more than 10 billion USD (ILO Newsletter 2-96).

In Russia and Ukraine the topic of wage arrears was particularly alarming.² Workers of all ages, from all regions and almost in all industries experienced wage delays. According to the results of the Ukrainian Enterprise Labour Flexibility Survey, in 1999 more than 80% of all enterprises stated some problems with punctual payment of wages. Public sector economy (e.g., education, pensions) was more affected than private sector (i.e, pension arrears had reached 500 million USD by August of the same year). However in both sectors the problem was equally severe (Standing and Zsoldos, 2000).

The picture looked similarly grave also in Russia. The wage debt amounted to around 8 billion USD in 1998. 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

²Unfortunately, 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. Moreover, countries in different parts of the world like Italy or China also have experienced wage arrears.

in public sector, for instance, as well as retired people were not paid during a number of months (in some cases even years). The use of wage arrears had taken the form of a “standard”, widespread labor cost adjustment instrument. 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 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 demand downturn and, as a result, production decline; the debts created within the economy, as well as monetary compensation replaced with barter. One more important reason is 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 governments could not pay public workers and pensioners. Furthermore, wage arrears seem to have been used as a governmental instrument of inflation deregulation.³ Additionally, the rapid price increase has also to some extent generated non-payment of wage. Finally, the monopsonistic position of some companies on the local labor markets significantly aggravated the problem of wage non-payments via lowering outside opportunities for their employees.⁴

All these problems made firms not only use the “standard” cost adjustment mechanisms (e.g., wage reduction, dismissing) but also postpone wage

³ “*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).

⁴ See Gryshyna (2001) for detailed analysis of the wage arrears determinants in Ukraine.

payments. Hence, reducing labor costs under negative economic shocks became considered as the main argument of why wage arrears has spread out in the post-Soviet countries.

5.1.1 Standard Approach

A big stream of empirical studies made in the 90s considers wage arrears as a flexible mechanism to reduce labor costs (see e.g., Layard and Richter, 1995, Alfandari and Schaffer, 1996; Desai and Idson, 2000; Lehmann et al., 1999).⁵ More precisely, this literature regards wage arrears as an *appropriate* mechanism even in spite of its illegitimate nature. Paraphrasing Earle, Spicer et al. (2004), the reason for this is as follows: The standard economics defines wage robustness as a main reason for unemployment; hence, when the degree of wage flexibility is determined by the wage sensitivity to economic shocks any adjustment instrument that increases wage flexibility can be of a big help.

At first sight, according to this approach wage arrears might be even preferred by the firms for a number of reasons. First of all, the mechanism of wage arrears application is easy: Employers do not need to renegotiate the labor contracts with their workers – wage arrears are decided unilaterally by the firm (Earle et al., 2004). In addition, interesting motivational arguments can be found in Lehmann et al. (1999). The authors argue that the level of workers' motivation (i.e, commitments) and loyalty may be lower under standard wage reductions than under wage delays. In case of wage cuts, most qualified workers may decide to quit. For the firm therefore it might be then

⁵The literature also gives some other explanations why firms may engage in wage arrears (e.g., Alfandari and Schaffer (1996), Earle and Sabirianova (2002) say that wage delays help to avoid taxes). Those, however, are not supported in the literature as main preconditions for the wage arrears existence.

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 Friebe 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) suggest that wage arrears might be seen as a credit from the workers to the firm. Again one can argue that according to this perspective wage arrears do have some advantages. 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 credit the employer (e.g., Core and Guay, 2001).

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. What is the justification for workers to accept such an obvious contract violation? The standard approach says that workers would rather oppose this practice. The approach focuses on two main responses to wage changes: quits and strikes. Earle, Spicer et al. (2004), assuming that wage arrears are equivalent to wage cuts, hypothesize that turnover and strikes increase in wage decrease simply because workers start looking for better jobs or try to fight for their rights.⁶

It is important to stress now, that any explanation which is provided by the standard economic approach can be applied only to the firms facing negative economic shocks. It would be, for instance, very hard to explain the use of the arrears in growing firms – firms with good liquidity, low levels of personnel turnover and the lower number of strikes. Therefore, the standard

⁶See also, e.g., Kennan (1986) and Farber (1994).

approach hypothesizes that unsuccessful firms are more likely to engage in wage arrears practices than successful firms. To summarize: Following the assumption that wage arrears are equivalent to wage cuts the standard economics mainly states that firms with higher wage arrears will have a higher employee turnover and a higher number of strikes.

However, this seems not 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 stable, i.e. around 4.5% (UEPLAC, 1999). 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 few strikes took 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 substantial wage arrears in seemingly profitable and successful 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 manager's and workers' behavior concerning wage delays is significantly affected by local labor market arrears, which under some conditions may be perceived as a legitimate practice, being, at the same time, formally outside the scope of the law.

5.1.2 Behavioral Approach

As it was discussed above, the prerequisites of wage arrears may be explained to some extent by the standard economic theory. However, Earle, Spicer and Sabirianova (2004) argue that wage arrears may have an independent dynamic. In other words, enterprises that do not face negative demand shocks or severe liquidity constraints also use wage arrears. While studying wage arrears in Russia, the authors introduce the notion of *neighborhood effects* (Earle and Sabirianova, 2004). They show that the local 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 form of organizational 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 look as 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*. From this perspective we can argue that “legitimacy” has little to do with legal bounds but rather depends on the individual cognitive perception of social reality, or individual *beliefs*. Beliefs, in their turn, are governed by social interactions⁷, social environment, group behavior etc. (Gächter and Fehr, 2000). Therefore, in any particular case individual actors

⁷ “... Berger and Luckman (1967) [...] argue that social reality is a human construction created through interaction” (Scott 2003, p.117).

or societal pressure groups can be *convinced* (via changing beliefs) that certain practices are legitimate. This may lead to their acceptance (Svensson, 2001). More precisely, Earl, Spicer et al. (2004) point out that legitimization of organizational practice takes place in two steps. First, in order to survive, some organizations adopt a practice which is economically defined as appropriate and efficient (Meyer and Rowan, 1977; Zucker, 1977). Afterwards, when the organizational practice becomes adopted by an initial number of organizations, that is, when it is understood to be appropriate and a necessary component of efficiency, other organizations are subject to considerable pressure to incorporate the practice into their formal structure. By doing so, organizations show that they are behaving on commonly accepted values in a proper and adequate manner (Meyer and Rowan, 1977; Tolber and Zucker, 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 (Tolber and Zucker, 1983). When the adoption process continues, primary efficiency considerations become less important for the diffusion 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 community behavior (Meyer and Rowan, 1977; Zucker, 1977). In other words the practice becomes *legitimate* outside the scope of the law.

Following the structure of these arguments, we come back to wage arrears. It should be clear now, that an important effect of the increasing use of wage arrears within a society is that firms will be more likely to engage in this practice independently of their economic performance. Furthermore, Earle and Sabirianova (2004) and Earle, Spicer and Sabirianova (2004) present empirical evidence of how the similar behavior of different firms on the market

influence the individual managerial behavior. More precisely, observing the behavior of the relevant reference groups, managers may gain not only from the practice itself, but also from the extent it is conformed by the society.⁸ *“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. Therefore the prevalence of wage arrears within a community not only influences the decision of managers, but also the decision of workers to accept or oppose it. Some studies on the attitude of workers concerning pay fairness indicate that in order to estimate their own conditions, it is crucial for the workers to compare themselves with others (i.e., relevant reference groups). Essentially, a central message of these studies is that relative payoffs influence worker’s opinion 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.⁹ In our 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 extent of wage delays in the market, therefore, decreases the workers’s incentives for any kind of workplace grievance behavior. Earl, Spicer and Sabirianova find a strong empirical support for this reasoning and say that

⁸See, e.g., Adams (1963), Pollis (1968) for the interesting basic and initial discussion on the social comparison, reference groups and reference outcomes.

⁹See Fehr and Schmidt 1999 for extensive discussion and survey.

“...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 terms, the individual behavior of a manger will be affected by the managers’ group behavior on the market, hence decreasing manager’s costs of wage delays. In the next chapter we summarize the above reasonings in the formal model of managerial 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

We 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 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 costs¹⁰ as $c(\alpha_i, \bar{\alpha}_{-i})$. The costs depend on the level of α_i and the average payment on the market without

¹⁰The decision not to pay what was promised brings about costs for the manager, e.g. increased worker turnover, shirking, loss of reputation, higher probabilities of strikes (Earl and Sabirianova, 2004).

firm i , $\bar{\alpha}_{-i}$ (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.

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

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

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

if $\alpha_i < \bar{\alpha}_{-i}$, and $c_{\alpha_i} = c_{\bar{\alpha}_i} = c_{\alpha_i \bar{\alpha}_i} = 0$ otherwise. The costs are decreasing in α_i , because wage payments reduce workplace grievance behavior. On the other hand, the costs are increasing in $\bar{\alpha}_{-i}$, because the increasing market payments make the costs of wage delaying higher.¹¹

The manager then maximizes

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

with the FOC

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

Let us define the inverse of the function b' as B , with $B(b'(\alpha_i)) = \alpha_i$, and let us label $\frac{\partial c(\alpha_i, \bar{\alpha}_{-i})}{\partial \alpha_i} = c'(\alpha_i, \bar{\alpha}_{-i})$. Using this we can rewrite the FOC as a fixed point equation in α :¹²

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

¹¹Note 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).

¹²This can be justified, e.g., by (5.3) and symmetry of the firms (i.e., wage payments), $\alpha_i = \bar{\alpha}_{-i}, \forall i$.

and

$$\alpha = B(c'(\alpha, \alpha)) \quad (5.5)$$

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

Let us consider the delayed part of the wage $(1 - \alpha_i)w$ as an involuntary loan from the worker, which gives a return 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 the following 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 costs of a wage non-payment strategy are a function of the wage non-payment decision taken by other firms. More precisely, $\bar{\alpha}_{-i}$, representing the average wage payment on the market, measures the degree of opposition to managerial practice, $\bar{\alpha}_{-i}(\max\{s - \alpha_i, 0\})^2$.¹³

¹³In other words, the manager's costs or disutility of paying a lower wage than promised

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

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

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 function¹⁴

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

and the payoff function of the manager is

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

As the framework of the model requires, the costs of the manager decrease in α_i , $c'_{\alpha_i} \leq 0$, and increase in $\bar{\alpha}_{-i}$, $c'_{\bar{\alpha}_{-i}} \geq 0$. This means that in general, engaging in wage arrears is costly for the manager. However, the manager's return to wage arrears increases if the rest of the firms engage in wage arrears

is an increasing function of the other managers' payments. Therefore $\bar{\alpha}_{-i}$ represents a simple version of some function $f(\bar{\alpha}_{-i})$, 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).

¹⁴No additional insight can be gained by allowing for more general functional forms.

as well. Therefore, the manager chooses α_i to maximize her payoff and solves

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

This yields

$$\alpha_i = \begin{cases} 1 - \frac{wr}{2\bar{\alpha}_{-i}} & , \text{ if } \bar{\alpha}_{-i} > 0 \\ 0 & , \text{ if } \bar{\alpha}_{-i} = 0. \end{cases} \quad (5.8)$$

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

$$\alpha_i = \max \left\{ 1 - \frac{wr}{2\bar{\alpha}_{-i}}, 0 \right\}. \quad (5.9)$$

Hence, each managers's payment is nonlinear in the average market payments. We focus 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, $\alpha_i = \bar{\alpha}_{-i}$. Given a wage w and an interest rate r , the set of such Nash equilibria will be characterized by the fixed-point equation

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

or

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

Each fixed point α is the common equilibrium payment level in a symmetric Nash equilibrium, and *vice versa*. It is possible to solve this equation for

three equilibria¹⁵

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

The observed multiple equilibria can be characterized by low, medium, and high levels of wage payment. The first equilibrium defines low or zero payment at zero average market payments.¹⁶ The second equilibrium gives an intermediate or threshold level of wage payments. The third equilibrium is characterized by high or full¹⁷ 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, only the two extreme ones are stable in a dynamic setting where the manager gradually adjusts her payment in the light of the current average market payments. To see this, we calculate the slope of the reaction function at the equilibrium points. Stable equilibria have a slope of the reaction function of less than one, $\alpha' < 1$. We check this for each equilibrium in turn.

First, using (5.9) we define α' as

$$\alpha' = \begin{cases} \frac{wr}{2\alpha^2} & , \quad \text{if } \alpha > \frac{wr}{2} \\ 0 & , \quad \text{if } \alpha < \frac{wr}{2} \end{cases} \quad (5.12)$$

For α_1^* it is clear that

$$\alpha' |_{\alpha_1^*} = 0 < 1 \quad (5.13)$$

¹⁵Notice $\alpha_1^* < \alpha_2^* < \alpha_3^* \leq 1$.

¹⁶It 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).

¹⁷If $r = 0$.

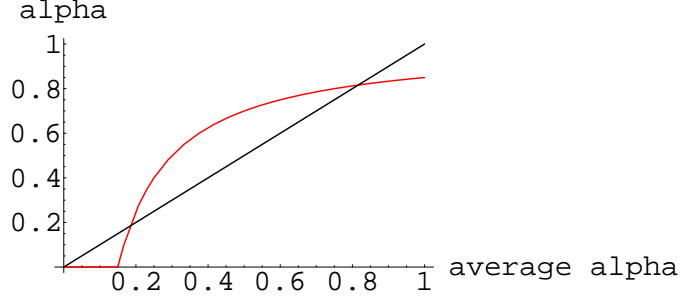


Figure 5.1: Reaction function for $w = 1$ and $r = 0, 3$.

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

$$\alpha' |_{\alpha_2^*} = \frac{wr}{2\alpha_2^{*2}} > 1 \quad (5.14)$$

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 means that the slope of the reaction function at the point of the second equilibrium is bigger than one and the equilibrium is not stable.

The third equilibrium, after making similar verification, proves to be stable with

$$\alpha' |_{\alpha_3^*} = \frac{wr}{2\alpha_3^{*2}} < 1 \quad (5.15)$$

or

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

The example in Figure 5.1 shows the reaction function and the three equilibria. The equilibria are the intersections of the function with the diagonal. From the picture it is also clear that only high and low payment equilibria are stable under most adaptive dynamics; a small deviation from the medium-payment equilibrium induces a movement towards the high or low payment equilibrium level. The important insight of the model is that the incidence of wage delays does not only depend on the economic conditions and performance of the firm.

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 only a small part of firms to start paying wages (e.g., the state who pays off a debt to publicly owned firms). The adaptive dynamics will afterwards bring the whole system to the stable high payment equilibrium. On the other hand, the system may leave a high payment equilibrium if one big employer (e.g. a monopolist on the local labor market) stops paying.

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

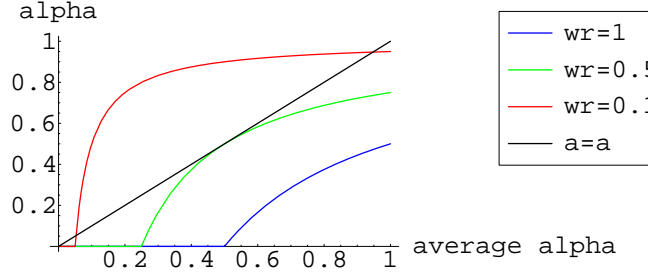


Figure 5.2: Possibility of different equilibria with changing interest rate and wage. Two dimensional representation.

provides managers with the high interest rate on short term deposits.¹⁸ 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 the manager's return to wage arrears. 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, Figure 5.3. Along with the dimensions already depicted in Figure 5.2, that is $(\alpha_i, \bar{\alpha}_{-i})$, we draw one more, $(\alpha_i, \bar{\alpha}_{-i}, wr)$. 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

¹⁸The 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.

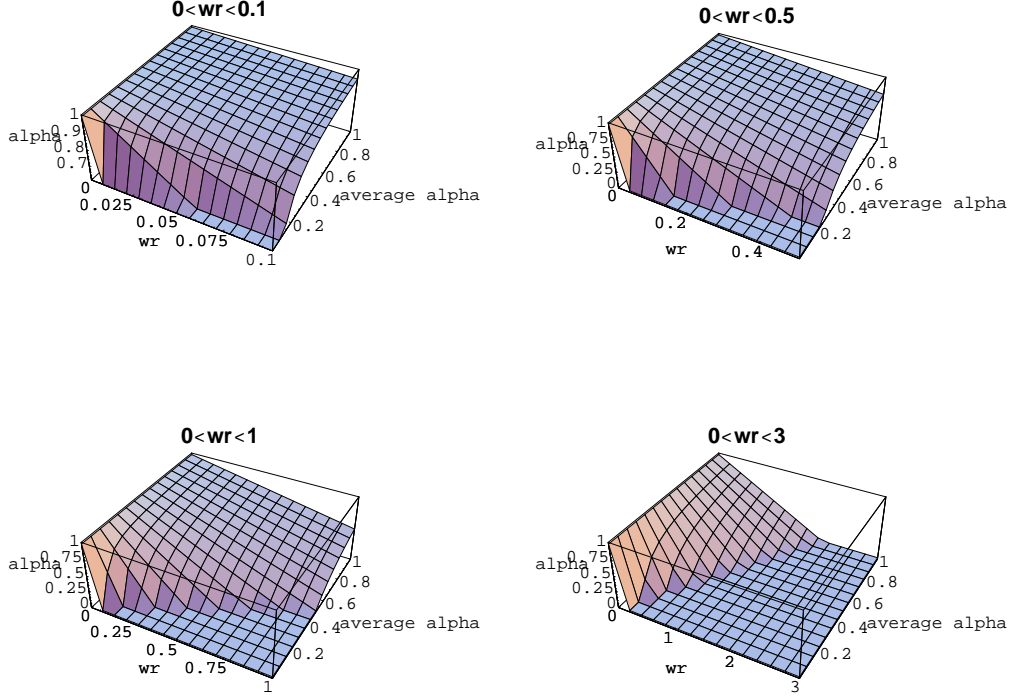


Figure 5.3: Possibility of different equilibria with changing interest rate and wage. Three dimensional representation.

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.¹⁹ Based on 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 used the terminology 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.²⁰ It is based on the Logit choice model. In this model the stochastic choice probabilities are proportional to exponentiated expected payoffs (Palfrey 2006). For example, 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 $\pi(x_i)$

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

where the “error parameter” λ , defines the sensitivity of choice probabilities regarding payoffs. As λ goes to infinity, all choice probabilities are equal,

¹⁹Individual payoff perturbations was used 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).

²⁰Due to its tractability and relatively simple interpretation, this model is most often used in the literature.

without taking into account payoff differences, although insignificant payoff difference will have significant consequences when λ goes to zero. Goeree and Holt (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).

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.²¹ 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

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

²¹We omit here the interest rate r for simplicity.

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.²² The term $\varepsilon(\cdot)$ is assumed to be an iid Extreme 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:

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

By completing the square and factoring out all terms in the exponential that do not depend on α , one can re-express (5.17) as²³

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

which is a univariate truncated normal distribution function with a location parameter $\mu = 1 - \frac{w_i}{2\beta_i}$ and scale parameter $\sigma^2 = \frac{\lambda}{2\beta_i}$.

²²Note, in the previous section $\bar{\alpha}_{-i}$ defines *how the rest of the firms behave* on the 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 beliefs β_i and consider only two participants $i = A, B$.

²³See Anderson et al. (1995).

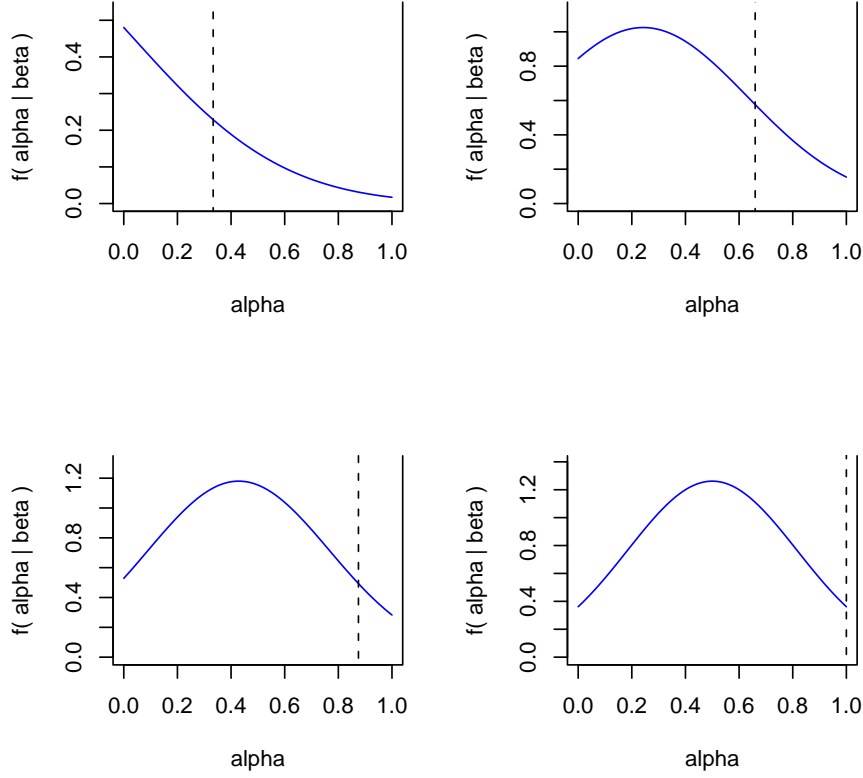


Figure 5.4: Probability density function characterizing the choice of α_i . Naive expectations equilibrium.

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., $\sigma^2 = \text{const}$ when $\lambda \rightarrow \infty$), it is easy to see that $\mu \rightarrow -\infty$ as β_i becomes smaller. Similarly, $\mu \rightarrow 1 - \frac{w_i}{2}$ 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). 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). 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:²⁴

$$\beta_i = E\alpha.$$

²⁴This 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.

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.

5.4 Concluding Remarks

In this work we focus on the group behavior and social norms framework in the labor economics context. We analyze a simple case of a moral hazard problem. The manager, violating a contract, unilaterally decides which part of the wage to pay (delay). We introduce a social norm *to pay the whole promised wage* which mitigates the problem by decreasing gains of those managers whose payment lower than the norm's level. We demonstrate that interaction of the social norm and community 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 equilibrium, are all theoretically possible. The simulation illustrated in figure 5.1 reveals that there can be jumps in payment levels even when the average market payment is changed only marginally. This outcome gives a possibility for a dynamic payment setting since, for example, it might only need a small number of firms that start paying to leave the low payment equilibrium. The analysis demonstrates how

the group behavior affects individual choices.

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 it was mentioned in the introduction, it is only in the past couple decades that deferred compensation has become an important part of the economics literature on compensation. 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. Although it is obvious that financial connotations play an important role for the choice of compensation system, the labor aspects of deferred arrangements have to be analyzed and understood (Lazear 1990). In the present research, therefore, our main purpose has been to shed new light on some important 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 concept as an important perspective that cuts across all deferred compensation profiles. Risk in our framework implies that an employer may, e.g., go bankrupt and, as a consequence, deferred payments may never materialize. 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 reach our initial goal.

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 highlights the behavioral aspects of bargaining over deferred compensation. Namely it shows the importance of commitments to the particular kind of future behavior for the provision of deferred compensation. Particularly, we consider the firm's commitments *to pay* and the worker's commitments *not to shirk* to play an important role in deferred payment arrangements. We concentrate on how the probability of bankruptcy can affect the trade-off between base payment (wage, salary) and deferred compensation (pensions, stocks, insurance, etc.). The results provide an interesting perspective on the relationship between bargaining and individual behavior as well as on the trade-off between base wage and deferred payments.

Finally, the last chapter 5 explains how some anomalous forms of deferred compensation may appear without bargaining. We focus here on anomalous form of deferred compensation – wage arrears. In contrast to the standard research on wage arrears, we follow here the alternative theory that explains wage arrears as a form of group behavior within society. In particular, we examine how group behavior and social norms can determine wage arrears. The approach provides an alternative to the standard economic predictions, allowing for several degrees of wage arrears in equilibrium. In addition, 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 amount of agents*, basically just to two. As a result, in order to say more about collective bargaining (which is another common bargaining approach in the real firm-union framework), the structure of our analysis has to be slightly changed. Furthermore, it would have been also not possible 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 concept should be chosen.²⁵

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. Whereas this modelling approach allows for simpler analysis, it is clear that bargaining in reality is far more arduous. More generally, we have to accept that the Principal-Agent framework is rather an extreme and therefore frangible theoretical modelling approach (Salanie, 1997).²⁶

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

²⁵See for more details Osborne et al. (1990), Binmore et al. (1992), and Salanie (1997).

²⁶See more on Principal-Agent paradigm, e.g., Sappington (1991), Salanie (1997), Laffont and Martimort (2002).

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. 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)²⁷. 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 follow a certain general pattern only to a limited extent. Many arrangements are born as an outcome of arm's-length bargaining between employer and employee. 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 research is required in order to fully understand the role of deferred compensation in labor contracts. The relationship between seniority and compensations, therefore, represents an important and exciting issue for further research.

²⁷In 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.

Dortmund, Juli 2006