Table 8.1. Regression results for broiler production

Dependent variable: settlement cost (cents/live weight pound)	
n=1167; mean=20.8. Estimates: α=0.55 (.008); β=0.26 (0.08)	
Test of payment period effects	
1. Mean performance identical between periods TRN1 and TRN2 ($\gamma_1 = \gamma_2$)and periods LPE_1 and LPE_2 ($\gamma_3 = \gamma_4$)	Not rejected
2. Mean performance identical across all periods $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4$	Rejected
Test of grower heterogeneity:	
3. Growers have identical mean performance ($\delta_1 = \delta_2 = \cdots = \delta_{77}$)	Rejected

to perform. There is no similar reasoning to expect handicapping in an LPE regime, unless there is a minimum payment provision. When a minimum payment provision is in place in an LPE regime, there is some incentive to handicap good players, but such incentives should be lower than in a pure tournament setting. The regressions of Table 8.1 suggest that integrators have two possible ways to handicap players: grow-out length and flock size. Both variables have an unfavourable effect on performance and are controlled by the integrator, and can be used for handicapping players. We show the results with the number of chicks with the following linear model

$$chicks_{it} = \nu + \theta_1 \delta_i + \rho_1 TRN + \gamma_1 \delta_i TRN + \text{ seasonal effects } + \epsilon_{it}$$

where δ_i is the quality variable of grower i and the variable $\delta_i TRN$ looks at the relationship between $chicks_{it}$ and performance under the tournament period. If there is some handicapping we would expect a negative coefficient on δ_i (negative θ_1), with better growers (lower δ_i) being given larger seasonally adjusted flocks. This is because flock size is indeed negatively related to δ_i. Indeed the coefficient θ_1 is negative, and suggests that better growers are given larger flocks. While this is consistent with handicapping it could also simply mean that better growers have more houses. But the key test is on the interaction effect between quality and the tournament periods. Since the incentive to handicap is greater under the TRN regime, one might expect this coefficient to be negative, suggesting that handicapping is stronger under tournaments than under the LPE regime. If a grower is good, it should have more chicks under tournament, so that low delta should be associated with high chicks in the tournament dummy. The coefficient γ_1 is indeed positive.

Garibaldi, 146–151

8.6 Efficiency Wage

The idea behind efficiency wage is that higher wages increase workers' productivity. There are several potential reasons for this phenomenon. In general, higher wages generate greater productivity through a commitment mechanism. For example, the higher the wages are relative to what the worker could get elsewhere, the less likely it is that the worker will quit. Another key reason has to do with supervision. The higher the wage, the larger the cost of being caught shirking. Indeed, employees realize that even though supervision may not be detailed enough to detect shirking with certainty, if they are caught cheating on their promises to work hard and are fired as a result, the loss of a job paying above market wages is costly. As a result a worker may have less incentive to shirk. The idea of high wage as a discipline device is exploited in this section.

The worker's utility depends positively on the compensation received and negatively on the effort exercised. Effort is chosen by the worker and can take two values. For simplicity we assume that e is a binary variable that can take two values $e = \{0, 1\}$. If the worker exercises effort he or she suffers a subjective cost equal to $c/2$ while he or she does not suffer any cost if $e = 0$. If the worker chooses $e = 0$ we say that the worker shirks. The utility function is described as

$$U = compensation - \frac{c}{2}e$$

where *compensation* is the income received by the worker.

The worker has an outside option equal to $u \geq 0$.

The firm worker pair has established a job and produces a labour product equal to y only if the worker exercises effort. If the worker does not exercise effort the value of the labour product is 0.

Effort is observable to the worker but it is not observable to the firm. All the firm can do is monitor the worker. We assume that the monitoring technology is such that the firm has a probability p of finding out whether the worker exercises effort.

If a worker exercises effort and produces the labour product y the firm offers him or her a wage w. The wage w is set unilaterally by the firm.

A worker that is caught shirking is immediately fired and he or she gets the outside wage u.

The compensation of the worker is then simply

$$compensation = \begin{cases} w & \text{if } e = 1 \\ pu + (1-p)w & \text{if } e = 0 \end{cases}$$

The firm's profits are defined as the difference between the value of the labour product and the wage, and they are positive only if the worker does not shirk. In formula, this is equivalent to

$$\pi = \begin{cases} y - w & \text{if } e = 1 \\ -(1-p)w & \text{if } e = 0 \end{cases}$$

The firm has a clear interest that the worker does not shirk, since otherwise its profits are going to be negative.

The worker will choose to exercise effort only if the utility with effort is larger than the utility under shirk. This is equivalent to:

$$\left(w - \frac{c}{2}\right) \geq (1-p)w + pu$$

where the left-hand side is the worker utility if the worker chooses $e = 1$ while the right-hand side is the utility if $e = 0$. Rearranging, the worker will exercise effort if and only if

$$w \geq u + \frac{c}{2p} \qquad \text{(NO SHIRKING)}$$

The previous condition is the fundamental equation of the efficiency wage, since it says that the worker will exercise effort only if the wage is large enough. In this setting, the only instrument that can induce the worker to exercise effort is a high wage. The logic goes as follows. Worker's dislike effort but if they are caught shirking they suffer a penalty equal to the wage loss. As a result, the larger the wage the lower the chance that the worker shirks.

Looking at the firm's profits, it appears that the firm would like to set the lowest possible wage, conditional on the worker choosing $e = 1$. It implies that the optimal wage is the minimum wage that satisfies the no shirking condition, and reads

$$w = u + \frac{c}{2p}$$

The efficiency wage is above the worker's outside option.

The problem solution is the following:

- The worker chooses $e = 1$ and gets a wage equal to $w = u + \frac{c}{2p}$
- The firm profits are $\pi = y - (u + \frac{c}{2p})$ and the job takes place as long as $\pi \geq 0$

From the solution to the model a first conclusion follows:

The efficiency wage increases the more difficult it is monitoring the worker

To establish this conclusion simply note that the lower p is, the larger is the wage. The intuition is that the worker needs to be compensated more the lower the probability of finding out whether he or she is shirking. This suggests that the asymmetric information over effort leads to an increase in wage. To investigate this further we can define the worker surplus as the difference between the utility of the worker and his outside option. The worker surplus is indicated with S_w and its expression reads

$$S_w = U - u.$$

Using the efficiency wage, the total surplus reads

$$S_w = (u + \frac{c}{2p}) - \frac{c}{2} - u$$

$$S_w = \frac{c(1-p)}{2p}$$

from which a conclusion immediately follows:

The worker enjoys a positive rent as long as $p < 1$.

As we argued above, even though the firm unilaterally sets the wage, the presence of asymmetric information leads to a wage that leads to a pure economic rent, with a utility larger than the outside option.

8.7 Deferred Compensation and Upward-Sloping Wage Profile

We now use the model of the previous section in a dynamic setting. We assume that there are two periods in the worker's career.

The first period corresponds to a period in which the worker is 'young' and the second period corresponds to a period in which the worker is 'old'.

In each period the worker has a utility function that is identical to the utility described in the previous section, and it is the sum of the compensation minus the cost of effort. We label w_y the wage in the first period, when the worker is young, and w_o the wage in the second period, when the worker is old. The cost of effort in each period is $\frac{c}{2}e$. The young worker has a lifetime utility that is given by the sum of the per period utility of the young and the old. In formula, the utility of the young worker is

$$U_y + U_o = \left(w_y - \frac{c}{2}e_y\right) + \left(w_o - \frac{c}{2}e_o\right)$$

where e_o is the effort chosen when the worker is old and e_y that chosen when he is young.

The other assumptions of the model are identical to those of the previous section. In particular, effort is chosen by the worker but it is not observed by the firm, which can monitor, in each period, the worker with a frequency $p < 1$. The worker, if he does not shirk, produces in each period a value of the labour product equal to y. The worker has an outside option in each period equal to u. The problem is described in Fig. 8.4.

The firm sets the wage for the young and the wage for the old, w_y and w_o. One of the key questions we ask in this section is whether w_y is different from w_o and notably whether $w_y < w_o$.

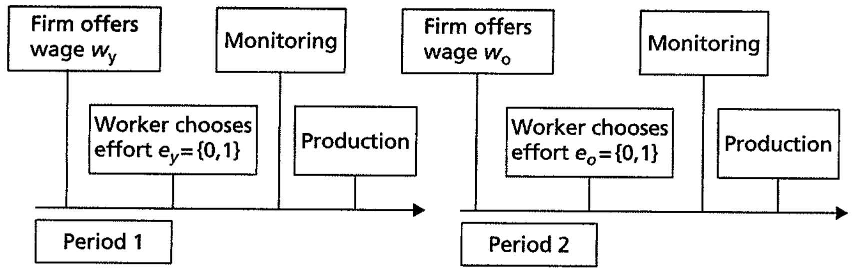

Figure 8.4. Deferred wages

The problem should be solved backwards, starting from period 2 and going backwards to period 1.

In the second period the problem is like a static problem, since there is only one period to go and thereafter the game ends. This suggests that in the second period the problem is identical to the efficiency wage model discussed in the previous paragraph. In formula the wage for the old worker is

$$w_o = u + \frac{c}{2p}$$

The key problem is for the firm to choose the young wage and for the worker to decide whether effort should be chosen or whether shirking is optimal. The firm can take into account the second period wage and knows that in the second period the worker will not shirk and will be paid a wage equal to w_o.

Let's focus on the worker. Suppose that the firm pays a wage w_y (which is still to be determined). The worker will choose to exercise effort if his lifetime utility with effort is larger than the lifetime utility without effort. This is equivalent to

$$\left(w_y - \frac{c}{2}\right) + \left(w_o - \frac{c}{2}\right) \geq (1-p)\left[w_y + \left(w_o - \frac{c}{2}\right)\right] + p2u$$

The left-hand side of the previous condition is the utility when the worker chooses effort and receives w_y when young and w_o when old. The right-hand side is the utility if the worker shirks in the first period, while he or she will not shirk in the second period, since we have already established this. Rearranging the previous expression one gets

$$(w_y + w_o) \geq \frac{c}{p} - \frac{(1-p)c}{2p} + 2u$$

and using the solution for the old wage the solution is

$$w_y \geq u + \frac{c}{2p} - \frac{(1-p)c}{2p} \qquad (8.1)$$

The firm's problem is now easy to determine, since the firm will choose the minimum young wage so that the worker does not shirk. This is identical to satisfying equation 8.1 with an equals sign so that

$$w_y = u + \frac{c}{2p} - \frac{(1-p)c}{2p}$$

The firm defers wages, and offers to the worker an upward-sloping wage profile with $w_y < w_o$.

The proof of the remark is simple, since it follows from a simple comparison of the wage of the young worker and the wage of the old worker. Indeed, $w_y = w_o - ((1-p)c/2p)$.

The reason for the upward-sloping wage profile can be understood by looking at equation (8.1), which represents the no shirking constraint in a dynamic setting. The firm knows that the worker, by shirking, loses not only the wage of the period 1 w_y but also the wage in the old phase. As a result the firm is able to reduce the wage of the young worker. The worker on the job has incentives to work diligently in order to qualify for the wage increase.