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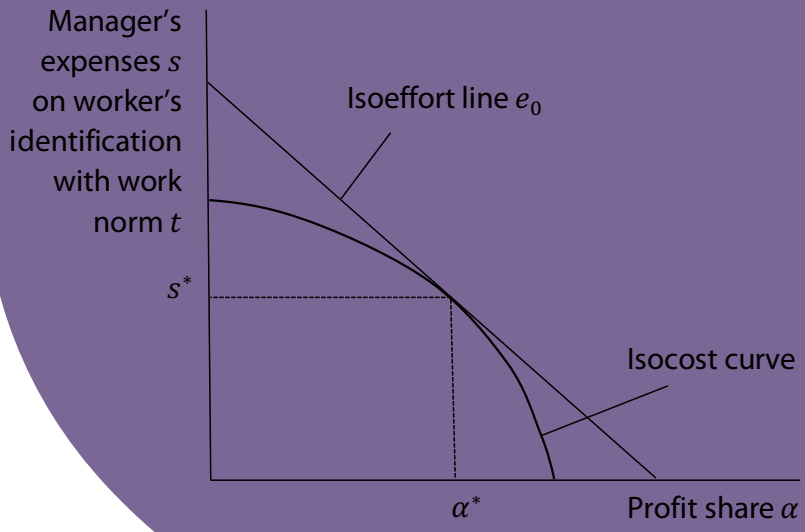

DISCUSSION PAPER 2018 #175

A microeconomic model of worker motivation based on monetary and non-monetary incentives

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ABSTRACT

By focusing on direct monetary incentives, the traditional literature on motivating workers predicts that high-effort outcomes are unlikely unless workers become residual claimants of profit. However, real world employment contracts typically display a low incidence of profit sharing. In this paper, I extend the canonical model of a revenue sharing contract by integrating two more options for incentivising workers. The literature to date has discussed these strategies in isolation from each other. First, I assume that workers derive utility from following a work norm. The manager can influence workers' identification with a high-effort work norm at a cost. Second, workers risk being fired if they are observed shirking. Depending on the rigidity of their employment contract, this threat of termination induces them to increase effort. Key drivers of the optimal employment contract are then the variance of output, the costs of inducing worker's identification with high-effort norms and the rigidity of the labour market.

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1 \ Introduction

To what extent and under which conditions workers' effort reflects the goals of their employers have been salient management questions since the early years of the industrial revolution. Mainstream economic thinking considers this to be a problem of providing workers with the right incentives. In this regard, neoclassical models of the production process see little difference between labour and other factors of production. Homogenous amounts of work can be bought in the market and instantaneously perform their duty in exchange for wage payment, according to their marginal contribution to material output. However, if this was an adequate description of reality, many courses in MBA programmes and much management literature would be obsolete.

Recent economic scholarship starts from the insight that workers' effort cannot be directly contracted by the employer (Lazear and Oyer 2013). A key question is thus how monetary incentives should be structured if managers possess only imperfect information and incomplete control over the effort of their workers. However, the formal structure of the monetary reward is only one among several dimensions of the employment contract. As recent literature acknowledges, workers' incentives may be of an informal and possibly non-monetary nature (Bowles 2004, 267–298). For example, if finding alternative employment is difficult, the threat of being fired can be a strong motivation for high effort (Shapiro and Stiglitz 1984). Inspired by ethnographies of the workplace, Akerlof and Kranton (2010) argued that it matters a lot to what extent workers identify with their employer and what kind of work ethics this implies.

In real world organisations, workers' behaviour is typically affected by all or several of these incentives simultaneously. However, while there is an extensive literature that analyses these dimensions in separation from each other, models that integrate them and remain analytically tractable are rare. At the same time, if the goal is to better understand variation and change in real world incentive schemes, such models are highly desirable. The following is an attempt to fill this lacuna.

In the sequel, I develop a microeconomic model of the employment relation which maps several strategies for incentivising workers simultaneously. The aim is to present a formally tractable structure that allows a systematic analysis of empirically important drivers of employment contracts and that can be used to simulate their relative effect. The model is based on the now canonical moral hazard model due to Holmstrom and Milgrom (1987). Their model analyses optimal contract choice based on constant absolute risk aversion of the worker and a linear incentive schedule.[1] In the following, I first summarise the basic structure of the model and derive its main predictions for the shape of monetary incentive schedules. I then extend the model in two directions by considering the possibility that workers derive utility from identifying with a company's work ethic and by introducing a positive termination probability in the case of shirking. In the full model, four strategies for incentivising workers are captured simultaneously: (1) a fixed wage, (2) a revenue share, (3) identification with a high-effort norm, and (4) the threat of termination.

1 See the instructive discussion of the model in Furubotn and Richter (2005, 206–222).

2 \ A basic model of the employment relationship

Consider a worker (or agent) supplying effort e to a production process of a firm owned by a principal (or manager). The firm's revenue q accrues to the principal and is a function of e. However, because effort is difficult to measure and profit may depend also on other factors than effort, the principal cannot directly contract the effort of the worker. A simple way to model this is by assuming that revenue depends on effort and a linearly separable random variable ε:

$$q = e + \varepsilon, \text{ with } \varepsilon \sim N(0, \sigma^2). \tag{1}$$

To elicit effort from the worker, the manager offers him a linear wage schedule w consisting of a fixed rate r and a variable payment in the form of a share α in revenue (Holmstrom and Milgrom 1987, 323):

$$w = r + \alpha q, \text{ with } 0 \leq \alpha \leq 1. \tag{2}$$

The model asks which values of r and α a profit maximizing principal will choose. To make this decision, the principal needs to know the agent's effort response as a function of the offered wage contract.

2.1. | The worker's effort choice

The worker is assumed to be risk averse with preferences described by a utility function $u(y) = -\exp(-ay)$, where y is a normally distributed, uncertain income, and a the constant absolute rate of risk aversion. The utility function can hence be written in a form that is linear in the mean $\bar{y}$ and variance σ_y^2 of income (Varian 1992, 172–190):

$$u(y) = \bar{y} - \frac{a}{2}\sigma_y^2.$$

Moreover, the worker is assumed to incur a utility cost of effort $\frac{1}{2}ke^2$, with k the constant marginal cost of effort.

Evaluated in monetary terms, the utility of the worker is thus determined by the wage schedule defining his income, the risk premium due to the variance of income, and the cost of effort. The worker chooses effort to maximise utility defined over income minus costs. Inserting (1) and (2) and considering the risk premium defined by the mean-variance utility function yields the following optimisation problem:

$$\max_e u(e) = r + \alpha e - \frac{1}{2}ke^2 - \frac{1}{2}a\alpha^2\sigma^2. \tag{3}$$

With effort entering the cost side as a quadratic term, utility is concave in effort. The first-order condition defines a globally optimal effort response of the worker as:

$$e = \frac{\alpha}{k}. \tag{4}$$

2.2. | The optimal incentive schedule set by the manager

The principal is assumed to be risk neutral and chooses α and r such as to maximise her expected profit $\pi \geq 0$ defined as revenue (1) minus labour costs (2). This optimisation process is subject to two constraints, namely that the worker will accept the employment offer over his next best (certain) alternative $\bar{u}$ (the *participation constraint*, PC), and that he will respond to a given (α, r) offer with effort defined by (4) (the *incentive constraint*, IC). The principal is considered a monopolistic wage setter on the labour market. He thus solves the following programme:

$$\max_{\alpha,r} E(\pi) = q - w = (1-\alpha)e - r, \text{ subject to} \tag{5}$$

$$e = \frac{\alpha}{k} \text{ (IC) and}$$

$$u(e) = r + \alpha e - \frac{1}{2}ke^2 - \frac{1}{2}a\alpha^2\sigma^2 \geq \bar{u} \text{ (PC).} \tag{6}$$

Assuming that $u(e) = \bar{u} = 0$, i.e. the participation constraint is exactly binding and the worker's opportunity costs are zero, inserting the two constraints into (5) yields:

$$\max_{\alpha} E(\pi) = \frac{\alpha}{k} - \frac{1}{2}\frac{\alpha^2}{k} - \frac{1}{2}\alpha^2 a\sigma^2.$$

This equation describes an inverse U-shaped profit function with a unique, profit maximising α:

$$\alpha^* = \frac{1}{1+ka\sigma^2}.$$

Substitution in (4) gives optimal effort:

$$e^* = \frac{1}{k(1+ka\sigma^2)},$$

and substitution in (6) the optimal fixed rate:

$$r^* = \frac{ka\sigma^2 - 1}{2k(1+ka\sigma^2)^2}.$$

2.3. | Discrete contractual solutions

It is instructive to note how assumptions about the parameters of the model imply certain discrete contractual arrangements as optimal solutions (Table 1). Depending on the assumptions about the contractibility of effort and the risk aversion of workers, three contractual equilibria emerge:

A. *Fixed wage*. If the principal can directly contract the risk averse agent's effort, there is no incentive constraint and the revenue share does only create costs for the principal. Hence, $\alpha^* = 0$ and the manager simply compensates the worker for his effort cost (and possibly some outside opportunity) by a fixed wage. All the risk is borne by the principal (Furubotn and Richter 2005, 215).

B. *Franchise*. If effort is not contractible and the worker is risk neutral, it is optimal for the principal to rent the production facility to the agent against payment of a fixed rental fee to the owner (a franchise). In this case, the worker becomes the residual claimant, faces optimal incentives and bears all the risk.

C. *Sharing*. Without contractibility but positive risk aversion, the worker is offered a wage schedule that includes both fixed and variable elements. The variable element decreases with increasing risk aversion and/or revenue variance. As soon as $a\sigma^2 > k^{-1}$, the fixed wage to the worker is positive. As a result, manager and worker share the risk. This second-best solution – considered the most realistic among the three – implies reduced effort for the worker and comes at the cost of smaller profits for the manager.

These results confirm the intuition that there must be strong non-wage incentives if risk-averse workers are to provide high effort under a fixed wage contract. On the other hand, franchise agreements are only likely to be observed if workers' risk aversion is small (or they have other mechanisms available to hedge their risk). In the absence of other incentives, a sharing contract balancing the two polar cases will imply efficiency losses.

Table 1 Equilibrium strategies for incentivising workers

	A	B	C	D	E
	Fixed wage	**Franchise**	**Sharing**	**Sharing & identification**	**Sharing, identification & threat of termination**
Contractibility of effort	Yes $\sigma^2 = 0$[a]	No $\sigma^2 > 0$	No $\sigma^2 > 0$	No $\sigma^2 > 0$	No $\sigma^2 > 0$
Worker's risk aversion	Positive $a > 0$	Zero $a = 0$	Positive $a > 0$	Positive $a > 0$	Positive $a > 0$
Manager's investment in identification	Zero $s = 0$	Zero $s = 0$	Zero $s = 0$	Positive $s_D^* = \frac{b}{2}\left(\frac{\bar{e}k - 1}{1 - bk}\right)^2 > 0$	Positive $s_E^* > 0$
Worker's identification with work norm	Zero $t = 0$	Zero $t = 0$	Zero $t = 0$	Positive $t_D^* = \frac{\bar{e}k - 1}{1 - bk} > 0$	Positive $t_E^* > 0$
Threat of termination	Zero $\theta = 0$	Zero $\theta = 0$	Zero $\theta = 0$	Zero $\theta = 0$	Positive $\theta > 0, d > 0$
Revenue share	$\alpha_A^* = 0$	$\alpha_B^* = 1$	$\alpha_C^* = \frac{1}{1 + ka\sigma^2} < 1$	$\alpha_D^* = \frac{1}{1 + ka\sigma^2}$	$0 < \alpha_E^* < 1$
Fixed rate	$r_A^* = \frac{1}{2k}$	$r_B^* = \frac{1}{2k}$	$r_C^* = \frac{ka\sigma^2 - 1}{2k(1 + ka\sigma^2)^2} > -\frac{1}{2k}$	$r_D^* = \frac{ka\sigma^2 - 1}{2k(1 + ka\sigma^2)^2} + t_D^*(\bar{e} - e_D^*) > r_C^*$	undetermined
Worker's effort	$e_A^* = \frac{1}{k}$	$e_B^* = \frac{1}{k}$	$e_C^* = \frac{1}{k(1 + ka\sigma^2)} < \frac{1}{k}$	$e_D^* = \frac{1}{k}(\alpha_d^* + t_d^*) > e_C^*$	undetermined
Manager's expected profit	$E(\pi)_A^* = \frac{1}{2k}$	$E(\pi)_B^* = \frac{1}{2k}$	$E(\pi)_C^* = \frac{1}{2k(1 + ka\sigma^2)} < \frac{1}{2k}$	$E(\pi)_D^* > E(\pi)_C^*$	$E(\pi)_E^* > E(\pi)_D^*$

Notes: See appendix for a description of the main symbols. A, B, and C are mutually exclusive strategies, while C is nested in D and D is nested in E. [a] Implying that manager can contract effort directly

3 \ Workers identify with high-effort work norms

Given the prevalence of fixed wages (or time rates) in modern economies, the model appears incomplete without a mechanism that provides non-wage incentives and thus ensures high effort of workers in the absence of revenue sharing or performance pay. The following extension is motivated by a recent literature on 'identity economics', stressing that workers care about the prevailing behavioural norms in their social environment (Akerlof and Kranton 2008; 2010). More specifically, AKERLOF and KRANTON suggest that individuals assign themselves to distinct social categories, which in turn are defined by a set of behavioural norms and ideals. Individuals are assumed to derive utility from conformity with their ideals or a loss from non-conformity.

According to this view, identity is a key to making organisations successful. Workers who identify with their firm's objectives consider themselves as 'insiders'. Such employees need little monetary incentive to perform their job well. On the other hand, 'outsiders', who in their mind quit the contract with their employer, are unlikely to provide more than minimum effort. Workers should thus be assigned to jobs with which they identify, and firms should invest in such attachments. Following the model above, note that this strategy of incentivising workers will be particularly cost effective to the firm if inducing identity is relatively easy to do, if production uncertainty is high and contracting of effort very costly or impossible, and if workers are particularly risk averse (Akerlof and Kranton 2010, 39–43).

3.1. | Worker's utility from work norm conformity

To capture the possible extra utility from identification with the workplace, I introduce an additional component into the worker's utility function (3). Inspired by Akerlof and Kranton (2008), I assume that there exists a high-effort work norm $\bar{e} \geq e^*$, the deviation from which may cause discomfort to the worker.[2] The strength of this discomfort depends on how much the worker identifies with his workplace and is captured by an identity parameter $t \geq 0$:

$$\max_e u(e) = r + \alpha e - \frac{1}{2}ke^2 - \frac{1}{2}a\alpha^2\sigma^2 - t(\bar{e} - e). \tag{7}$$

This revised optimisation problem yields the following IC and PC:

$$e = \frac{\alpha + t}{k} \text{ (IC) and} \tag{8}$$

$$r + \alpha e - \frac{1}{2}ke^2 - \frac{1}{2}a\alpha^2\sigma^2 - t(\bar{e} - e) \geq \bar{u} \text{ (PC).} \tag{9}$$

The manager may induce a worker's identification with a high-effort norm at the workplace by increasing t at a marginal cost of b, where the total expenses on inducing identification amount to:

$$s = \frac{1}{2}bt^2. \tag{10}$$

2 Akerlof and Kranton (2008), by using an absolute value function, capture work norms that may be either higher or lower than optimal effort without identity. To keep the model simple, I concentrate on the case of a work norm eliciting higher effort.

Activities to increase workers' identification with the firm could include job rotation schemes, investing in the layout of the work place, or sponsoring social activities including sport events, company receptions and retreats. Interpreting this investment in identity as a part of the wage bill (2), the latter must be rewritten as:

$$w = r + \alpha q + s,$$

so that the manager's problem now becomes:

$$\max_{\alpha,s} E(\pi) = \frac{\alpha+t}{k}\left(-\frac{1}{2}k\frac{\alpha+t}{k} + t + 1\right) - \frac{1}{2}\alpha^2 a\sigma^2 - s - t\bar{e}\,, \tag{11}$$

subject to (8) to (10). This problem D is concave in α and s and can be solved for a unique equilibrium. Moreover, it is additively separable in α and s, so that α^* remains unchanged. The first order conditions yield the following closed-form solutions:

$$\alpha_D^* = \frac{1}{1+ka\sigma^2}\,, \tag{12}$$

$$s_D^* = \frac{b}{2}\left(\frac{\bar{e}k-1}{1-bk}\right)^2\,, \tag{13}$$

$$t_D^* = \frac{\bar{e}k-1}{1-bk} \tag{14}$$

$$e_D^* = \frac{1}{k(1+ka\sigma^2)} + \frac{\bar{e}k-1}{k-bk^2} = \frac{1}{k}\left(\alpha_d^* + t_d^*\right) > e_C^*, \text{ and} \tag{15}$$

$$r_D^* = \frac{ka\sigma^2-1}{2k(1+ka\sigma^2)^2} + t_D^*(\bar{e} - e_D^*) > r_C^*. \tag{16}$$

This solution requires suitable parameter values making sure that $t_D^* \geq 0$, such as $b > \frac{1}{k} > \bar{e}$. If $s_D^* > 0$, compared to the sharing contract, worker's effort, his fixed compensation, and the manager's profit all increase.[3] Fostering the identification of workers with the firm emerges as a complementary incentive strategy (Table 1).

The comparative statics of the model defined by eqs. (11)–(16) are summarised in Table 2. While the negative effects of the direct or indirect cost parameters a, b, k and σ^2 are fairly obvious, a note on the effect of $\bar{e}$ may be in order. Whereas $\bar{e}$ has no effect on α, we have $\frac{\partial t}{\partial \bar{e}} = \frac{-k}{bk-1} < 0$ from (14). This effect is due to the role of $\bar{e}$ in the participation constraint (9). For a given t, the higher $\bar{e}$, the more costly it is to secure workers participation. This lowers the attractiveness of s as an incentivising strategy, thus the negative effect.

3 If spending on s was not profitable, t_D^* would be equal to zero.

Table 2 Comparative statics of the identity model

Parameters	Outcomes					
	α (12)	r (16)	s (13)	t (14)	e (15)	π (11)
a	–	ambiguous	0	0	–	–
b	0	ambiguous	–	–	–	–
$\bar{e}$	0	ambiguous	–	–	–	–
k	–	ambiguous	–	–	–	–
σ^2	–	ambiguous	0	0	–	–

3.2. | Least cost elicitation of effort

If investing in the worker's identification with the workplace is an alternative strategy for securing his effort, the manager's problem may also be viewed as finding the least-cost combination of eliciting effort:

$$\min_{\alpha,r,s} w = r + \alpha e + s,$$

subject to (8) to (10) and a given effort level $e_0 = e(\alpha, r, s)$.

Following the standard problem of least cost combination of factors (Chiang 1984, 418–420), I consider μ the shadow price (or cost) of the effort level. Hence, the solution to this problem yields the following optimality condition (subscripts denoting partial derivatives):

$$\frac{w_\alpha}{\alpha} = \frac{w_s}{s} = \mu,$$

In words, μ denotes the marginal cost of securing effort in the optimality state. Alternatively,

$$\frac{w_\alpha}{w_s} = \frac{\alpha}{s}, \tag{17}$$

which is the marginal rate of substitution of α for s. Given suitable parameter values, both marginal cost functions are convex:

$$w_\alpha = \alpha\left(\frac{1}{k} + a\sigma^2\right),$$

$$w_s = \frac{1}{\sqrt{s}}\frac{\bar{e}}{\sqrt{2b}} + 1 - \frac{1}{bk}.$$

The first term of (17) thus defines a concave isocost curve of feasible α, s combinations, given a certain budget. The second term describes an isoeffort line with constant negative slope, collecting

all α, s combinations that just suffice to elicit a given level of worker's effort. The optimal solution is defined by the tangency point of both (Figure 1).

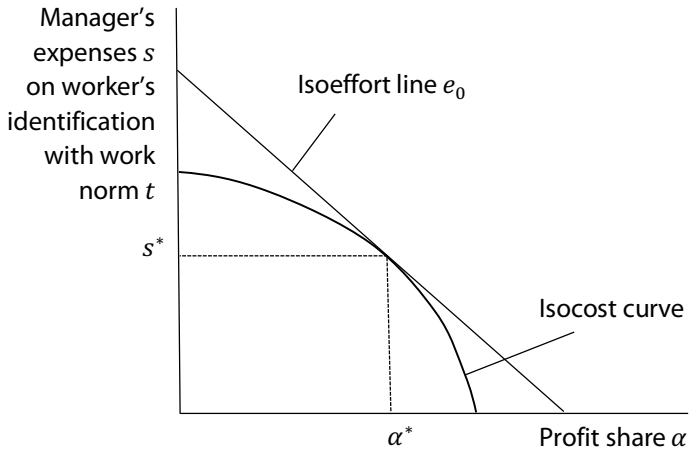

Figure 1 Least cost combination of eliciting worker's effort

4 \ Threat of termination

In labour markets where involuntary unemployment prevails, the threat to fire workers may be considered as an effective disciplining device (Shapiro and Stiglitz 1984; Bowles 1985). The idea gave rise to a class of 'efficiency wage models' (Akerlof and Yellen 1986): if the employment contract creates a rent for the worker vis-à-vis his next best alternative, the threat of losing it may induce him to abstain from shirking.[4]

Inspired by Bowles (2004, 269–280), I model this idea by introducing a positive termination probability that depends negatively on the worker's effort. In addition or alternatively to the incentive strategies discussed so far, the manager also announces a termination probability $\theta(e)$ with $\frac{\partial \theta}{\partial e} < 0$. It is assumed that without further cost to the manager, she occasionally observes the worker and may decide to fire him if she deems his performance to be unsatisfactory. The likelihood of termination is the lower the more diligent the worker. If the worker is fired, he obtains a certain reservation income worth $\bar{u}$ for the rest of his lifetime and is replaced by another, identical worker.

4 The term 'efficiency wage' is not particular useful, as the equilibria in such models are typically characterised by technical and Pareto inefficiency (Bowles 2004, 278).

The worker thus decides about e to maximise the present value v of his expected utility over an infinite horizon, given a rate of time preference i:

$$\max_e v = \frac{u(e)+(1-\theta(e))v+\theta(e)\bar{u}}{1+i}.$$

Under the stationarity assumption that $v = const$, this equation can be rearranged as:

$$v = \frac{u(e)-i\bar{u}}{i+\theta(e)} + \bar{u}.$$

Following Bowles (2004, 271), the first term on the right hand defines the employment rent of the worker, and the second the reservation income. In words, the present value of the job consists of the employment rent plus the fallback position.

Under the assumption that $i = \bar{u} = 0$, the worker's optimisation problem takes the form:

$$\max_e v = \frac{u(e)}{\theta(e)}. \tag{18}$$

For the remaining analysis, I define the termination function as follows:

$$\theta(e) = \frac{1}{de+1}, \tag{19}$$

with $d > 0$ measuring the rigidity of the employment contract. In words, the higher d, the more difficult (or simply the less likely) it is for the manager to shed workers (Figure 2). A high d may be due, for example, to strict employment legislation protecting the rights of workers but may also reflect a low level of unemployment in the local labour market.

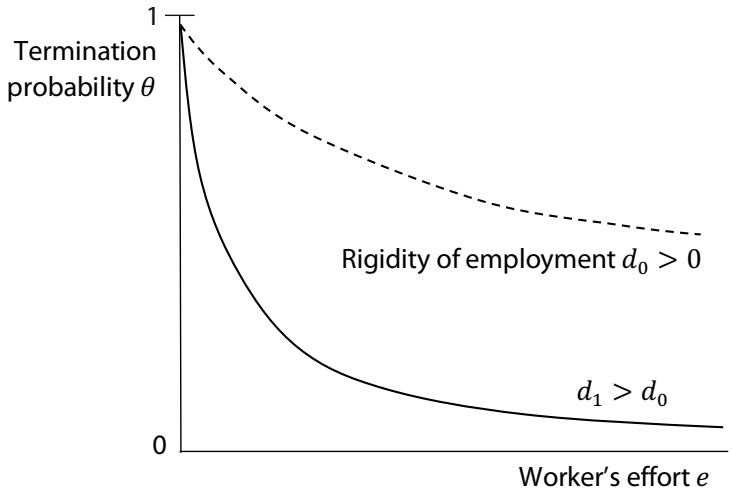

Figure 2 The termination probability

Holding all other variables constant, a more rigid employment contract lowers optimal effort (Figure 3).

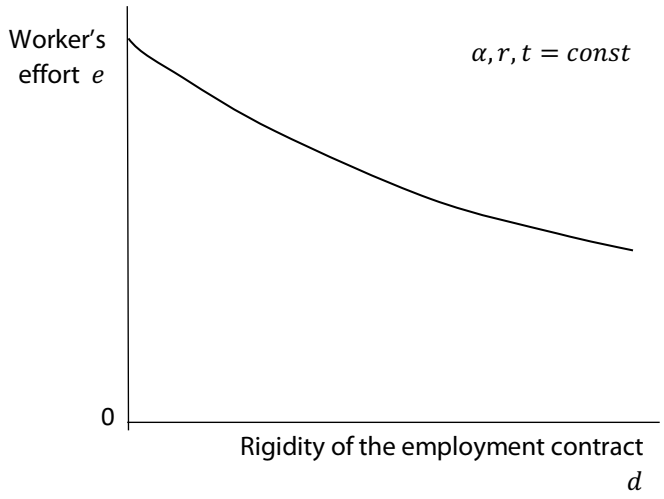

Figure 3 Contract rigidity and worker's response

Inserting (7) and (19) into (18) and solving for e yields a relatively complex but still analytically tractable effort response function as follows:

$$e = \frac{2\alpha d + 2dt - k + \sqrt{dk\big(2(\alpha + t) + d(-3a\alpha^2\sigma^2 - 6\bar{e}t + 6r)\big) + 4d^2(\alpha + t)^2 + k^2}}{3dk} \text{ (IC).} \qquad (20)$$

The new participation constraint reads:

$$\left(r + \alpha e - \frac{1}{2}ke^2 - \frac{1}{2}a\alpha^2\sigma^2 - t(\bar{e} - e)\right)\frac{1}{\theta(e)} \geq 0 \text{ (PC),}$$

which under $\bar{u} = 0$ is identical to (9), as $\theta(e)$ can be eliminated under a strictly binding PC.

The manager's problem is thus as follows:

$$\max_{\alpha,r,s} E(\pi) = e - \tfrac{1}{2}ke^2 - \tfrac{1}{2}a\alpha^2\sigma^2 - t(\bar{e} - e) - s, \text{ subject to (10) and (20).}$$

Introducing a positive termination probability into the model can thus be illustrated in Figure 3 by moving on the x-axis from right to left. Everything else constant, this (assumedly) costless additional incentive mechanism will increase worker's effort and the profits of the manager. As a complement to the other strategies, this scenario E may hence alter the optimal mix of strategies (Table 1).

If the manager responds to a decreasing d by adjusting the other incentive strategies, the effects are less straightforward. In fact, it is likely that the manager will react by reducing α and s, thus (possibly) lowering optimal effort and output. Indeed, the formulation of the termination model implies that all incentivising strategies are now interdependent. Unfortunately, due to the complexity of the model at this stage, no analytic solutions can be derived. However, effects can be simulated using suitable parameter values. To make the simulation tractable, I treat $r = const$ as a parameter. The results are presented in Table 3.

Table 3 Simulated effects in the termination model

	Outcomes					
Parameters	α	s	t	e	π	θ
a	–	+	+	ambiguous	–	ambiguous
b	+	–	–	–	–	+
d	+	ambiguous	ambiguous	+	–	–
$\bar{e}$	+	–	–	–	–	+
k	+	–	–	–	–	+
σ^2	–	+	+	ambiguous	–	ambiguous
r	–	–	–	–	–	+

Notes: Simulation based on partial variation of parameter values documented in the appendix

The simulations exhibit the following characteristics of the model, which are generally plausible:

- The optimal profit share α declines with increasing risk aversion of the worker a or increasing variance of output σ^2. At the same time, optimal expenses on identification s increase, so that the total effects on effort e are ambiguous (other than in scenario D summarised in Table 2).

- Costly identification expressed by an increasing b makes profit sharing more attractive as a motivation strategy and thus increases α while s decreases.

- A more rigid employment contract (increasing d) lowers incentives for workers and induces managers to increase α It may also increase s; the effect is ambiguous. The total effect on optimal effort is positive, but at the cost of lower profits for the manager.

- Increasing the work norm $\bar{e}$ causes disutility for the worker, thus tightening the participation constraint (as in scenario D). In the present model, the manager reacts by increasing α, although the total effect on effort is negative.

- Increasing the marginal effort costs k generally makes production more expensive. Given the current parameter values, it tends to make profit sharing a more attractive motivation strategy for the manager.

- A rising fixed wage r reduces the need for other motivation strategies, but at the cost of lower effort and lower profits.

5 \ Conclusions

By focusing on direct monetary incentives, the traditional literature on workers' incentives predicts that high-effort outcomes are unlikely unless workers – at least to some extent – become residual claimants of profit. Holmstrom and Milgrom (1987) show that in a second-best world characterised by non-contractibility of effort and asymmetric information, a mixture of sharing and fixed wage will be optimal, thus balancing incentive provision and risk bearing by the worker. However, real world employment contracts are typically much richer and display a lower incidence of profit sharing than predicted by this model. In this paper, I extended the Holmstrom/Milgrom model by integrating two more options for incentivising workers into its formal structure. According to the first extension, workers derive utility from following a work norm. The manager can influence workers' identification with a high-effort work norm at a cost. In the second extension, workers risk being fired if they are observed shirking. Depending on the rigidity of their employment contract and their outside options, this threat of termination induces them to increase effort.

The extended model thus captures four strategies for incentivising workers simultaneously: fixed wage, revenue share, identification with high-effort norm, and threat of termination. The model highlights plausible interdependencies among these strategies and makes predictions about a rational selection of strategies under given constellations characterising the economic environment. The key drivers of the strategy portfolio are the variance of output, the costs of inducing worker's identification with high-effort norms and the rigidity of the labour market. Real world employment relationships where these parameters differ will provide a testing ground for the validity of the model.

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APPENDIX

Table A1 Parameters and outcome variables of the model

Parameters		Main outcome variables	
a	Worker's absolute rate of risk aversion	e	Worker's effort level
b	Manager's marginal cost of inducing worker's identification with work place	q	Firm output
d	Rigidity of the employment contract	r	Fixed wage rate
$\bar{e}$	Effort level of work norm	s	Manager's investments in worker's identification with work place
k	Worker's marginal cost of effort	t	Degree of worker's identification with work place
σ^2	Variance of random output disturbance	u	Worker's utility level
		w	Wage schedule (=cost of effort elicitation)
		α	Profit share in wage schedule
		θ	Termination probability
		π	Manager's profit

Table A2 Simulation scenarios for the termination model

Parameters	Baseline scenario	Simulation range
b	300	270–330
d	0.02	0.005–0.03
$\bar{e}$	200	186–214
k	0.0045	0.0044–0.0046
σ^2	40	20–60
r	25	15–35

Notes: a not simulated, as effects are identical to σ^2. Simulations were carried out using the SOLVE function in Wolfram Mathematica 8.0

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