Kirstein, Roland; Will, Birgit E.

**Working Paper**

# Efficient Compensation for Employees? Inventions.

CSLE Discussion Paper, No. 2003-03

**Provided in cooperation with:**
Universität des Saarlandes (UdS)

# Efficient Compensation for Employees' Inventions.[†]

Roland Kirstein[*] Birgit Will[**]

Center for the Study of Law and Economics
Discussion Paper 2003-03
August 2003

**Abstract**

We analyze the legal reform concerning employees' inventions in Germany. Using a simple principal-agent model, we derive a unique efficient payment scheme: a bonus which is contingent on the project value. We demonstrate that the old German law creates inefficient incentives. However, the new law concerning university employees and the pending reform proposal concerning other employees also fail to implement first-best incentives. With suboptimal incentives to spend effort on inventions, the government's goal, an increase in the number of patents, is likely to be missed. (88 words)

**JEL classification:** K 12,J 33, C72

**Encyclopedia of Law and Economics:** 1620, 0330

**Keywords:** Moral hazard, hold-up, efficient fixed wage

---

[†]We are grateful to Jürgen Backhaus, Jennifer Brown, Klaus Brockhoff, Thomas Eger, André Knoerchen, Manfred Koenigstein, Hugo Kossbiel, Dorothea Kübler, Veronika Nolte, Rudolf Richter, Bettina Rockenbach, Tobias Rötheli, Hans-Bernd Schäfer, Dieter Schmidtchen, and other seminar participants in Berlin, Erfurt, Frankfurt, Hamburg and Saarbrücken for most valuable comments. Remaining errors, however, are ours.

[*]Dr. rer. pol., Assistant Professor of Economics, and corresponding author: Center for the Study of Law and Economics (CSLE), University of Saarland, D-66041 Saarbrücken, Germany; (rol@mx.uni-saarland.de, http://rolandkirstein.de). A part of this research was done while I enjoyed the hospitality of the University of California in Santa Barbara (Economics Department) and Berkeley (Law School). Financial aid by the Thyssen Stiftung is gratefully acknowledged.

[**]Diplom-Kauffrau and Research Assistant, Center for the Study of Law and Economics (CSLE), University of Saarland, D-66041 Saarbrücken, Germany (email: b.will@mx.uni-saarland.de).

# 1 Introduction

We analyze a proposed reform of the German law concerning the adequate compensation for employees' inventions.[1] The current law, as well as the proposed reform, requires employees to report to their employer any invention made in relation with the work contract. If, under the current law, the employer claims the rights to the invention, then he is obliged to file for a patent and to pay a compensation to the employee. This compensation is subject to negotiation, yet the parameters that are relevant for bargaining are regulated by accompanying legal rules.

The old law has often led to legal action between the two parties. The federal Government has amended the law with guidelines for the determination of an adequate compensation.[2] Even though these guidelines are not binding, many firms seem to comply with them.[3] Therefore, the reform proposal aims at introducing a clearly defined compensation scheme. It shall consist of two components: first, the employer is supposed to pay a fixed compensation, the amount of which is independent of the project value; second, the employee is eligible for a share of the project value if it exceeds a threshold value eight years after the invention. This payment scheme is mandatory; deviations are only allowed as far as they consist of higher payments to the employee. Thus, contracting around, is prohibited even if the parties had an incentive to agree upon lower payment components.

Contractual provisions like this are observable at several U.S. universities.[4] Ger-

[1] *"Gesetz über Arbeitnehmererfindungen"* (ArbEG). The draft of the proposal was published by the German Federal Department of Justice on October 25th, 2001, in German language, download under *http://www.bmj.bund.de/images/10333.pdf*.

[2] *Richtlinien für die Vergütung von Arbeitnehmererfindungen im privaten Dienst*, July 20, 1959, BAnzg. Nr. 156, modified on September 1, 1983 (BAnzg. Nr. 169); online available under *http://transpatent.com/gesetze/rlarberf.html*.

[3] The guidelines propose to take into account three criteria: the compensation should be low if the employee a) holds a position in which making inventions is a part of his job profile, b) has made use of many resources provided by the employer whereas his own contribution of knowledge is relatively small, or c) holds an intermediate position in the hierarchy of the employer's firm. See Kesten (1996, 657), who gives an extensive and critical analysis of the guidelines. See also Reimer/Schade/Schippel (2000) for the lawyers view on the law and the guidelines.

[4] Cherensky (1993) discusses such pre-invention agreements in the light of "personhood" theory. In particular, he stresses the fact that employee inventors often receive only a "token" payment in exchange for the transfer of their property rights in their future research. For an extensive discussion of employee inventions in the US see Merges (1999), who presents legal and economic arguments to derive his insights, however without a rigorous contract theoretical analysis. According to Eisenberg (2002, 4), patenting activities of US universities are mainly concerned with biomedical research.

man scholars, however, did enjoy a privilege under the old law.[5] They were exempt from the obligation to report their inventions to their universities, which had no right to the inventions. This privilege was based on the constitutional right of scholars to their research results.[6] The reform of this part of the old law has already been decided upon in the German Bundestag.[7] From now on, German scholars have to report their inventions to their universities; if the university claims the right on the invention, it has to file for a patent. Apart from employees outside the universities, scholars receive a compensation that amounts to 30 percent of all returns.

There is an enormous body of literature concerning patent law in general.[8] Most of these contributions focus on the problem of optimal length and breadth of patent rights.[9] The longer and wider the patent right, the more incentives are provided for the inventor, but the larger is the ex-post inefficiency due to the monopoly position granted to him. A broader patent right may dampen the incentives to develop complementary products or further inventions which are based on the previous one.[10] Other papers derive empirically to which extent patent rights have led to an increase in the value of products or firms.[11] Meurer (1989) and Crampes/Langinier (2002) have focused on the enforcement of patent rights in court. According to the latter paper, the detection of patent infringement is a pre-requisite for bringing suit, and requires costly market observation.

In this paper, we leave these questions out of focus. We only want to discuss the incentive effects created by the employers' property rights to their employees' inventions on the one hand, and the compensation scheme the employers have to pay to the inventors on the other hand. Our model draws on principal-agent theory, combining elements of moral hazard and hold-up. We derive a unique efficient payment scheme that consists of a lump-sum payment only. We

[5] See §§42 f. of the ArbEG.

[6] Art. 5 III of the German Constitution.

[7] *"Gesetz zur Änderung des Gesetzes über Arbeitnehmererfindungen"*, Bundesgesetzblatt Teil I, Nr. 4, January 24th 2002. The initiative of the Federal Government is published as Bundestags-Drucksache 14/7565, Nov. 23rd, 2001, *http://www.ipjur.com/data/1407565.pdf*, which is identical with the initiative of the parties that support the Federal Government (Social Democrats, Green): *Bundestags-Drucksache* 14/5975, May 5th, 2001, *http://www.ipjur.com/data/1405975.pdf*.

[8] See, e.g., Kitch (1998) for an overview.

[9] See Klemperer (1990). Gallini/Scotchmer (2002) presents an overview over alternative means for the protection of intellectual property rights.

[10] See Scotchmer (1991) and (1996).

[11] E.g., Schankermann (1998). Lanjouw/Pakes/Putnam (1998) have developed proxies to measure patent values.

show that freedom to negotiate over the compensation after the invention has been made provides inefficient incentives for the employees to spend effort on inventions.[12]

Our analysis, based on rigorous economic theory, also allows more differentiated results than those presented in Brockhoff (1997). He argues informally that "collective regulation" (by legislation) is neither necessary, nor effective in order to motivate employees to make inventions. Individual agreements or collective agreements (on the firm level) are preferable.[13] According to our model, an ex-ante agreement is necessary to implement efficient effort. Negotiations over the compensation after the invention already has been made put the employer into a hold-up position. If this is anticipated by the employee, his incentives to spend effort on making the invention in the first place are suboptimal.

Our results are very similar to those derived in Scotchmer (1991) for the case of upstream and downstream inventions. According to this paper, to provide proper incentives for the upstream inventor requires him to be granted with a share of the value of the downstream invention.[14] From the viewpoint of the Property-Rights theory, however, this assignment of property rights to several persons might cause an "Anti-Commons" problem, as pointed out by Heller/Eisenberg (1998).[15] Our solution does not lead into this problem, since the property rights are, in each stage of our game, exclusively assigned to either the employer or the employee.

In the second section of this paper we introduce the notation of our model. Its key assumption is that the employee's effort increases the (unobservable) success probability of an invention project, whereas the employer's input may increase the final market value of a successful project.

We first derive, in the normative part of our analysis, the socially optimal effort of the two parties and demonstrate under which conditions the optimal solution is the equilibrium of the two games we analyze. This normative result serves as a benchmark, neglecting the interaction structure that determines the payment parameters.

Having done this, we focus on the conflict and the possibly arising inefficiencies between employer and employee. In this positive part of the analysis, we set

[12]Thus, our model follows the view of Kitch (1977, 265) who points out that the function of the patent law is to increase the output from resources devoted to technological invention.
[13]See Brockhoff (1997, 685).
[14]See Scotchmer (1991) and (1996).
[15]See also Heller (1998) and Hardin (1968). While a "Commons" problem is characterized by inefficient over-usage, an "Anti-Commons" is likely to be under-used in an inefficient manner.

up two different games which describe two stylized types of interaction. The first of these games refers to the reform proposal and the new law concerning university scholars. In this model, the payment scheme is fixed ex ante when the interaction starts. The goal of this analysis is to derive the payment parameters that implement first-best effort. In the second game, which reflects the situation under the old law, the parties negotiate about the compensation scheme after the invention has been made.

In section 3, we discuss to which extent the results of our analysis had to be modified if some of the assumptions made in section 2 were relaxed (in particular the two-sided risk-neutrality). In section 4, we apply the theoretical results to the reform proposal concerning employees in general, and to the new law concerning university scholars in Germany. In section 5, we draw conclusions.

# 2 The model

## 2.1 Outline

We consider an interaction between two players, the employee (denoted as E) and the Firm (F) that has employed E.[16] The timing of events and actions is as follows:

1. E decides about his effort, denoted as $e$ with $e \in [0, 1]$, to spend on a research project.[17] Effort increases the probability of success, but burdens the employee with cost, denoted as $c(e)$, with $c(0) = 0$, $dc/de > 0$ for $e > 0$, $dc(0)/de = 0$, and $d^2c/de^2 \geq 0$.

2. A chance move decides whether the project is successful or not. The probability of success is denoted as $p(e)$, with $dp/de > 0$ and $d^2p/de^2 \leq 0$. Thus, the probability of an unsuccessful project is $1 - p(e)$. In this case the game ends.

3. If the project turns out to be successful, then F decides whether to claim the invention or not. If not, then the game ends.

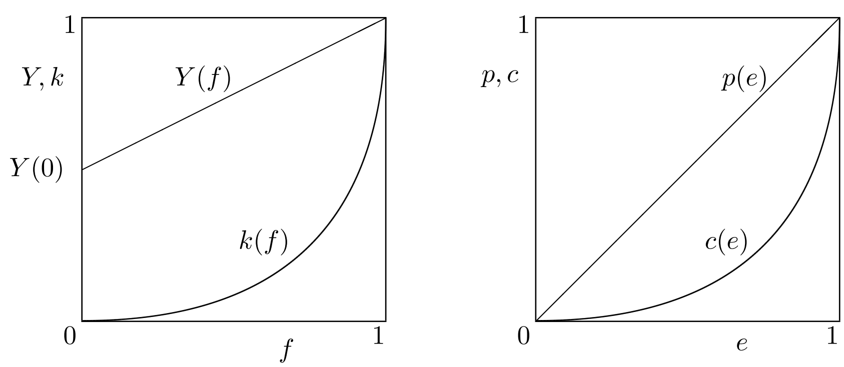
[16] Subsequently, we categorize the firm F as female, and the employee E as male.

[17] Note that our model is not only applicable to the case of an employee who does research as his main job. It also covers the case of an employee who makes an invention by chance, but has to spend some effort in order to evaluate what he has discovered. His outside option would be to simply neglect the discovery.

4. If F decides to claim the results, then she chooses her effort to promote the project (and thereby to further increase its value). We denote this effort as $f$, with $f \in [0, 1]$, and the value of a successful project as $Y(f)$, with $Y(0) > 0$ and $dY/df > 0 \geq d^2Y/df^2$. $Y(0)$ is the value of a successful project that E is left alone with.[18] F's effort raises cost, denoted as $k(f)$, with $k(0) = 0$, $dk/df > 0$ for $f > 0$, $dk(0)/df = 0$ and $d^2k/df^2 \geq 0$.

Thus, we assume that $Y(f)$, $k(f)$, $p(e)$, and $c(e)$ are twice differentiable and continuous. The above assumptions guarantee that both parties' efforts cause convex cost and a concave output. The output generated by E's effort is the success probability, and the output generated by F's effort is the additional project value. Both of these outputs contribute to an increase in the expected project value. The differences $Y(f) - k(f)$ and $p(e) - c(e)$ are both concave functions. **Figure 1** demonstrates examples for the assumed input and output functions of the two parties.

Figure 1: Inputs and outputs of F and E




$Y(f)$, $k(f)$, $p(e)$, and $c(e)$ are assumed to be common knowledge,[19] whereas the effort decisions of both parties are observable by them, but not verifiable. Contractual payments, therefore, can not be made contingent on actual effort.[20]

[18] Even though we assume $Y(0)$ to be clearly positive, our models would also allow to derive results for a low value of $Y(0)$ or even for the case $Y(0) < 0$.

[19] Uncertainty about the project value is discussed in section 3.

[20] Strausz (1999) proposes a mechanism that implements first-best effort in sequential partnerships with observable, but non-verifiable effort. In his mechanism, the partners provide

We assume the parties to be rational and risk-neutral, hence they maximize their expected monetary payoff.[21] If the project is not a success, then the parties' payoffs amount to $-c(e)$ for E and 0 for F. If the project is successful, and F does not claim the research results, then the payoffs are $Y(0) - c(e)$ for E and 0 for F.[22]

In case of a cooperation between F and E, the parties' payoffs depend on the payment F has to make in order to obtain the project results. We limit our view to payment schemes that consist of two components:

- a contingent fixed payment (denoted as $\Phi$), which is independent of the project value as realized by F's actually chosen effort, but will only be paid if the employee has made an invention,
- and a share of the final project value (denoted as $\alpha$, with $\alpha \in [0, 1]$).

Thus, the payoffs of the parties in case of cooperation are $\alpha Y(f) + \Phi - c(e)$ for E and $(1-\alpha)Y(f) - \Phi - k(f)$ for F.[23] In the subsequent analysis, we distinguish three ways for determining these payment parameters:

- in section 2.2 we derive the first-best efforts, neglecting possible conflicts between E and F as well as the actual structure of the interaction;
- in section 2.3 we derive the payment parameters that implement the first-best solution under the assumption that these parameters are set exogenously (either by a third party like a regulator, or by an ex-ante agreement between E and F);[24]
- in section 2.4, we assume that the parties negotiate over the payment

effort that increase output. In our model, the employee's effort does not contribute to the project value, but to the probability of a success. Therefore, his mechanism is no applicable to the problem introduced here.

[21]In section 3, the impact of risk-aversion is discussed. Risk-neutrality on the side of the Firm provides the justification for our simplifying assumption that $Y(f)$ is deterministic. If the project value were a random variable, the risk-neutral firm would simply calculate with the expected value.

[22]We simplify the analysis by assuming that the product market situation of F is not affected negatively if E makes use of his outside option. We discuss the impact of this effect on the respective equilibria of the games in section 3.

[23]Thus, it is assumed that motivation is mainly extrinsic. See Orbach (2002, 93) for a discussion of intrinsic motivation in the context of employees' inventions.

[24]In this paper, we do not analyze how the payment parameters are set in advance, since we limit our view to the interaction, given these parameters. For now, we would simply assume that the parties or the regulator have incentives to choose the payment parameters that implement efficient effort.

parameters as soon as the project has turned out to be successful, i.e. during stage 3 of the interaction described above.

## 2.2 First-best solution

In this section we derive the socially optimal efforts for F and E, i.e. the effort choices that maximize the joint payoff. The decision of player F to purchase the results of E's research has no impact on the maximum social value of the project: if F's effort is productive, then social optimality would require her investment to be made, regardless of who owns the project returns. The social value only depends on the employee's investment into the success probability and the firm's promotion of the project value. As the (expected) social benefit, we define the sum of the parties' payoffs, irrespective of the positive analysis of the interaction. We denote the expected social benefit as

$$\Sigma(e, f) = p(e)[Y(f) - k(f)] - c(e).$$

A combination of the two parties' efforts is optimal, if this expected social benefit is maximized. We label the optimal values of $e$ and $f$ with an asterisk:

$$(e^*, f^*) = \arg\max \Sigma(e, f).$$

Therefore, $e^*$ and $f^*$ satisfy the following first-order conditions:

$$\frac{dc(e^*)/de}{dp(e^*)/de} \stackrel{!}{=} Y(f^*) - k(f^*) \tag{1}$$

and

$$\frac{dY(f^*)}{df} \stackrel{!}{=} \frac{dk(f^*)}{df} \tag{2}$$

The concavity assumptions made above guarantee that second-order conditions are satisfied. Furthermore, they imply our first (partial) result:

**Proposition 1:** $e^*, f^* > 0$.

**Proof:** Follows directly from our assumptions, since the initial marginal costs are zero, whereas the initial marginal values are positive.

According to this proposition, cooperation between the parties is socially desirable. This implies that, even under the rather general assumptions we have made, an equilibrium without cooperation cannot be optimal. Leaving aside strategic considerations, the parties should always be able to benefit from an agreement.

Note that, if the condition (2) is fulfilled, this does not imply that F actually claims the project and chooses her optimal effort. Even if her contribution to the project value is socially desirable, her individual incentives may keep her from doing so. Her actual decision only depends on her incentives and not on the social desirability of her options.

## 2.3 Equilibrium if payment is exogenously given

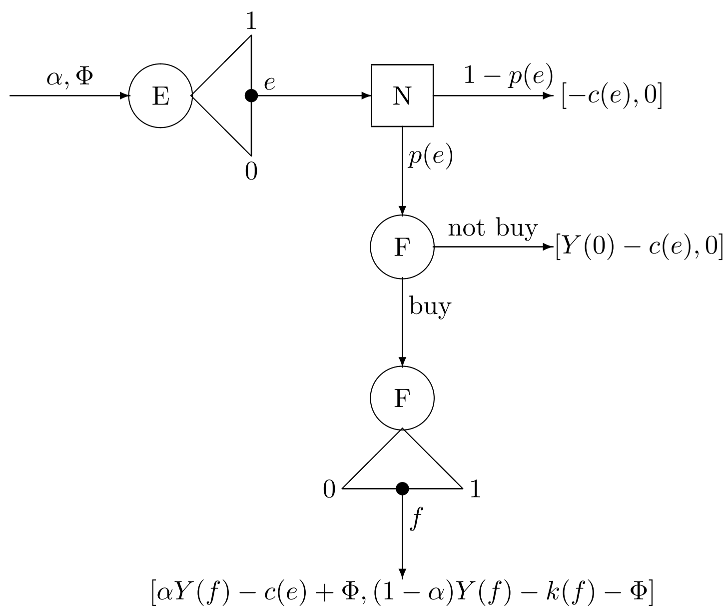
In this section, we assume that the payment components $\alpha$ and $\Phi$ are set exogenously. This can have been done by, e.g., a collective wage agreement or by governmental regulation. **Figure 2** visualizes the interaction. At the beginning of the game, the players E and F know the exogenous values of the payment parameters $\alpha$ and $\Phi$. First, E chooses the effort $e$, then "Nature" (N) chooses the success of the project. In the case of success, F decides whether to buy or not, and in case that she has bought the project, she chooses her effort $f$. This model can be interpreted as a stylized generalization of the situation under the reform proposal as well as under the new law concerning university employees. It is a generalization since the law and the proposal specify specific payment values, while our model allows to derive the payment parameters that implement the optimal efforts.

In the previous section we have already demonstrated that cooperation between E and F is efficient. F will actually choose "buy" if her payoff from doing so is non-negative. Thus, we only have to derive the payment parameters that implement efficient effort choices, provided F chooses cooperation. Proposition 2 states the conditions under which optimal efforts (as derived in the previous section) are implemented, i.e., E chooses $e^*$ and F chooses $f^*$.

> **Proposition 2:** If the payment parameters are exogenously given, then $\alpha = 0, \Phi = Y(f^*) - k(f^*)$ is the unique parameter combination that implements the first-best solution $(e^*, buy, f^*)$.
>
> **Proof:** See Appendix.

We call the expression $Y(f) - k(f)$ the "net value of F's contribution". If F chooses efficient effort, then the net value of her contribution is $Y(f^*) -$

Figure 2: Game with exogenous payment parameters $(\alpha, \Phi)$




$k(f^*)$, which equals the value fixed bonus parameter $\Phi$ that implements efficient effort on E's side.[25] According to Proposition 2, the payment parameters $(\alpha, \Phi)$ implement efficient effort if the variable component $\alpha$ equals zero (hence, it is desirable that F is put into the role of the residual claimant), and if the fixed payment component $\Phi$ equals the net value of F's efficient effort. The efficient fixed component is, thus, independent of the parties' actual effort choices $(e', f')$ and of the actually realized project value $Y(f')$. It is exogenously determined (by the derivatives of the $Y$ and $k$ functions) which level of the fixed payoff component is efficient. Even though $\Phi^*$ is a fixed payment in the sense that it is independent of the actual effort or project value, E will only receive it if the project turns out to be successful. Thus, it is a bonus (rather than a fixed wage). In the framework of our game, E receives nothing if his project is a failure.

One of the results in Proposition 2 is not surprising at all, namely the one

[25] Note that $Y(f) - k(f)$ is not the rent generated by the cooperation between F and E. The cooperation rent is $Y(f) - k(f)$ net of the opportunity costs of the cooperation, i.e., $Y(0)$ (while $c(e)$ is already sunk).

that concerns the variable component of the payment. If an invention turns out to be successful, then E takes over the role of the principal in a principal-agent-relationship with F. Then, F is the agent who needs incentives to spend efficient promotional effort. In such a simple principal-agent setting with two risk-neutral actors, a “sell the shop” contract is clearly efficient. This contract is realized by setting $\alpha = 0$, since this makes F the sole residual claimant of the project.

A bit more surprising is the result according to which a unique value of the contingent fixed wage exists. This result is due to the fact that our model addresses a two-sided incentive problem. If only F’s incentives were to be considered, then any fixed wage would be efficient as long as the two parties’ participation constraints are obeyed. It is the opportunity to make a take-it or leave-it offer that allows the principal to claim the whole cooperation rent by setting a negative fixed wage.[26] In our model, it is necessary for efficiency and not due to bargaining power that the bonus payment transfers the complete value of F’s contribution to the principal E.

A straightforward corollary of Proposition 2 is that the principal E collects the highest possible payment if $\alpha$ and $\Phi$ are set efficiently. Any $\alpha \neq \alpha^*$ would implement less than efficient effort on F’s side, which leads to a smaller than efficient net value of F’s contribution, $Y(f^*) - k(f^*)$. This net value is the maximum possible fixed payment, since F would otherwise choose not to buy the project. This result is summarized in the following proposition.

> **Proposition 3:** If $\Phi < \Phi^*$ and $\alpha > \alpha^*$, the total payment to E is smaller than under the efficient payment parameters.
>
> **Proof:** Straightforward.

## 2.4 Equilibrium if parties bargain over payment

Now we analyze the case in which the payment components $\alpha$ and $\Phi$ are subject to negotiation after E has spent his effort, and after the project of E has turned out to be successful. This is a stylized model of the situation under the old German law.

[26] Inderst (2002) points out that the first-mover advantage is an assumption according to which the bargaining power is assigned to the principal only. The paper relaxes this assumption in the context of a hidden-type model.

Figure 3: Game with negotiation over payment parameters $(\alpha, \Phi)$

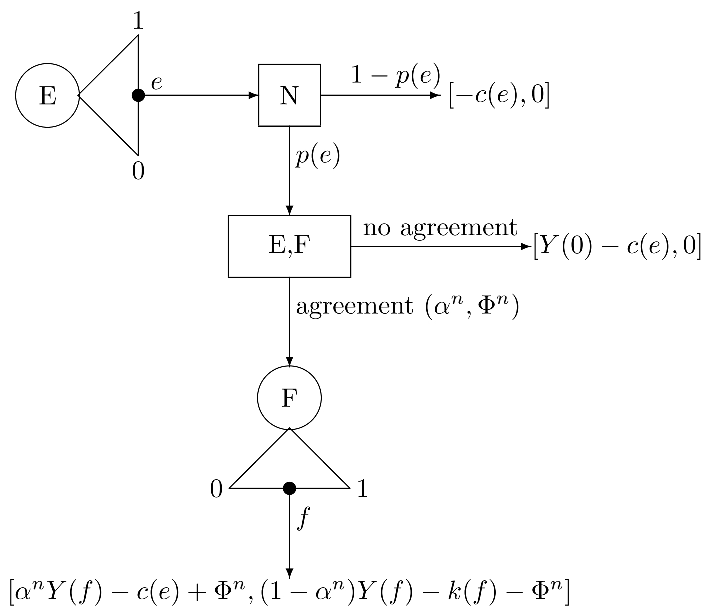



**Figure 3** visualizes this interaction. At the beginning of the game, E chooses effort $e$ and "Nature" (N) chooses the success of the project. In the case of success, E and F bargain over the payment scheme. We employ the symmetric Nash bargaining solution, according to which the parties share the net benefit of an agreement evenly. If an agreement is closed, then F may decide upon her effort $f$. We denote the equilibrium strategy profile as $(e^n, \alpha^n, \Phi^n, f^n)$. Proposition 4 states the predicted result for these negotiations.

**Proposition 4:** If the payment parameters are subject to bargaining, then the parties choose $\alpha^n = 0$, $f^n = f^*$. The predicted contingent fixed payment component then is

$$\Phi^n = \frac{Y(f^*) - k(f^*) + Y(0)}{2} \tag{3}$$

and $e^n$ satisfies the condition

$$\frac{dc(e^n)}{de} \stackrel{!}{=} \Phi^n \tag{4}$$

**Proof:** See Appendix.

One implication of Proposition 4 is the impact of the stand-alone value of a successful invention $Y(0)$ on the bargaining result: the higher $Y(0)$, the greater $\Phi^n$. Furthermore, even if the stand-alone value $Y(0)$ is only zero, E would still achieve a positive bargaining result, due to the assumption of equal bargaining power. Thus, even in this case E would have an incentive to spend positive effort, since the marginal costs of zero effort are assumed to be zero: $dc(0)/de = 0$.

## 2.5 Comparison of the results

Obviously, it is possible for either a regulator or the parties of an ex-ante agreement concerning $\alpha$ and $\Phi$ to implement the first-best effort. To determine the equilibrium payment scheme via negotiations, however, appears to be even more demanding. Proposition 5 demonstrates that the efficient outcome is unlikely to occur if the payment parameters are subject to negotiations.

**Proposition 5:** If the parties negotiate about the payment scheme, then the negotiated variable payment is efficient ($\alpha^n = \alpha^*$), whereas the negotiated contingent fixed payment is smaller than the efficient one, i.e., $\Phi^n < \Phi^*$.

**Proof:** see Appendix.

According to Proposition 5, the agreed upon contingent fixed payment $\Phi^n$ would only be greater than (or equal to) the fixed payment that implements efficient effort $e = e^*$ if the net gain derived out of F's contribution were negative, in other words: if cooperation between E and F is not beneficial. In such a case however, there will be no agreement between the parties concerning a cooperation in the first place.

On the contrary, if the contribution of F to the project's value is beneficial, then the agreed upon wage $\Phi^n$ is smaller than the efficient $\Phi^*$. Note that this result would also be true if the asymmetric Nash solution were applied, as long as the agent F has at least some bargaining power. Only in case the bargaining power of F is zero,[27] negotiations over $\Phi$ would lead to the efficient solution. The effect on E's effort choice is described in Proposition 3.

**Proposition 6:** If the parties negotiate about the payment scheme, then the effort of E is suboptimal low ($e^n < e^*$).

**Proof:** straightforward consequence of Propositions 2 and 4.

[27] Which is highly unlikely.

Thus, the optimal effort choice of E is suboptimal small if he anticipates the negotiation result ($\alpha^n = 0, \Phi^n < \Phi^*$). While the exogenously given payment scheme can be set (by ex-ante agreement or by law) such that first-best efforts are implemented on both sides, the freedom to negotiate over the payment scheme will lead to a suboptimal payoff on E's side. Therefore, the freedom to negotiate leads to a smaller social benefit, compared to a world in which the payment scheme is fixed before E chooses his effort.[28].

# 3 Discussion

The previous analysis is based on some quite restrictive assumptions. In this section, we want to discuss the extent to which the derived results would be modified if these assumptions were relaxed. We start with allowing for risk-neutrality (which may become particularly relevant if the project value is stochastic instead of deterministic), then we examine the impact of a product market effect in case the employee makes his invention available to a competitor of his employer, and finally we discuss second-best solutions in case the employer also spends effort ex-ante, or the employee also spends effort ex-post.

## 3.1 Risk-neutrality

We have assumed both parties to be risk-neutral. In principal-agent models, the employee is often modeled as the (more) risk-averse party. If the employee is the agent (and not the principal, as it is the case in our model), then the introduction of risk-aversion makes it harder, if not impossible, to specify a first-best contract.

In the context of our model, this problem plays no role. If we would introduce risk-aversion on E's side, our results were only reinforced. Recall that E is the principal, not the agent in the subgame that starts after an invention has been made. Thus, the more risk-averse E, the more desirable it is to sell the residual claim to F. Incentives to spend effort and risk-allocation aspects work towards the same direction in our model, as far as the variable payment is concerned.

Risk-aversion on E's side, however, would have an impact on our result concerning the efficient bonus payment $\Phi$. This bonus is contingent on E's research effort $e$ being successful. If he fails to generate an invention, he receives zero. Thus, the bonus payment exposes E to the full risk. If E was risk-averse (and F

[28]This result is similar to the one in standard hold-up or renegotiation models.

risk-neutral), then the result derived in Proposition 2 would not be efficient. E would be better off by receiving a fixed wage which is independent of the success of the project. This would reduce E's risk, but may distort his incentives to spend effort.

A further modification would be the introduction of a stochastic project value. Then, $Y$ does not only depend on F's effort, but also on a random variable. Under the assumption of risk-neutrality, F simply calculates with the expected project value. Thus, her decision situation is unmodified. With respect to her effort $f$, it would be efficient to make her the residual claimant. However, a stochastic project value $Y(0)$ has an impact on the bargaining situation of a risk-averse E: the outside option of E would be less attractive as it is in the case with a deterministic project value. E would deduct a risk premium from the expected project value generated without an agreement. This implies a lower threat point on E's side in the Nash product, which leads (c.p.) to a lower agreed upon fixed payment. The more risk averse E, the greater is the inefficiency of the Nash bargaining solution.

## 3.2 Product market effect

Our result that the Nash bargaining solution leads to an inefficient outcome is based on the assumption that the firm receives zero in case of a non-agreement (which we have made for the sake of simplicity). Whereas this assumption does not influence the Pareto-efficient solution, it has an influence on the Nash-bargaining solution.

However, F's position in the product market could be deteriorated if a competitor makes use of E's invention. This has an impact on her payoff in case of a non-agreement: F's outside option is negative instead of zero. This increases the agreed upon bonus payment, yet not necessarily to the efficient level. It can even be the case that the product market effect leads to a bonus payment that is higher than the efficient one.

## 3.3 Ex-ante effort by F or ex-post effort by E

We have assumed that F only spends effort after the invention has been made (and after he has claimed the invention). This assumption neglects that F may also make ex-ante investments, such as providing a laboratory, which increase the probability of success or the project value. If the ex-ante effort of F and E are made sequentially, then the above model would be a subgame of the new, extended game. In such a subgame, it would therefore still be efficient to put F into the position of the residual claimant, and to distribute the project value among the parties by a bonus payment to E. The higher this bonus payment, the more effort is spent by E during the first stage of the game, while this decreases F's incentives to spend initial effort. The output of the first stage is the success probability of the project. Thus, there is no way to induce efficient effort (at least not with a budget-balanced sharing rule).[29] At best, a second-best efficient bonus scheme could be derived that minimizes the inefficiency.

Furthermore we have assumed that only F can increase the project value after the invention has been made. The model could also be modified by taking into account that E might as well spend ex post effort to foster the project value. Then it would not be efficient to assign the residual claim to F. Even in the framework of our simple model, with a deterministic project value, no budget balanced sharing rule exists that motivates both parties to spend efficient ex-post effort, unless the parties are risk-averse.[30] With sequentially invested ex-post efforts and verifiable output, Strausz (1999) has demonstrated a mechanism that implements first-best effort.[31] If both parties can contribute to foster the project value, then the payment scheme should distribute the residuum among them, which would make it necessary to decrease the (success contingent) fixed payment to E. Thus, it might be impossible to implement first-best efforts in such a situation.

# 4 Analysis of the German reform proposal

In this section, we make use of the results derived in section 2 above, and evaluate the two German legal reforms under scrutiny: the proposed reform of the complete law on employees' inventions, concerning employees in general, and the new legislation concerning university employees only. The latter has already passed the German *Bundestag*. Compared to the old law, both these reforms no longer require the parties to negotiate about the compensation, which is clearly an advantage in terms of efficiency. However, the payment parameters set are suboptimal in both cases.

[29]See Holmstrom (1982).
[30]See Holmstrom (1982) and Rasmusen (1987).
[31]Lülfesmann (2002) has analyzed the sequential team problem for stochastic output.

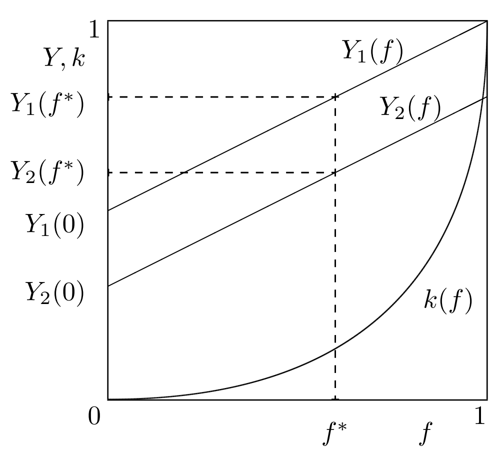
## 4.1 The proposed reform for non-university employees

According to the draft of the legislative proposal that was published by the German Federal Ministry of Justice, an employee who makes an invention has to reveal this to his employer. If the employer claims the rights to the invention, the employee is entitled to a financial compensation in three steps:

1. 750 Euro immediately;
2. 2,000 Euro 3.5 years after the employer has claimed the invention;[32]
3. a share of the returns if the project exceeds a threshold value.[33]

Leaving aside the fact that the fixed payment is due in two parts, it amounts to 2,750 Euro in case the employer makes use of the invention. This contingent fixed payment will be paid only if an invention is actually made and is independent of the actual project value. It is also independent of the net value of the employer's effort. However, as we have shown above, the efficient fixed wage equals just this net value: $\Phi^* = Y(f^*) - k(f^*)$.

Figure 4: Optimal $\Phi$ for different project




[32] If the employer has claimed the invention, but does not make use of it, i.e. if he stores it as a business secret, then the employee is entitled to an additional payment of 500 Euro only.

[33] Returns greater than 5,000,000 Euro, or profit greater than 125,000 Euro eight years after the invention was claimed.

Figure 4 shows an example for two different projects. In project 1, the final project value is determined by the function $Y_2(f)$, while project 2 is described by $Y_2(f)$. For simplification, the slopes and F's costs $k(f)$ are identical, thus in both cases, the optimal effort of F is $f^*$. The only difference is that the first project value exceeds the second. From efficiency point of view, the bonus for researcher 1 should exceed the bonus for researcher 2, since $\Phi_1^* = Y_1(f^*) - k(f^*)$ is greater than $\Phi_2^* = Y_2(f^*) - k(f^*)$.

Obviously, the efficiency criterion would be met by the legal provision only in very exceptional cases. In most of the cases, the bonus payment prescribed by the law will either exceed the respective efficient one, or be too small. Let us briefly discuss the three possible cases of a mandatory bonus $\Phi'$ in the above example:

a) $\Phi' < \Phi_2^*$: F receives both projects for a payment $\Phi'$.

b) $\Phi_2^* < \Phi' < \Phi_1^*$: F buys project 1 for a bonus payment $\Phi'$, whereas she rejects the other project.

c) $\Phi' > \Phi_1^*$: F rejects both projects.

In the framework of our model, it is inefficient, however, if F rejects a project, since her the efficient contribution is positive (see Proposition 1 above). In cases a) and b), F would buy both or at least one of the projects, if successful. However, the mandatory bonus only induces inefficient small effort on E's side. Should F consider to pay a higher bonus in order to make E work harder? A closer look on the incentive situation of F makes clear, however, that the voluntary payment of a higher bonus is unlikely.

Paying the mandatory bonus, F's expected payoff is positive. Even with inefficient (but positive) effort of E, the probability of a success is positive. In case of a success, F may retain a positive share of the project value. If she would pay the efficient bonus, i.e. the net value of her contribution, then her expected payoff would be zero. Thus, she has no incentive to pay the efficient bonus.

Nevertheless, F may have an incentive to pay voluntarily a higher bonus: if she is residual claimant ($\alpha = 0$), then F chooses $\hat{\Phi}$ to maximize

$$p(\hat{e})[Y(f^*) - k^(f^*) - \Phi]$$

subject to two constraints: the bonus has to exceed the mandatory one, i.e., $\hat{\Phi} \geq \Phi'$, and E chooses his payoff as a reaction on F's choice of $\Phi$: $\hat{e} = \arg\max p(e)\Phi-$

$c(e)$. The first-order condition for E's reaction is $\Phi dp/de = dc/de$. Given our assumptions made in section 2, a positive relation exists between the bonus and E's effort choice $\hat{e}$: $d\hat{e}/d\Phi > 0$. Then, F's maximization problem can be rewritten as

$$\hat{\Phi} = \arg\max p[\hat{e}(\Phi)] \cdot [Y^* - k^* - \Phi]$$

s.t. $\hat{\Phi} \geq \Phi$. Neglecting the constraint for the moment yields the following first-order condition:

$$\frac{dp}{de}\frac{d\hat{e}}{d\Phi}[Y^* - k^* - \hat{\Phi}] = p[\hat{e}]$$

As long as $\Phi' < Y^* - k^*$, situations exists in which this condition is fulfilled, hence an interior solution exists with $\hat{\Phi} > \Phi'$. However, as argued above, $\hat{\Phi}$ is always smaller than the efficient bonus $\Phi^* = Y^* - k^*$.

The proposal provides a third payment component, which adds another distortion: The employee is entitled to a share of the project returns. Even though the occurrence of this share is uncertain, the expected value is positive and therefore exceeds the efficient share ($\alpha^* = 0$). A positive share of the (expected) returns induces the firm to spend less than efficient effort. Furthermore, we have demonstrated in our Proposition 3 that E's payment is necessarily smaller than the optimal contingent fixed wage if the parties deviate from the optimal payment scheme. Thus, E's incentives to spend effort in the first stage are distorted as well.

Three aspects, however, suggest a qualification of these unambiguous result concerning the reform proposal:

- The old law frequently led to costly litigation. The reform proposal provides a redress for this drawback, since the payment components are exactly defined. A clear standard, even though it may be inefficient in most cases, at least avoids litigation costs. It is left to empirical research to demonstrate which effect outweighs the other: the inefficiency of the standard or the saved litigation costs.

- If the success of a project also depends on ex-ante effort of the employer, then a suboptimal low bonus $\Phi$ can be second-best efficient. The difference $\Phi - Phi^*$, which the employer retains, creates an incentive for her to spend ex-ante effort.

- If the employee is risk-averse (instead of risk-neutral, as we have assumed above), then second-best efficiency may require a decrease in the bonus and a (higher) fixed wage that is independent of the project success in order to reduce the employee's exposition to risk.

## 4.2 The special law concerning university employees

The current German law contains a privilege concerning inventions made by university scholars. According to this rule, professors did not have to announce their inventions to their employer, the university. In particular, the university did not have any right to the invention.

Even though the reform proposal discussed above has not been brought into the German parliament yet, a law on this particular privilege has passed the German Bundestag recently. The new regulation provides a right for the universities to any invention made by university employees (not only scholars), and introduces a payment scheme that is different from the one for employees in general. The employee receives 30 percent of the returns, and no fixed fee.

In the terms of our model, the new law sets $\Phi = 0$ and $\alpha > 0.3$ since it expressly refers to the returns, not the profit. According to our analysis, this implements too little effort on the employers side: $f < f^*$. In addition to this, Proposition 3 demonstrates that the incentives for the employee are suboptimal as well, since the resulting payment will be smaller than the efficient fixed fee.

The new law would deserve a more favorable judgement if university scholars can contribute ex-post effort to the promotion of the invention. In our analysis above, we have assumed that it is only the employer who increases the project value. If the employee's effort is also relevant in this stage of the game, then the payment scheme should provide incentives for him as well as for the firm. However, according to the literature on university inventions, this is not compelling. University scholars appear to be rather unaware of how to create (or increase) the value of their inventions.[34] Moreover, even if the scholars are able to contribute to the project value, it is still to be proven whether a variable payment $\alpha = 0.3$ is (second-best) optimal.

The main reason why the Federal Government brought forward this legal initiative was its concern that the number of patents, compared to the number of inventions made at the universities, is too small nowadays. Two reasons for this

[34] See Brockhoff (1998).

are considered: First, the universities do not have installed patent bureaus yet; the shift of property rights shall induce them to build up such institutions. If patent files are a matter of scale economies, then this idea may lead to efficiency.

Another problem addressed by the new law is the observation that researchers often have no interest in filing for a patent, but rather want to publish their results in scientific journals. The German patent law[35] prohibits patents from being issued if the idea has already been published, because publication turns it into "state of the art". Thus, if they want to file for a patent, the universities would need, in principle, to prohibit prior publication by the researchers.

However, the German constitution grants researchers a basic right to their scientific results.[36] The shift of the patent rights to the universities itself is not considered a violation of the researchers constitutional rights, whereas an obstacle for publication would certainly be one. Therefore, the new law tried to balance the interests of the universities and the researchers by introducing an elaborate system of time limits: the researcher, having announced his publication to his university, has to wait two months before submitting his results to a scientific journal, which gives the university time for evaluation of the project and filing of the patent.[37] This procedure intends to make both filing for patent and scientific publication of the results possible.

The explicit intention of the new law is to increase the number of patents. However, the incentive structure of the new law leads to inefficient effort. Thus, the total number of inventions may decrease, and the total number of patents may decrease even if the rate of patents increases substantially.

# 5 Conclusion

We have analyzed a sequential interaction between an employee E (who is engaged in research and may produce an invention) and an employer F (who may purchase the invention in case of a successful project). We have distinguished two institutional settings, namely exogenously fixed payment schemes vs. negotiation over payment after the project has turned out to be successful. As the starting point of our analysis, we have set up a simple principal-agent model

[35]§3 German patent law

[36]Art. 5 III of the German *Grundgesetz*.

[37]See the proposal made by the legal committee of the German *Bundestag*, published as *Bundestags-Drucksache* 14/7573, Nov 26th, 2001, *http://dip.bundestag.de/btd/14/075/1407573.pdf*.

with complete information and two risk-neutral players. In both settings, we have derived the optimal variable payment to E (the principal) that implements the optimal effort of the agent F. In both cases, the optimum is zero. Thus, an optimal contract puts the employer into the position of the residual claimant. The right to the residual income motivates her to spend efficient effort on the promotion of the invention, which generates the maximum cooperation rent.

However, the two legal institutions under scrutiny are clearly different with respect to the fixed payment and the effort of E in the respective equilibrium. Under the negotiation rule (and this result is also true in case of re-negotiation over exogenously fixed payments), both the agreed upon fixed payment and E's effort are predicted to be smaller than optimal.

Thus, the optimal contract between employer F and employee E should give F the residual claim to the project value. This motivates F to invest efficient effort into the promotion of the project, which generates the maximum cooperation rent. E should receive a fixed fee (in case of a successful invention) that equals the net value of this cooperation rent. Neither a variable payment, nor ex-post negotiations implement efficient effort on both sides.

Modifications of our starting model may lead to partly different results:

- The introduction of risk-aversion on the employees' side even reinforces our results if project value is modeled stochastically. The extent of the inefficiency is even greater under the

- Within the framework of the old law, the bargaining result may be less inefficient as indicated by our analysis if a product market effect exists. A product market effect is a decline in the firm's profit if the employee moves on to a competing firm which makes use of his invention. Lower profit translates into a negative threat point, and thus a higher willingness to pay, on the side of the firm.

- The mandatory bonus provided by the new law can be lower than the efficient one. However, this can be second-best efficient if a first-best solution is not attainable, maybe for risk-aversion on the side of the employee, or if the employer can also contribute ex-ante effort to increase the success probability.

- A positive variable payment can only be second-best optimal if the employee can also contribute ex-post effort to increase the project value.

Our analysis demonstrates that both laws, the new one concerning universities, and the proposed one concerning employees in general, have a tendency to set inefficient incentives for spending effort into inventions. Thus, the German government might fail to reach its goal, namely to increase the number of patents in Germany.

# References


Brockhoff, Klaus (1997). Ist die kollektive Regelung einer Vergütung von Arbeitnehmererfindungen wirksam und nötig? in: *Zeitschrift für Betriebswirtschaftslehre* 67 (7), 677-687.

Brockhoff, Klaus (1998). Patentierung von Hochschullehrererfindungen; in: Franke, N./von Braun, C.F. (eds.): *Innovationsforschung und Technologiemanagement*; Berlin et. al.: Springer, 49-61.

Cherensky, Steven (1993). A Penny for Their Thoughts: Employee-Inventors, Preinvention Assignment Agreements, Property, and Personhood; in *California Law Review* 81 (2), 597-666.

Crampes, C./Langinier, C. (2002). Litigation and Settlement in Patent Infringment Cases, in: *The RAND Journal of Economics* Vol. 33 (2), 258-274.

Eisenberg, Rebecca S. (2002). Reexamining Drug Regulation from the Perspective of Innovation Policy; unpublished mimeo, University of Michigan Law School, Ann Arbor.

Gallini, Nancy and Suzanne Scotchmer (2002). Intellectual Property: When Is It the Best Incentive System?, National Bureau of Economics Research, *Innovation Policy and the Economy* Vol. 2, Issue 1, Washington/D.C. 2002, S. 51-77.

Hardin, Russel (1968). The Tragedy of the Commons; in: *Science* 162, 1243-1248.

Heller, Michael A. (1998). The Tragedy of the Anticommons. Property in the Transition from Marx to Markets; in: *Harvard Law Review* 111, 621-688.

Heller, Michael A. and Rebecca S. Eisenberg (1998). Can Patents Deter Innovation? The Anticommons in Biomedical Research, in: *Science* 280, 698-701.

Holmstrom, Bengt (1982). Moral Hazard in Teams; in: *Bell Journal of Economics* 13, 324-340.

Inderst, Roman (2002). Contract Design and Bargaining Power, in: *Economics Letters* 74, 171-176.

Kesten, Ralf (1996). Innovationen durch eigene Mitarbeiter. Betriebswirtschaftliche Aspekte zur monetären Beurteilung von Diensterfindungen nach dem Gesetz über Arbeitnehmererfindungen; in: *Zeitschrift für Betriebswirtschaftslehre* 66 (6), 651-673.

Kitch, Edmund W. (1977). The Nature an Function of the Patent System; in: *The Journal of Law and Economics* 20, 265-290.

Kitch, Edmund W. (1998). Patents; in: Newman, P. (ed.): *The New Palgrave Dictionary of Economics*, Vol. 3., London/New York: Macmillan.

Klemperer, Paul (1990). How Broad Should the Scope of Patent Protection Be? in: *The RAND Journal of Economics* 21, 113-130.

Lanjouw, Jean O., Ariel Pakes and Jonathan Putnam (1998). How to Count Patents and Value Intellectual Property: The Uses of Patent Renewal and Application Data; in: *The Journal of Industrial Economics* 46 (4), S. 405-432.

Lülfesmann, Christoph (2002). Team Production, Sequential Investments, and Stochastic Payoff; in: *Journal of Institutional and Theoretical Economics* 157 (3), 430-442.

Merges, Robert P. (1999). The Law and Economics of Employee Inventions; in: *Harvard Journal of Law and Technology* 13, 1-63.

Meurer, Michael (1989). The Settlement of Patent Litigation; in: *The RAND Journal of Economics* 20, 77-91.

Orbach, Barak Y. (2002). The Law and Economics of Creativity in the Workplace; Harvard Law School, Discussion Paper No. 356, Cambridge/MA.

Rasmusen, Eric (1987). Moral Hazard in Risk-Averse Teams; in: *The RAND Journal of Economics* 18, 428-435.

Reimer, Eduard, Hans Schade and Helmut Schippel (2000). *Das Recht der Arbeitnehmererfindung: Kommentar zu dem Gesetz über Arbeitnehmererfindungen und deren Vergütungsrichtlinien*; 7. ed., Bielefeld, Berlin: Erich-Schmidt-Verlag.

Schankermann, Mark (1998). How Valuable is Patent Protection? Estimates by Technology Field; in: *The RAND Journal of Economics* 29 (1), 77-107.

Scotchmer, Suzanne (1991). Standing on the Shoulders of Giants. Cumulative Research and the Patent Law; in: *Journal of Economic Perspectives* 5 (1), 29-41.

Scotchmer, Suzanne (1996). Protecting Early Innovators: Should Second-Generation Products be Patentable? in: *The RAND Journal of Economics* 27, 322-331.

Strausz, Roland (1999). Efficiency in Sequential Partnerships; in: *Journal of Economic Theory* 85, 140-156.

# Appendix

## Proof of Proposition 2

When choosing her effort $f$, F solves the following maximization problem:

$$\max_f \ (1-\alpha)Y(f) - k(f) - \Phi$$

The first-order condition is

$$(1-\alpha)\frac{dY}{df} - \frac{dk}{df} \overset{!}{=} 0.$$

The second-order condition guarantees a maximum:

$$(1-\alpha)\frac{d^2Y}{df^2} - \frac{d^2k}{df^2} < 0.$$

Comparison of the first-order condition with equation (2), i.e. equation (2), shows that $f^*$ is implemented if, and only if, $\alpha = 0$.

F prefers buy over not buy if, and only if, $(1-\alpha)Y(f) - k(f) - \Phi > 0$. Given $\alpha = 0$, this implies that

$$\Phi < Y(f^*) - k(f^*)$$

Given $\alpha = 0$ and $\Phi < Y(f^*) - k(f^*)$, E chooses his effort by solving the following maximization problem:

$$\max_e \ p(e)[\alpha Y(f^*) + \Phi] - c(e)$$

which yields the first-order condition

$$\frac{dp}{de}\Phi - \frac{dc}{de} \overset{!}{=} 0$$

The second-order condition $\Phi d^2p/de^2 - d^2c/de^2 < 0$ guarantees a maximum. The first-order condition is equivalent to

$$\frac{dc/de}{dp/de} \overset{!}{=} \Phi$$

Comparison of this expression with equation (1) demonstrates that E is motivated to spend optimal effort if, and only if, $\Phi = Y(f^*) - k(f^*)$, q.e.d.

## Proof of Proposition 4

Given a bargaining result $(\alpha^n, \Phi^n)$, F solves the same maximization problem as demonstrated in the proof of Proposition 2. Thus, it is only $\alpha^n = 0$ that would implement optimal effort $f^*$. Hence, the bargaining problem is reduced to determine $\Phi^n$. Given $\alpha = 0$, the symmetric Nash bargaining solution maximizes the Nash product

$$[\Phi^n - c(e) - Y(0) + c(e)] \cdot [Y(f^*) - k(f^*) - \Phi^n - 0]$$

which can be reduced to $[\Phi^n - Y(0)][Y(f^*) - k(f^*) - \Phi^n]$. The first-order condition for a maximum is

$$[Y(f^*) - k(f^*) - \Phi^n] \stackrel{!}{=} [\Phi^n - Y(0)]$$

which is equivalent to $\Phi^n = 0.5[Y(f^*) - k(f^*) + Y(0)]$, q.e.d.

## Proof of Proposition 5

Recall that, according to Proposition 2, the optimal effort $e^*$ is implemented if, and only if, $\Phi^* = Y(f^*) - k(f^*)$. Recall furthermore that, by assumption, $Y(f^*) - k(f^*) > Y(0)$, which implies $\Phi^* > 0$. The comparison of the results in Propositions 2 and 4 therefore yields $\Phi^n < \Phi^*$, q.e.d.

# Abstracts

In Germany, employers can claim the right to any invention made by their employees, but they have to pay a compensation if they do so. Recently, this compensation has been the subject of a legal reform proposal and a new law concerning university employees. In this paper, we set up a simple principal-agent model to analyze the current law, the reform proposal and the new law. Our model allows us to derive a unique efficient payment scheme that consists only of a fixed bonus which is contingent on the project value. We show that the freedom to negotiate over the compensation after the invention has been made (as it is provided by the old law) creates inefficient incentives. Efficiency requires the compensation to be fixed ex-ante, as it is provided by both the proposed law (concerning employees in general) and the new law (concerning university scholars). However, both set the payment schemes inefficiently way. With suboptimal incentives to spend effort on inventions, the government's goal, an increase in the number of patents, is likely to be missed.

*In Deutschland haben Arbeitgeber ein Recht auf jede Erfindung, die ihre Arbeitnehmer im Rahmen des Dienstverhältnisses machen. Wenn sie dieses Recht wahrnehmen, müssen sie jedoch eine Kompensation zahlen. Diese Rechtslage ist vor kurzem durch ein neues Gesetz für Hochschulangestellte reformiert worden. In diesem Beitrag untersuchen wir mit Hilfe eines simplen Prinzipal-Agenten-Modells das alte Recht, das neue Gesetz sowie den ausstehenden Reformvorschlag (der sich auf Arbeitnehmer ausserhalb der Universitäten bezieht). Wir leiten her, dass ein effizientes Kompensationsschema nur aus einer Bonuszahlung besteht, die auf den Projekterfolg bedingt ist. Wir zeigen, dass die unter dem alten Recht nötigen Verhandlungen über erfolgreiche Projekte ineffiziente Anreize erzeugen. Nur eine vorab festgelegte Vergütung - wie sie im neuen Gesetz und im Reformvorschlag vorgesehen ist - kann effizient sein. Dennoch setzen beide Novellierungen ineffiziente Anreize. Daher ist es möglich, dass das Hauptziel der Reform, mehr Patente aus Universitäten zu gewinnen, verfehlt wird.*

En Allemagne, l'employeur peut revendiquer le droit d'exploiter toute invention faite par l'employé, à condition toutefois de lui verser une compensation. Le versement de cette compensation a fait récemment l'objet d'un projet de loi et d'une nouvelle loi applicable aux employés des universités. Dans cet article, nous proposons un modèle de principal-agent, afin d'analyser la loi actuelle, le projet de loi et la nouvelle loi. Notre modèle permet de définir un système de paiement à la fois unique et efficace, articulé autour d'un bonus fixe dépendant de la valeur du projet. Nous nous proposons de démontrer que le système actuel, qui laisse aux parties la liberté de négocier la compensation après que l'invention a été faite, est inefficace sur le plan incitatif. L'efficacité passe par la fixation ex ante de la compensation, conformément au projet de loi - concernant les employés en général - et à la nouvelle loi (applicable aux chercheurs universitaires). Mais les systèmes de rémunération inscrits ne sont pas efficaces. En l'absence d'incitations économiques suffisantes, il est peu probable que le gouvernement atteigne son objectif, qui est d'accroître le nombre des brevets d'invention.