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Incentives and earnings growth

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ABSTRACT

The career prospects of newly recruited employees differ substantially within an organization. The stars experience considerable growth in earnings; others can hardly maintain their entry salaries. This article sheds light on the mechanisms generating the observed heterogeneity in earnings growth by investigating the effects that explicit short-run incentives and implicit incentives have on earnings growth. The model's predictions are tested using personnel records from a large bank and are found to be consistent with the observed earnings growth during the first half of the employees' careers.

1. Introduction

The career prospects of newly recruited employees differ substantially within an organization. The stars experience considerable growth in earnings over the following years; others can hardly maintain their entry salaries. Identifying the mechanisms generating this heterogeneity in earnings growth is essential to understand behavior such as consumption and saving (Deaton, 1992) and to show the way to a successful career.

In this paper, I investigate the implications of incentives for earnings growth. The employment relation is captured by a dynamic moral hazard model which is similar in nature to Gibbons and Murphy (1992) and its predictions are examined using personnel records from a large bank. While the stylized model imposes structure, the main contribution of the paper is the empirical application which adds to the scant empirical literature on contracting. The innovation is to use detailed data on performance and the structure of earnings, i.e., separate information on base pay and bonus payments, to identify the mechanisms that lead to earnings growth.

It is well-known that most employment relations are subject to moral hazard issues and that these will have implications for earnings, see Mirrlees (1974, 1976) and Holmström (1979, 1982a). This follows from the fact that employees can take action to affect the probability distribution of the performance outcome. In simple situations the moral hazard problem can be solved by motivating the employee through explicit short-run incentives, i.e., by paying bonuses to high-performing employees. However, Fama (1980) noted that in a more general setting the moral hazard problem is solved partly by implicit

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incentives where current performance is rewarded (or punished) in the future – an idea which was further developed by Holmström (1982b, 1999).[1]

The theoretical model presented in this paper builds on these ideas. That is, employee performance is determined by effort and ability and high performers are rewarded by bonuses and their reputation grow which in turn leads to higher future earnings. In contrast, low performers miss out on bonuses and their reputation take a hit with the implication that their earnings fall behind those of high performers. A natural consequence is that individual performance has important implications for the way earnings evolve over the career for a given employee and differences in performance will lead to heterogeneity in earnings growth across individuals.

To be precise, the model's first prediction is that the mean and variance of earnings grow with age. While this prediction can be established using competing theoretical frameworks, as is discussed below, the model offers additional predictions about the mechanisms leading to earnings growth which are not easily obtained in such competing models. For example, the model's second prediction is that explicit incentives increase with age, implicit incentives decrease with age, and total incentives (as measured by the sum of the explicit and implicit incentives) are balanced over the career. Finally, the model predicts the structure of the implicit incentives: implicit incentives consist of higher future expected bonus payments and potentially of higher future base pay.

When testing the predictions on data from a large bank, it is established that the model performs well in predicting earnings growth during the first half of employees' careers. Up to the age 45 the mean and variance of earnings grow, explicit incentives increase, and implicit incentives decrease. The model cannot explain, however, the decline in the mean and variance of earnings and the drop in explicit incentives observed in the second half of the employees' careers.

The paper is structured as follows. In the next section I present a theoretical model for earnings growth which incorporates explicit bonus incentives and implicit incentives. The empirical results are presented in Section 3. Finally, a conclusion is provided in Section 4.

2. Theory

In this section, I present a dynamic moral hazard model for earnings growth. The focus is on a common employment situation where employees of unknown and heterogeneous productive ability work for a firm. The employees who become more productive over time as a consequence of on-the-job human capital acquisition are paid a base salary and are incentivized by both explicit and implicit incentives.

2.1. The model

The model entails the contracting relation between a risk-neutral employer and a continuum of risk-neutral employees. Employer and employee form a principal-agent relationship. The employer is competing in a labor market characterized by public learning, i.e., information is symmetric but imperfect. The employees are of unobserved heterogenous productive ability, but the ability distribution in the market is known.[2] That is, employers and employees know that a proportion (μ) of the employees have high productive ability θ_H, and the rest ($1-\mu$) have low productive ability θ_L, $\Theta = \{\theta_L, \theta_H\}$ and $0 < \theta_L < \theta_H < 1$. In this respect, some employees are systematically more productive than others. Further, the employer maximizes profits and the employee maximizes utility.

The model has two periods, $t = 1, 2$, and long-term contracts are not feasible due to limited commitment.[3] Further, limited liability is assumed; thus, in the first period, the firm offers its employees a contract specifying a base payment ($w_1 \geq 0$) and a potential bonus ($b_1 \geq 0$). If the contract is accepted, the employees are hired. Subsequently, the employee chooses a level of effort $e_t \in \{0, e\}$ which is unobserved by all other parties. At the end of the period, output is realized and observed by all. If the employee qualifies, i.e., has high output, a bonus is paid. The second period starts with a revision of the beliefs about an employee's productive ability which is based on the observed performance history. The new contract is adjusted accordingly. The employee accepts or rejects the new contract; if accepted, a level of effort is chosen. Finally, the second period's output is observed and bonuses paid.

Employees are paid according to their expected productivity. The output (y) is binary, and the employee may produce either a high or a low output. In the first period, the low output ($\underline{y_1}$) is normalized to zero. In the second period, low output ($\underline{y_2}$) is η, $\eta > 0$. High first period output is $\overline{y_1} > 0$, and in the second period it is $\overline{y_2} = \overline{y_1} + \eta$. The parameter η reflects that an employee's productivity increases with time. This can be thought of as on-the-job human capital acquisition.

An employee of type j, $j = L, H$, produces high output with probability $\theta_j \in \Theta$. But when effort is exerted, i.e., $e_t = e$, which costs the worker a disutility of c, the probability of producing the high output increases by ρ. It is assumed that $\theta_j + \rho < 1$ and that the productivity gain due to effort exceeds the cost of effort, i.e., $c \leq \rho\overline{y_1}$. Thus, it is efficient for the employee

[1] See Borland (1992) for a survey of the literature and Dewatripont et al. (1999a,b) for a detailed treatment.

[2] Mutually unknown ability can be thought of as modeling college graduates fresh out of university. The graduates might not have a significant information advantage because they do not know the actual work environment.

[3] This is a weak assumption in the present context because I study the bank's operations in a country where job protection is relatively low and at a level similar to that in the US. Further, costs associated with dismissals are very low when measured on an international scale.

to exert effort. Further, to simplify notation $\bar{e}$ is used to denote that an employee exerts high effort in both periods, i.e., $\bar{e} \equiv \{e_1 = e, e_2 = e\}$.

New employees have no performance history; as a result the employer expects the individual to be of average productive ability, i.e. $E_{\Theta}\theta = \mu(\theta_H - \theta_L) + \theta_L$. Thus, when effort is exerted, the probability of producing a high output is:

$$P_1 = Pr(\overline{y_1}|e_1 = e) = \mu(\theta_H - \theta_L) + \theta_L + \rho.$$

In the second period, the beliefs concerning an employee's productive ability depend on the individual's performance history. This is because employers know that employees of high productive ability are more likely to produce a high output than employees of low productive ability as $\theta_H + \rho > \theta_L + \rho$. Thus, when an employee is observed producing a high output, the beliefs about expected productive ability are increased and the employee's reputation grows. Similarly, beliefs are downgraded when low output is observed leading to a declining reputation. It follows that an employee who exerts effort in both periods and has high performance in the first period is expected to produce a high output in the second period with probability:

$$\overline{P_2} = Pr(\overline{y_2}|\overline{y_1}, \bar{e}) = \frac{(\theta_H + \rho)^2\mu + (\theta_L + \rho)^2(1 - \mu)}{P_1}.$$

For an employee who exerts effort in both periods but has a low first-period output, the probability is:

$$\underline{P_2} = Pr(\overline{y_2}|\underline{y_1}, \bar{e}) = \frac{(1 - \theta_H - \rho)(\theta_H + \rho)\mu + (1 - \theta_L - \rho)(\theta_L + \rho)(1 - \mu)}{1 - P_1}.$$

Thus, the gap in the second-period performance probability due to reputation is:

$$\Delta P = \overline{P_2} - \underline{P_2} = \frac{\mu(1 - \mu)(\theta_H - \theta_L)^2}{P_1(1 - P_1)} > 0. \tag{1}$$

2.1.1. The contract

The model is solved backward to account for strategic behavior. The employee chooses a level of effort in each period to maximize utility. Because employers learn about an individual's productive ability from first-period output, the employee's second-period utility depends on y_1. This implies that the employee exerts effort in the second period when:

$$b_2 Pr(\overline{y_2}|y_1, \bar{e}) + w_2 - c \geq b_2 Pr(\overline{y_2}|y_1, e_1 = e, e_2 = 0) + w_2, \tag{2}$$

where the performance probability, $Pr(\cdot|y_1, \cdot)$, depends on first-period output, which implies that employees with different first-period performances face different incentive constraints.

Naturally, the employee exerts effort when the gain in compensation from exerting effort exceeds the cost of effort. The left-hand side of (2) shows the utility when effort is exerted. The employee receives a bonus payment (b_2) with probability $Pr(\overline{y_2}|y_1, \bar{e})$ and a base pay of w_2. This comes at a cost of c. The right-hand side shows the utility when no effort is exerted, and here the total compensation is lower because the probability of receiving a bonus payment is reduced.[4] It follows that:

$$b_2 = \frac{c}{\rho}.$$

An employee's performance in the first period is disclosed and observed by the market. Thus, competition among prospective second-period employers implies that the contract accepted by the employee earns zero expected profits. So, expected productivity equals expected compensation:

$$E(y_2|y_1, \bar{e}) - w_2 - b_2 Pr(\overline{y_2}|y_1, \bar{e}) = 0,$$

or,

$$w_2 = (\overline{y_1} - b_2)Pr(\overline{y_2}|y_1, \bar{e}) + \eta.$$

From this it follows that the wage in the second period depends on first-period output y_1. In contrast, the size of the second-period bonus payment (b_2) is independent of prior performance and thus the explicit second-period incentives are independent of first-period performance. However, the expected bonus payment, $B_2 = b_2 Pr(\overline{y_2}|y_1, \bar{e})$, does depend on the performance history because past performance determines the probability by which the employee is expected to receive a bonus payment. This implies that expected earnings in the second period (W_2) is determined in part by first-period output:

$$W_2|_{\{y_1, \bar{e}\}} = \overline{y_1} Pr(\overline{y_2}|y_1, \bar{e}) + \eta,$$

[4] Note that the workers and the firm have conflicting objectives, implying that the incentive and the limited liability constraints bind.

and that the gap in earnings (R) due to employee reputation is:

$$R \equiv W_2|_{\{\overline{y_1},\bar{e}\}} - W_2|_{\{\underline{y_1},\bar{e}\}} = \underbrace{b_2 \Delta P}_{\text{growth in expected bonus payments}} + \underbrace{(\overline{y_1} - b_2)\Delta P}_{\text{growth in basepay}} \tag{3}$$

Eq. (3) states that the implicit incentives (R) are made up of higher future bonus payments because $b_2 = c/\rho > 0$ and $\Delta P > 0$, and higher future base pay when $\overline{y_1} > c/\rho$. It is also clear that the implicit incentives vanish if $\Delta P = 0$. Thus, if the employees are homogeneous in one of the following dimensions: $\mu = 0$, $\mu = 1$, or $\theta_L = \theta_H$, then $R = 0$ (see Eq. (1)).[5]

Now the parameters of the first period can be determined. The employee's decision to exert effort takes into account that the output in this period affects the payoff in the second period. These implicit incentives add value to the first-period contract independent of the effort decision. But, by exerting effort the probability of high output, and thereby the probability of obtaining the second-period compensation premium (R), is increased by ρ. Apart from this, the incentive problem is similar to the one in the second period, and the employee exerts effort if:

$$b_1 Pr(\overline{y_1}|e_1 = e) + w_1 - c + \rho R \geq b_1 Pr(\overline{y_1}|e_1 = 0) + w_1.$$

Hence, the first period bonus is:

$$b_1 = \frac{c - \rho R}{\rho},$$

which implies that explicit incentives in the first period are $b_1 = c/\rho - R$. It follows that the base pay in the first period is:

$$w_1 = (\overline{y_1} - b_1)P_1.$$

This completes the characterization of the employment contract and leads to Lemma 1:

Lemma 1. The contract is characterized by:

$$b_1 = \max\left\{0, \frac{c - \rho\overline{y_1}\Delta P}{\rho}\right\},$$

$$w_1 = \max\left\{0, \left(\overline{y_1}(1 + \Delta P) - \frac{c}{\rho}\right) P_1\right\},$$

$$b_2 = \frac{c}{\rho},$$

$$\text{and } w_2|_{\{y_1\}} = \left(\overline{y_1} - \frac{c}{\rho}\right) Pr(\overline{y_2}|y_1, \bar{e}) + \eta.$$

2.1.2. Predictions

The model predicts that the mean and variance of earnings increase with age. The reason is that all employees acquire human capital on the job, which make them more productive and in turn increase their earnings. But, at the same time, the market is learning about the employees' productive abilities and the resulting differences in reputation lead to differences in earnings growth.

This first prediction can also be established using other theoretical frameworks. For instance, a learning model where high-ability workers accumulate human capital at a faster rate than low-ability workers would produce a similar prediction. Those models, however, are in general silent about the structure of incentives and how incentives influence earnings growth. The model presented here is explicit about these important issues.

Two types of incentives motivate employees: short-run explicit incentives and implicit incentives and their sum is denoted total incentives. In the model, the explicit incentive is the magnitude of the bonus (b). This is the reward a high performer receives in the period where the high performance is achieved. The implicit incentive is the performance-driven earnings growth (R). This is the reward current high performance gives in the future. From the results presented in Lemma 1 the model's predictions are that explicit incentives increase with age because $b_2 > b_1$ and that implicit incentives are positive and of the magnitude $R > 0$. Further, implicit incentives decrease with age and total incentives are balanced over the career as $b_1 + R = b_2$. These predictions mirror those of Gibbons and Murphy (1992).

A novel result in the model is the prediction about the structure of the implicit incentives. From Eq. (3) it follows that the implicit incentives (R) are made up of higher future bonus pay and potentially of higher future base pay. Thus, implicit

[5] An obvious alternative explanation of why R could be zero is that the assumption of symmetric learning is violated. A natural consequence of asymmetric learning (i.e., the incombent firm learn more about a workers productivity than outside firms), workers have less of an incentive to work hard to make the market believe that they are of high ability as they will not receive the full return on this investment. Consequently, implicit incentives are reduced or vanish completely.

Table 1
Earnings growth by age.

	Total Earnings (std. dev.)	Base pay (std. dev.)	Bonus (std. dev.)	Bonuses paid out (std. dev.)
Age < 30	57,163 (14,539)	55,096 (9561)	2067 (8188)	4299 (15,453)
Age 30 – 39	76,159 (51,733)	67,496 (19,385)	8663 (39,232)	16,385 (55,029)
Age 40 – 49	73,743 (49,536)	67,529 (21,463)	6214 (36,110)	12,900 (55,481)
Age 50+	64,202 (23,781)	62,325 (18,485)	1877 (9263)	4476 (13,822)
Total	69,054 (40,017)	64,397 (19,453)	4657 (27,819)	9269 (38,699)

incentives do not come simply as a permanent increase in base pay when employees have high performance. Instead, the higher future pay is, in part, a result of the higher future expected productivity which will result in higher future bonuses.[6]

These predictions are summarized below.

Prediction 1 (Earnings growth) *The mean and variance of earnings increase with age.*
Prediction 2 (Incentive structure) *Explicit incentives increase with age, implicit incentives decrease with age, and total incentives (as measured by the sum of the explicit and implicit incentives) are balanced over the career.*
Prediction 3 (Implicit incentives) *Implicit incentives consist of higher future expected bonus payments and potentially of higher future base pay*.

3. Empirical analysis

In this section the predictions from the theoretical model are examined empirically using the personnel records from a large bank.[7] It is established that the model's predictions are well aligned with the data during the first half of employees' careers. That is, the mean and variance of earnings increase during this period and incentives are structured according to expectation. When it comes to the second half of the career the model is challenged by the data which is most forcefully exemplified by the declining earnings profile.

3.1. Earnings and performance data

The data used in the analysis stem from the personnel records of a large bank with more than 10,000 employees. The sample years are 2004–2009. The company's personnel records contain details about employee performances and earnings – and most importantly for this study – information on the composition of earnings, i.e., separate information on base pay and bonus payments.

There is a total of 69,743 employee-year observations available for analysis. Due to missing performance ratings the sample size is reduced to 57,601 employee-year observations. Missing information on education reduces the sample further to 54,984 observations (79 percent of the original sample).

The measure of earnings used throughout the analysis is real annual earnings (in 2004 prices and measured in dollars), which is constructed as annual base pay plus bonuses obtained during the year. In Table 1 descriptive statistics for the different income measures are presented. Earnings follow the conventional concave Mincer profile. This pattern is also found for base pay but the turning point in the age profile seems to occur later. Bonuses are highest for the group aged 30–39, are somewhat lower for the 40–49 age group, and are much lower for the youngest (<30) and oldest (+50) age groups. A similar pattern is observed when focusing on the magnitude of the bonuses paid out. For all income measures the variances follow concave age patterns.

The employees are subject to a performance appraisal each year. The performance ratings are subjective in the sense that they are given to employees by immediate supervisors. The scores range from 1 (low) to 5 (high). From Table 2 it follows that relatively few employees receive the low scores 1 or 2, the clear majority of employees receive the scores 3 or 4, and 7.5 percent get the top score 5.

The scale used by the firm and the distribution of the performance scores are comparable to what is observed in many other firms. This is documented in a recent paper by Frederiksen et al. (2012), who show that many firms apply a 5-point scale and that low scores are rarely used. In particular, when comparing the performance distribution observed in this firm with the distribution applied by the firm studied in the famous papers by Baker et al. (1994a,b) the scale is the same and the only discernible difference is that their firm gives out marginally higher scores.

[6] It should be noted that while the first part of the prediction on bonuses is directly falsifiable, the second part related to base pay calls for an empirical assessment that sheds light on the structure of implicit incentives.

[7] The data was obtained from the bank for research purposes; and because the bank is still in operation, the data is not publicly available. However, the dataset has recently been used by Frederiksen et al. (2012) in a study of subjective performance measures and career outcomes. In that study, the bank is benchmarked to five other companies for which similar data is available.

Table 2
Performance distribution.

Rating scale		
Low	1	0.11
	2	2.44
	3	42.52
	4	47.48
High	5	7.45

Table 3
Log earnings functions.

	Model 1	Model 2	Model 3
Age/100	5.79 (0.14)	5.74 (0.13)	0.88 (0.10)
Age squared/1000	−0.65 (0.016)	−0.64 (0.015)	−0.09 (0.01)
Job function	No	Yes	Yes
Job level	No	No	Yes
Turning point for the age profile	44.77	45.20	47.81
R^2	0.282	0.326	0.693
Observations	54,984	54,984	54,984

Note: All regressions control for gender, a quadratic in tenure and education and year dummies. Standard errors are robust.

3.2. Earnings growth

In this section I evaluate the model's first prediction. The prediction states that the mean and variance of earnings increase with age. The descriptive statistics in the previous section showed a concave pattern in age for both the mean and the variance of earnings. Here the relation is investigated using regressions analysis.

To properly establish the earnings gradient in age I estimate log earnings functions; the results are presented in Table 3. The first model includes, besides a quadratic in age, a gender dummy, a quadratic in tenure, and education and year dummies. The age profile is established to have the conventional concave shape with a turning point at age 44.77. Adding dummies for job function, i.e., dummies for working in the business unit, the market function or in a central staff position, only moderately affect the age profile and shifts the turning point to 45.20. A more significant change is observed once job levels are controlled for. The R^2 jumps from 0.326 to 0.693 and the age profile flattens significantly. However, the turning point for the age profile stays close to the previously established level and the maximum is achieved at age 47.81. Thus, as predicted, earnings grow (at least during the first half of employees' careers).

The second part of the first prediction is that the variance of earnings increases with age. To assess this, I reestimate the log earnings functions from Table 3 and obtain the (non-robust) residuals from the regressions. In a second step, I regress the squared residuals on the same set of explanatory variables used in the respective models in Table 3 – as in a standard heteroskedasticity test. Focus is on the age profiles in these regressions. For the two models (Model 1 and Model 2) where the point estimates of age and age squared are significant, the profiles are concave with turning points at 46.21 and 47.82, respectively. In the last model (Model 3), which controls for job level, the age profile is insignificant.

We saw that the turning point of the age profile for earnings was only moderately shifted by the inclusion of job levels. When it comes to the variance the age profile becomes insignificant once job levels are controlled for. The model's prediction is that the variance of earnings increase with age because employees are rewarded for their performance – which could take the form of a wage jump upon promotion. For this reason, the prediction should be evaluated in a model which does not control for job level. Thus, based on the results from Table 4 it is established, in accordance with the prediction, that the variance of earnings is increasing up to the mid/late forties (and then it starts to decline).

In sum, the empirical results show that both the mean and variance of earnings increase until employees reach the mid-forties. Thus, the model predicts the dynamics in cross-sectional earnings for the first half of employees' careers.

3.3. Incentive structure

In this section, I evaluate the incentive structure. The first part of the second prediction states that explicit incentives increase with age. In the model explicit incentives are measured as the magnitude of bonus payment actually paid out (b). Hence, the test of this prediction is to establish if older employees are paid higher bonuses when they have high performance.

Table 4
The earnings variance and age.

	Model 1	Model 2	Model 3
Age/100	1.91 (0.359)	1.33 (0.352)	0.017 (0.348)
Age squared/1000	−0.207 (0.041)	−0.139 (0.040)	−0.004 (0.040)
Job function	No	Yes	Yes
Job level	No	No	Yes
Turning point for the age profile	46.21	47.82	Insignificant
R^2	0.005	0.006	0.004
Observations	54,984	54,984	54,984

Note: All regressions control for gender, a quadratic in tenure and education and year dummies.

Table 5
Explicit incentives.

	Model 1	Model 2	Model 3
Dependent variable	Bonus	Bonuses paid out	Bonuses paid out
Performance score	6414 (290)	8547 (496)	−53,461 (7420)
Age	1567 (106)	3189 (226)	−10,075 (1273)
Age squared	−18 (1)	−36 (2)	135 (15)
Performance × age			3492 (375)
Performance × age squared			−45 (4)
Turning point for the age profile	42.83	44.21	–
R^2	0.057	0.078	0.089
Observations	54,984	27,625	27,625

Note: All regressions control for gender, a quadratic in tenure and education and year dummies. Standard errors are robust.

The first assessment of the prediction is to establish if the bonus gradient in age is positive. The results from a regression of bonus on performance, a quadratic in age and controls is presented as the first model in Table 5. Clearly, higher performance leads to a higher bonus and the age profile is concave with a turning point at age 43.

Because explicit incentives in the model are measured by (b) a second assessment of the prediction is to focus on bonuses actually paid out. This is done in the second model of Table 5 where the dependent variable is bonuses paid out but otherwise the specification is the same as for Model 1. As expected, the point estimate on the performance score increases and the concavity of the age profile prevails but the turning point shifts to age 44.

While the first two models illustrate the relation between bonuses, performance and age, the test of the second prediction is to be found in Model 3. The test is to establish if older workers are rewarded more highly for high performance. This requires the inclusion of an interaction term between performance and age. The results from this estimation are presented as Model 3. Unfortunately, it is difficult to interpret the point estimates because of the quadratic interaction term. For this reason, I have illustrated the effects in Fig. 1 for a baseline person with different performance scores (four versus five). It is clear from the figure that not only is the age profile concave, but it also widens between employees with performance score four and performance score five up to age 39. Hence, as predicted, it is the case that during the first part of the career relatively older employees are rewarded more highly for performance.

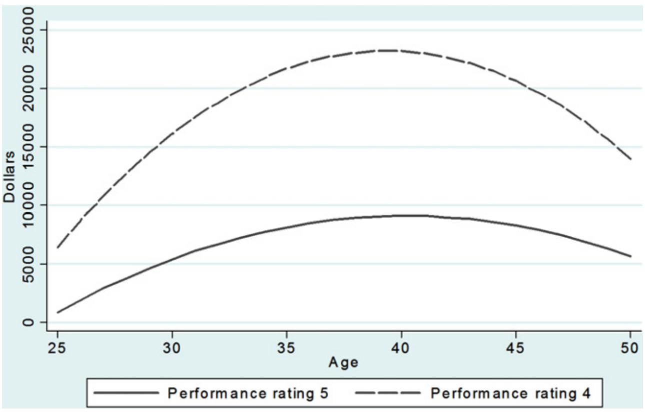

Fig. 1. The magnitude of bonuses paid out to employees with performance ratings 4 and 5.

Table 6
Implicit incentives.

	Model 1	Model 2	Model 3
Performance score	693.78 (139.22)	709.30 (220.98)	4490.00 (1013.60)
Age	1.43 (95.05)	−138.73 (12.44)	158.65 (64.39)
Age squared	−1.63 (1.02)		
Age × performance			−8397 (19.30)
R^2	0.035	0.034	0.035
Observations	44,547	44,547	44,547

Note: All regressions control for gender, a quadratic in tenure and education and year dummies. Standard errors are robust.

The second part of the prediction is that implicit incentives decrease with age. The implicit incentive is the performance driven earnings growth (R). I determine the magnitude of the implicit incentive by first regressing the growth in earnings between year t and year $t+1$ on the obtained performance score in year t and controls. The results are presented in Table 6. The results show that performance has a positive effect on earnings growth but the age profile is insignificant. For this reason, I estimate a second model which has the same specification as Model 1 except for the fact that the quadratic age term has been omitted. The results show – as before – that performance has a positive effect on earnings growth and now the effect of age is negative. The positive effect of performance on earnings growth underlines the empirical importance of implicit incentives.

To establish how implicit incentives change with age I estimate a third model which includes an interaction term between age and performance. In this model the effects of performance and age on earnings growth are positive but the interaction term is large and negative. Hence, as predicted, implicit incentives decrease with age.

The last part of the prediction is that total incentives are balanced over the career. Total incentives are the sum of explicit incentives and implicit incentives. I will take the magnitude of the explicit incentive as the bonus payment to an employee who receives a performance rating of 5 (the highest possible score). Thus, the magnitude of the explicit incentive can be seen as the dotted line in Fig. 1. The magnitude of the implicit incentive is equal to the performance-driven earnings growth. I determine the magnitude of the implicit incentive as the difference between the earnings growth of a benchmark employee who receives the top score, 5, and the earnings growth of a benchmark employee who receives the bottom score, 1.

The magnitudes of the explicit, implicit, and total incentives are illustrated in Fig. 2. I have already shown that explicit incentives increase in a concave way during the first part of the career and that implicit incentives decrease linearly. Hence, total incentives are not constant over the employees' careers as predicted by the model. However, it is the case that during the first half of the career the magnitudes of the implicit and explicit incentives move in opposite directions as predicted by the model.

3.4. Implicit incentives

The model's third prediction is that the implicit incentives are made up of higher future bonus payments and potentially of higher future base pay. This prediction is assessed by decomposing the implicit incentives obtained in Model 3 in Table 6 into the part which is due to higher base pay growth and the part due to bonus growth. That is, I estimate models similar to Model 3 for the three income growth measures: earnings growth, bonus growth, and base pay growth. The result of the decomposition is presented in Fig. 3. The results show that the implicit incentives split nicely into base pay growth and bonus growth and that both are positive early in the career but decline with age. Most importantly, the model predicts that implicit incentives are made up of higher future bonuses which is the case empirically early in the career. The model also

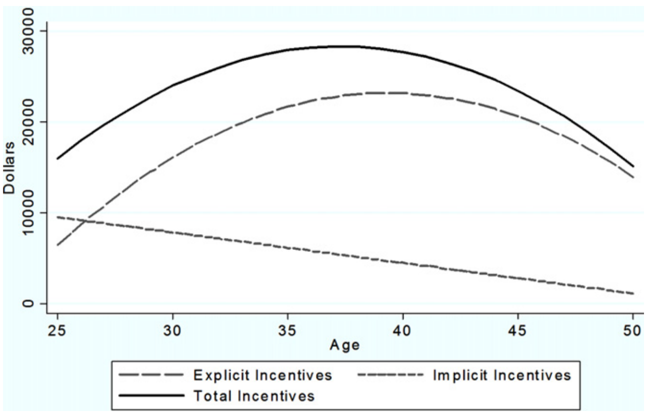

Fig. 2. Incentive structure.

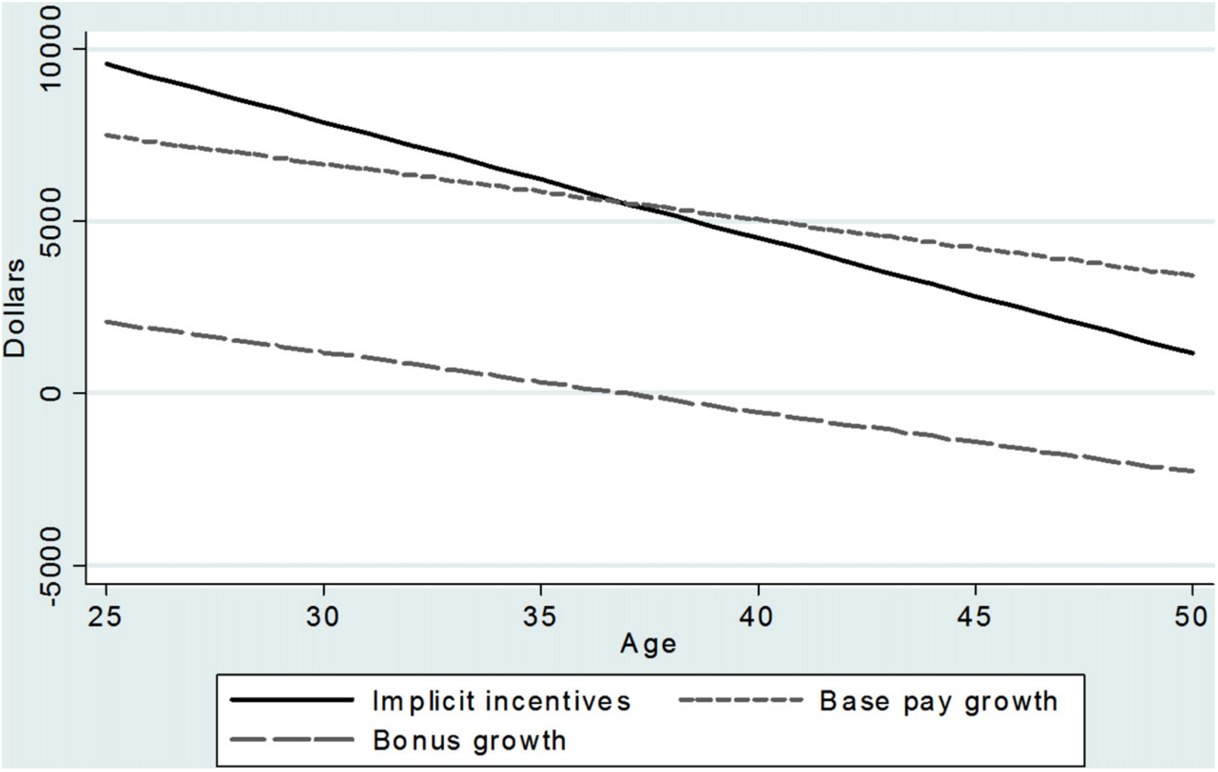

Fig. 3. The structure of implicit incentives.

states that implicit incentives could be due to performance driven base pay growth. The empirical results confirm this. Thus, the model's third prediction find some support in the data.

3.5. Discussion

The model's predictions are broadly supported by the data when focusing on the first half of employees' careers. For instance, the model can explain the observed increase in the mean and variance of earnings. The data shows, however, that both the mean and variance of earnings start to decline when employees reach the mid-forties. The human capital literature has discussed at length why the earnings profile may drop toward the end of the career, but there has been relatively little focus on the variance. In the context of a firm it is the case that earnings are highly correlated with job levels as we saw when job levels were introduced among the controls in the log earnings functions presented in Table 3. Thus, the decline in the earnings variance after age 45 is likely to be explained by the fact that promotions are limited by the pyramid shape of the organizational hierarchy, which implies that employees will tend to congest at the upper part of the pay range within a job level – a feature not incorporated in the model.

A second interesting finding is that explicit and implicit incentives move in opposite directions early in employees' careers. This implies that bonus incentives are moderated early in the career when implicit career concern incentives are strongest and then gradually increase as the incentive effect of career concerns is weakened. Hence, the trade-off between the two types of incentives is clearly observed in the data.

That the trade-off between implicit and explicit incentives is observed early in the career is of particular interest because previous empirical research on implicit incentives has focused on employees close to retirement. That is, Gibbons and Murphy (1992) identify implicit (career concerns) incentives among CEOs using late career dynamics, Gompers and Lerner (1999) identify implicit incentives by studying the contracts used in venture capital limited partnerships, and Chevalier and Ellison (1999) establish the empirical relevance of implicit incentives from employee turnover among mutual fund managers.[8] In this paper, implicit (and explicit) incentives are identified from career dynamics among employees in a bank. Thus, implicit incentives seem to be relevant not only for employees close to retirement but also for younger workers. Further, implicit incentives also seem to play an important role in common employment situations, such as the employment relations in a

[8] It should also be noted that a growing experimental literature is testing the importance and implications of implicit incentives. See Irlenbusch and Sliwka (2006) and Koch et al. (2009).

bank, and not just for CEOs or mutual fund managers. This observation broadens the relevance of the theory beyond the special contracts used for the highest corporate levels.

Focus in this paper has been on the common employment relation where employees are compensated directly for performance through explicit short-run bonus incentives (and implicit incentives). While this setup seems appropriate to describe the way employees are motivated in the bank, it should be noted, however, that this is only one of many possible ways employees can be motivated. For example, one finding in this paper (and in Gibbons and Murphy, 1992) is that the presence of strong implicit incentives may eliminate the need for explicit short-run incentives (at least early in the career). In a somewhat different setting, Frederiken and Takáts (2011) derive a hierarchy of incentives which identifies promotions and threats of dismissal as the most attractive incentive devices and bonuses as residual incentives that should be introduced only if the first two types of incentives prove insufficient. So, in other organizational settings a different mix of incentives may prove optimal and, in particular, the use of bonus pay seems to depend strongly on the prevalence of other types of incentives.

This is an important point when focus is on the relation between incentives and earnings growth. Obviously, contracts offering bonuses, as in the bank, are likely to induce more volatility in earnings growth than contracts relying on other types of incentives because bonuses may vary in magnitude across years and employees may only receive bonuses in some years. It is also well understood that the composition of workers in a firm that explicitly offers performance pay may differ from the composition in other firms. In particular, Lazear (1986, 2000) showed that a shift from fixed pay to performance pay (piece-rate) not only increased average performance in the firm due to individual responses in effort to incentives, it also implied that more able workers selected into the company. Empirical assessments supporting this finding are provided by Booth and Frank (1999) and Henneberger and Ziegler (2012) who document that workers on performance pay receive a sizable wage premium relative to employees on fixed pay. Hence, the link between incentives and earnings growth may be different for a variety of reasons between firms offering performance pay and those who do not, but such differences are at present not well understood.

4. Conclusion

Earnings growth varies substantially across newly recruited employees. In this article, I have used a dynamic moral hazard model which incorporates explicit short-run incentives and implicit incentives to shed new light on the mechanisms that lead to the sizeable differences in earnings growth. The presented model underlines that both explicit and implicit incentives (and the trade-off between the two) play a key role for the way earnings grow. When the model's predictions are tested using the personnel records from a large bank I find that the model performs well in explaining earnings growth during the first half of employees' careers.

An important finding in this paper is that it is essential to acknowledge the interplay between performance, incentives, and pay to understand the earnings process. For example, performance is important for short-run volatility in earnings because high performance may lead to bonus payments. It is also the case that performance manifests itself more permanently in the earnings process when implicit incentives are present because the performance history is important for remuneration. In fact, current performance may in part determine both future bonus payments and future base pay. Nevertheless, the earnings dynamics literature has only recently started to explicitly address the issues of incentives (Baker et al., 1994b; Belzil and Bognanno, 2008; Frederiksen et al., 2010; Dias da Silva and Van der Klaauw, 2011), and further research along these lines may prove particularly fruitful.

To conclude, the article offers some new perspectives on earnings growth. While the presented model explains earnings growth during the first half of employees' careers, extensions are need to explain the dynamics in the second half of the career. I hope that this challenge will be accepted and that the paper in this respect paves the way for future research.

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