Dividing the Costs and Returns to General Training

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Abstract

Unlike other data sets, recent interviews from the National Longitudinal Survey of Youth obtain information on who bears the explicit costs of training. The data indicate that the employer almost always pays the explicit cost of training that the worker receives on the employer's premises and often pays for the explicit costs of what appears to be off site general training. Furthermore, our wage regressions indicate that completed spells of general training paid for by previous employers have a larger effect on the wage than completed spells of general training paid for by the current employer. While these results are contrary to the conventional human capital model, we present a model that demonstrates how contract enforcement considerations can lead to employers paying for purely general training. An employer in our model offers a future wage guarantee in order to provide an assurance that he will not extract excessive rents from workers who demonstrate by not quitting that they place a relatively high valuation on the employer's job. When this wage guarantee is binding, a small increase in a worker's productivity caused by an increase in his stock of human capital will not cause the employer to pay a higher wage. This sharing of the returns to general training makes the worker less willling to pay for the training by himeself but provides the employer with an incentive to share the cost.

I. *Introduction*

In a seminal paper, Becker (1962) originally pointed out that the division of the costs and returns to training between an employer and a worker can have important effects on labor turnover. Hashimoto (1981) followed up Becker's discussion by formally determining the division of costs and returns that maximizes the expected value of an employer-worker match. Interestingly, the existing empirical evidence suggests that employers realize an inordinate share of the returns to training. For example, Barron, Berger, and Black (1993), Barron, Black and Loewenstein (1989) and Bishop (1988) find that the impact of an hour of training on productivity growth is about five times as large as the effect on wage growth.

Given that employers seem to realize most of the returns to training, we would also expect that employers incur most of the costs. Workers can bear the costs of training either explicitly or indirectly in the form of a lower wage. Earlier researchers have not had information on workers' explicit training costs, and thus have limited their attention to workers' implicit costs during the training period. Their findings indicate that workers bear little, if any, of the costs of training in the form of a lower starting wage: see Barron, Black, and Loewenstein (1989), Barron, Berger, and Black (1993), Lynch (1992), and Parsons (1989). Unlike other data sets, recent data from the National Longitudinal Survey of Youth have information on who bears the explicit costs of training. This paper looks at this new information. It also uses the new data to re-examine the relationship between wages and training, both during and after the training period.

Not surprisingly, the National Longitudinal Survey of Youth data indicate that the employer almost always pays the explicit cost of training that the worker receives on the employer's premises. Much more surprisingly, the employer often pays for the explicit costs of what appears to be general training: seminars or training programs outside of work and training that a worker receives in business school, an apprenticeship program, a vocational or technical institute, or a correspondence course. Furthermore, our wage regressions indicate that completed spells of this general training paid for by previous employers have a larger effect on the wage than completed spells of general training paid for by the current employer.[1] These latter two observations are both at odds with the standard human capital model, which predicts that workers should pay for all the costs and realize all the returns to general training investments.

In the next section of this paper, we present a model that demonstrates how contract enforcement considerations can lead to employers paying for purely general training. Our model follows up on the initial suggestion by Kuhn (1994) and Black and Loewenstein (1995) that employers' inability to make certain long-term wage commitments may be important in determining how the costs of and returns to training are shared between them and their workers. The key to our explanation as to why employers share the returns and costs to general training is the suggestion by Black and Loewenstein that a wage guarantee can be helpful in preventing employers from extracting excessive rents from workers who demonstrate by not quitting that they place a relatively high valuation on the employer's job. When this wage guarantee is binding, a small increase in a worker's productivity caused by an increase in his stock of human capital will not cause the employer to pay a higher wage. This sharing of the returns to general training makes the worker less willing to pay for the training alone but provides the employer with an incentive to share the cost.

Section three of the paper describes the new training information in the National Longitudinal Survey of Youth. Section 4 then examines the evidence on the sharing of the costs and returns to training. Possible alternative explanations for our results are discussed in the concluding section.

II. *A Simple Model of Rent Extraction*

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[1] Using earlier NLSY data, Lynch also finds that off-the-job training acquired before current employment has a significant and positive effect on a worker's wage, but prior off-the-job training at the current employer does not. Lynch notes that her finding may reflect either the fact that young workers are acquiring the training in order to "move to another employer or career track or the ... sharing of the costs of training with the current employer through lower wages... (but) unfortunately, it is difficult to identify from the (earlier) NLSY data who is paying for the direct costs of off-the-job training."

Consider a match between an employer and worker that begins in period 0. Suppose the employer and worker both have an infinite time horizon and discount factor β. The worker's value of marginal product in period t, P_t, depends on $\hat{T}_t$, the total amount of training he has received in the past and on a random disturbance v_t.[2] Specifically, letting T_τ denote the training that the worker received in period τ, we have

(1a) $\hat{T}_t = \sum_{\tau=0}^{t-1} T_\tau$

(1b) $P_t = \psi(\hat{T}_t) + v_t.$

We will assume that $\psi' > 0$ and $\psi'' < 0$; that is, past training raises the worker's current productivity, but there are diminishing returns.

As first pointed out by Johnson (1978), workers differ in their valuation ε of the non-pecuniary attributes of the employer's job. We will treat ε as a random variable with density function g and cumulative distribution function G and we will let $V_t(\varepsilon)$ denote the value of the employer's job at time t to a worker whose realized non-pecuniary valuation is ε. Knowledge about ε is the private information of the worker, but the functions g and G are common knowledge.

Workers are able to engage in on the job search. Letting y_t be a random variable denoting the value of an alternative job located at the beginning of period t, a worker with non-pecuniary valuation ε quits the employer's job if $y_t > V_t(\varepsilon)$. Assuming that y_t is distributed with density function f_t and cumulative distribution function F_t, the probability that the worker quits is simply

(2) $Q_t(\varepsilon) = 1-F_t(V_t(\varepsilon)).$

Using Bellman's principle, the value of the employer's job to the worker at the beginning of period t is given by

[2] The disturbance v_t may reflect either a demand shock or the fact that the employer only learns about a worker's productivity over time.

$$(3) \quad V_t(\varepsilon)= w_t + \varepsilon - k_tT_t + \beta[V_{t+1}(\varepsilon)F_{t+1}(V_{t+1}(\varepsilon)) + \int_{V_{t+1}(\varepsilon)}^{\infty} y_{t+1}f_{t+1}(y_{t+1})dy_{t+1}],$$

where w_t denotes the wage the employer offers at time t and k_t denotes the (direct) cost to the worker of a unit of training.

Provided that training is not purely specific, the worker's past training raises his productivity elsewhere as well as at his current employer. More precisely, a worker's past training $\hat{T}_t$ raises the value of an alternative job in period t by the amount $\alpha\psi(\hat{T}_t)$, where α is a parameter between 0 and 1 that represents the generality of the employer's training (note that $\alpha = 1$ corresponds to purely general training and $\alpha = 0$ corresponds to purely specific training). The density of y_t is thus given by

$$(4) \quad f_t(y_t) = f(y_t - \alpha\psi(\hat{T}_t)),$$

where in the absence of training the value of an alternative job is distributed with density function f and cumulative distribution function F. In interpreting (4), note that past training shifts the worker's initial distribution of alternatives to the right by the amount $\alpha\psi(\hat{T}_t)$. Making use of (4), equation (3) can be rewritten as

$$(5) \quad V_t(\varepsilon) = w_t + \varepsilon - k_tT_t + \beta[V_{t+1}(\varepsilon)F(\hat{V}_{t+1}(\varepsilon)) + \int_{\hat{V}_{t+1}(\varepsilon)}^{\infty} (x + \alpha\psi(\hat{T}_{t+1}))f(x)dx],$$

where $\hat{V}_t(\varepsilon) \equiv V_t(\varepsilon) - \alpha\psi(\hat{T}_t)$.

From equations (2), (4), and (5), we obtain

$$(6a) \quad \partial Q_t(\varepsilon)/\partial w_t = -f(\hat{V}_t(\varepsilon)) < 0$$

$$(6b) \quad \partial Q_t(\varepsilon)/\partial \varepsilon = -f(\hat{V}_t(\varepsilon))[1 + \beta(1-Q_t(\varepsilon)) + \beta^2(1-Q_{t+1}(\varepsilon))^2 + \dots] < 0$$

$$(6c) \quad \partial Q_t(\varepsilon)/\partial \hat{T}_t = f(\hat{V}_t(\varepsilon))\alpha\psi'(\hat{T}_t) > 0.$$

That is, other things the same, the worker's quit probability in period t is inversely related to both his wage and his valuation of the non-pecuniary features of the employer's job and is positively related to the past training he has received.

While the employer is not able to directly observe the valuation ε that a worker places on the non-pecuniary attributes of the job, the fact that a worker has stayed with the employer through period t-1 provides the employer with information about ε. Letting $g_t(\varepsilon)$ denote the employer's updated posterior density of the worker's ε conditional on the worker's not quitting in period t - 1, we have

$$\text{(7a)} \quad g_t(\varepsilon) = g_{t-1}(\varepsilon)\,\frac{1 - Q_{t-1}(\varepsilon)}{1 - Q_{t-1}} \quad \text{for } t \geq 1$$

$$\text{(7b)} \quad g_0(\varepsilon) = g(\varepsilon).$$

It follows immediately from (6b) and (7a) that the greater a worker's tenure, the higher the probability that he has a high ε draw. To find the probability Q_t that a worker who has stayed with the employer through period t-1 quits at the beginning of period t, we need only take the expectation of $Q_t(\varepsilon)$ over ε, or $Q_t = \int_{-\infty}^{\infty} Q_t(\varepsilon) g_t(\varepsilon) d\varepsilon$.

The employer's profit depends on the worker's valuation of the non-pecuniary aspects of the employer's job because the higher is ε, the lower is the worker's quit probability. If the employer knew ε, then the employer's profit at the beginning of period t would be

$$\text{(8)} \quad \begin{aligned} \pi_t(\varepsilon) &= (1-Q_t(\varepsilon))(P_t - w_t - c_t T_t + \beta\pi_{t+1}(\varepsilon)) \\ &= (1-Q_t(\varepsilon))[(P_t - w_t - c_t T_t) + \sum_{\tau=t+1}^{\infty} \beta^{\tau-t} \prod_{i=t+1}^{\tau} (1 - Q_i(\varepsilon))(E(P_\tau) - w_\tau - c_\tau T_\tau)], \end{aligned}$$

where c_t denotes the cost to the employer of providing a unit of training during period t. As discussed above, the employer does not observe ε. The expected value to the employer of a worker at time t is thus the expectation of $\pi_t(\varepsilon)$, or

$$(9) \qquad \pi_t = \int_{-\infty}^{\infty} \pi_t(\varepsilon) g_t(\varepsilon) d\varepsilon .$$

Two contracting assumptions are common in the literature. At one extreme, it is sometimes assumed that an employer can credibly commit to any future wage profile at time 0. This assumption is not very plausible, especially when one considers that it implicitly presumes that the employer can make future commitments on the basis of decisions that have not yet been made at the time he hires the worker. For example, a promise by the employer to raise a worker's wage by some specified amount if the worker invests in an extra unit of training in period t will be difficult to enforce if the training is not easily verifiable by a third party. In addition, the promise will create a serious incentive problem if, as seems likely, the value of the worker's training depends upon the effort he puts in during the training period. Of course, the employer could promise to increase the worker's future wage by the actual increase in his future productivity, but this promise is not readily verifiable.

Because an employer's commitment to condition future wages on variables, such as future productivity, that are not readily observed by outside parties will not be credible, it is sometimes assumed that an employer must offer a contract that he will not have an incentive to alter after the employment relationship has begun. In spite of this appealing motivation, the pure self-enforcing assumption is not completely satisfactory because it allows no wage commitments at all. While there are certainly restrictions on the commitments that employers can make, there does not seem to be anything preventing them from at least committing to some minimum guaranteed wage.

Rather than assume that an employer has either a perfect ability to commit or absolutely no ability to commit, it seems more reasonable to assume, as do Black and Loewenstein (1995), that at the time of hire the employer guarantees some minimal wage in the future, but is free to offer a higher wage if he so desires. Let ω_t be the minimal guaranteed wage that the employer promises at the time of hire to pay in period t. The employer's actual wage offer w_t in period t maximizes π_t subject to the constraint that

$$(10) \quad w_t \geq \omega_t.$$

Differentiating (9) with respect to w_t, we see that the wage at time t that maximizes π_t subject to the wage commitment (10) satisfies the first-order condition

$$(11) \quad \partial\pi_t/\partial w_t = \int_{-\infty}^{\infty}\{(-\partial Q_t(\varepsilon)/\partial w_t)(P_t - c_tT_t - w_t + \beta\pi_{t+1}(\varepsilon)) - (1 - Q_t(\varepsilon))\}g_t(\varepsilon)d\varepsilon + \hat{\mu}_t = 0,$$

where $\hat{\mu}_t$ is a non-negative Kuhn-Tucker multiplier that is equal to zero if the wage guarantee is not binding in period t (that is, $\hat{\mu}_t = 0$ if $w_t > \omega_t$). For our subsequent analysis, it will be convenient to normalize by dividing both sides of (11) by $1\text{-}Q_t$. Doing so and rearranging terms using (7a) gives us

$$(12) \quad \eta_t(P_t - c_tT_t - w_t) = 1 - \beta\int_{-\infty}^{\infty}\eta_t(\varepsilon)\pi_{t+1}(\varepsilon)g_{t+1}(\varepsilon)d\varepsilon - \mu_t,$$

where

$$\begin{aligned}(13a) \quad \eta_t(\varepsilon) &\equiv [-\partial Q_t(\varepsilon)/\partial w_t]/[1\text{-}Q_t(\varepsilon)] \\ &= f(\hat{V}_t(\varepsilon))/F(\hat{V}_t(\varepsilon)) \\ &\equiv \varphi(\hat{V}_t(\varepsilon))\end{aligned}$$

denotes the normalized quit responsiveness of a worker whose valuation of the non-pecuniary attributes of the employer's job is ε,

$$\text{(13b)} \quad \eta_t \equiv \int_{-\infty}^{\infty} \eta_t(\varepsilon) g_{t+1}(\varepsilon) d\varepsilon$$

denotes the expected value of $\eta_t(\varepsilon)$, $\mu_t \equiv \hat{\mu}_t$, and $\varphi(x)$ denotes the hazard rate $f(x)/F(x)$ which is assumed to be diminishing.[3]

In interpreting (12), note that $P_t - c_t T_t$ is the worker's value of marginal product in period t net of the training costs that the employer incurs. If the wage guarantee is not binding in period t (so that $\mu_t = 0$) and if the employer does not to expect to earn any profits in future periods (so that $\int_{-\infty}^{\infty} \eta_t(\varepsilon)\pi_{t+1}(\varepsilon) g_{t+1}(\varepsilon) d\varepsilon = 0$), then we see from (12) that the employer's period t wage offer will be less than the worker's net marginal product and the employer will extract some of the current rents from the match. The less responsive is the normalized quit rate to a change in the wage (that is, the smaller is η_t), the lower the self-enforcing wage offer and the greater the share of rents that the employer extracts. If we now relax the assumption that future profits on retained workers are zero, then we see that the fact that the employer expects to earn positive profits on a retained worker in the future will temper his rent extraction today.

Differentiating (13a) yields

$$\text{(14)} \quad \partial\eta_t(\varepsilon)/\partial\varepsilon = -\varphi'(\hat{V}_t(\varepsilon)) < 0.$$

In other words, a worker's normalized quit responsiveness $\eta_t(\varepsilon)$ is inversely related to his valuation of the non-pecuniary features of the employer's job. Because equations (6a) and (7b) imply that workers with greater tenure are more likely to have a high ε draw (or, more formally, that there exists a critical value $\hat{\varepsilon}$ such that $g_t(\varepsilon) > (<)\ g_{t+1}(\varepsilon)$ as $\varepsilon > (<)\ \hat{\varepsilon}$), it follows immediately that the

[3] Many common distributions, including the uniform and the normal, have a diminishing hazard rate. A diminishing hazard rate is sufficient to ensure that the second order condition to the employer's mazimization problem is satisfied.

greater is a worker's tenure t, the lower is his expected quit responsiveness η_t. As discussed above, a falling η_t provides the employer with an incentive to reduce his wage offer over time. Thus, if training and productivity growth are not sufficiently high, the self-enforcing wage will fall with tenure.[4] Of course, a sufficiently high rate of productivity growth will cause the self-enforcing wage to rise, although at a lower rate than productivity.

By offering a wage guarantee at the time the worker is hired, the employer in effect promises to limit the amount of rents that he will attempt to extract in the future. Because the employer's future attempts to extract rents lead to quits that are not jointly optimal, it will generally be efficient to offer a positive wage guarantee. Of course, although a higher wage guarantee has the advantage of reducing quits, it also induces dismissals when there is a negative value of marginal product shock v_t. As discussed by Black and Loewenstein, the optimal wage guarantee just balances these two competing considerations.

In our current multiperiod setting, it might be most natural that the wage commitment take the form of a promise never to cut the wage of any retained worker in the future, so that the guaranteed wage in period t simply equals the wage offer in the previous period, or $\omega_t = w_{t-1}$. Besides being intuitively plausible, this form of the wage guarantee can be justified on efficiency grounds because the resulting contract is easy to implement and prevents the employer from making low future wage offers that induce inefficient turnover. From our discussion above, we know that this constraint will be binding when training and productivity growth are relatively low. Given diminishing returns to training (i.e., $\psi'' < 0$), the wage guarantee will generally be binding once a worker's tenure becomes sufficiently high.

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[4] The observant reader may note the presence of an additional effect: a worker with a higher ε is more valuable to the employer because he has a lower quit rate (in equation (12), this effect works through the fact that $\beta\int_{-\infty}^{\infty}(\eta_t(\varepsilon)/\eta_t)\pi_{t+1}(\varepsilon)g_{t+1}(\varepsilon)d\varepsilon$ tends to rise over time). This effect in and of itself would cause the self-enforcing wage to increase, but is generally dominated by the effect from the falling η_t. For example, when f(y) and g(ε) are normal densities and β is not extremely close to 1, one can show using numerical methods that the self-enforcing wage will fall with tenure if there is no productivity growth over time.

We might also note that there are other possible justifications of a wage guarantee besides its potential use as a means of preventing employers from extracting excessive rents from workers. In accordance with the suggestion by Shapiro and Stiglitz (1984) and the efficiency wage literature, the guaranteed wage may be the lowest wage that the employer can offer and still deter workers from shirking. Alternatively, the constraint may perhaps be justified as representing a "social norm" that the employer must adhere to if he does not want to hurt the morale of his workers. In any case, what is crucial for our current analysis is not the exact nature and level of the wage guarantee, but simply the fact that a wage guarantee exists and may be binding. We have thus chosen to simplify the ensuing discussion by taking the actual wage guarantee as being determined exogenously to our model.[5]

The Division of the Returns to Training

The division of the returns to training depends crucially on whether or not the wage guarantee is binding. To see this, let us determine the effect that a change in the amount of training received by the worker in periods 0 through t-1 has on the employer's wage offer in period t. When the wage guarantee is not binding in period t, $\mu_t = 0$, so that differentiation of (8) using (1), (6), and (11) yields

$$(15)\qquad \begin{aligned} \frac{\partial \pi_t}{\partial \hat{T}_t} &= \int_{-\infty}^{\infty} \{(1-Q_t(\varepsilon))\psi'(\hat{T}_t) - \frac{\partial Q_t(\varepsilon)}{\partial \hat{T}_t}(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))\}g_t(\varepsilon)d\varepsilon \\ &= \psi'(\hat{T}_t)\int_{-\infty}^{\infty} \{(1-Q_t(\varepsilon))\psi'(\hat{T}_t) + \alpha\frac{\partial Q_t}{\partial w_t}(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))\}g_t(\varepsilon)d\varepsilon \\ &= (1-\alpha)\psi'(\hat{T}_t)\int_{-\infty}^{\infty} \{(f(\hat{V}_t(\varepsilon)(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))\}g_t(\varepsilon)d\varepsilon \end{aligned}$$

and differentiation of (12) yields

[5] What is important for the ensuing analysis is not so much the exogeneity of the wage guarantee per se so much as the implicit assumption that the wage guarantee is set before training is determined. We will discuss this point in more detail in the conclusion.

$$(16) \quad \frac{\partial w_t}{\partial \hat{T}_t} = \frac{\psi'(\hat{T}_t)[\eta_t - \alpha\int_{-\infty}^{\infty}\phi'(\hat{V}_t(\varepsilon))(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))g_{t+1}(\varepsilon)d\varepsilon]}{\eta_t - \int_{-\infty}^{\infty}\phi'(\hat{V}_t(\varepsilon))(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))g_{t+1}(\varepsilon)d\varepsilon]}$$

$$> 0.$$

When training is purely specific, $\alpha = 0$ and equations (15) and (16) reduce to

$$\frac{\partial \pi_t}{\partial \hat{T}_t} = \psi'(\hat{T}_t)\int_{-\infty}^{\infty}\{(f(\hat{V}_t(\varepsilon)(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))\}g_t(\varepsilon)d\varepsilon \ ,$$

$$\frac{\partial w_t}{\partial \hat{T}_t} = \frac{\psi'(\hat{T}_t)}{1-(1/\eta_t)\int_{-\infty}^{\infty}\phi'(\hat{V}_t(\varepsilon))(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))g_{t+1}(\varepsilon)d\varepsilon]} \ .$$

Thus, in periods where the wage guarantee is not binding, the employer shares part, but not all, of the returns to the past investments in specific training with the worker. Naturally, this implies that the worker will share the cost of the training investment in the form of a lower wage at the time of the investment.

In contrast, when $\alpha = 1$, (15) and (16) reduce to $\partial\pi_t/\partial\hat{T}_t = 0$ and $\partial w_t/\partial\hat{T}_t = \psi'(\hat{T}_t)$, which is the standard result that the worker receives all the returns to past investments in general training. Because a general training investment in period τ does not raise the employer's future profits, the employer will not be willing to incur any of the costs of general training. Thus, training will occur only if the worker bears the full cost of training, either directly or indirectly in the form of a lower wage.

The result that the worker realizes all the returns and incurs the entire cost of general training depends crucially on the assumption that the employer's promised wage guarantee (10) is never binding. To see this, note that if the wage guarantee is binding at time t, then the Kuhn-Tucker multiplier μ_t is positive and $w_t = \omega_t$. Differentiation of (11) then yields

(17a) $\partial w_t/\partial \hat{T}_t = 0$

(17b) $\partial \mu_t/\partial \hat{T}_t = -\psi'(\hat{T}_t)[\eta_t - \alpha \int_{-\infty}^{\infty} \phi'(\hat{V}_t(\varepsilon))(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))g_{t+1}(\varepsilon)d\varepsilon] < 0.$

That is, if the employer's wage guarantee is binding in period t, then a marginal increase in $\hat{T}_t$ has no effect on the employer's wage period t wage offer. This result should not be surprising. If the wage guarantee is binding in period t, then the employer is constrained to offer a wage above the self-enforcing level. Since the employer is paying a wage higher than he would like, a marginal increase in $\hat{T}_t$ has no effect on his wage offer.

To find the effect of an increase in $\hat{T}_t$ on the employer's expected profit when the wage guarantee is binding, we need merely differentiate (8) to obtain:

(17c) $\partial \pi_t / \partial \hat{T}_t = (1-\alpha)\psi'(\hat{T}_t)\int_{-\infty}^{\infty}\{(f(\hat{V}_t(\varepsilon)(P_t - c_t T_t - w_t + \beta\pi_{t+1}(\varepsilon))\}g_t(\varepsilon)d\varepsilon + \mu_t.$

When training is completely general, (17c) reduces to $\partial \pi_t / \partial \hat{T}_t = \mu_t > 0$. Thus, if the wage guarantee is binding, even purely general training will lead to an increase in the employer's profit. To understand this result, note that if the employer were to increase the worker's period t wage by the increase in his general productivity, $\psi'(\hat{T}_t)$, then the worker's quit rate and the gap between the worker's net marginal product and his wage (P_t - $c_t T_t$ - w_t) would both be unchanged, which implies that the employer's period t profit, π_t, would be unchanged. But from (17a), we know that the employer's optimal course of action is to keep the wage unchanged. It thus follows immediately that a higher $\hat{T}_t$ must lead to an increase in the employer's profit. Since the employer realizes some of the returns to even purely general training, he is willing to pay some of the costs.[6] The worker, on the other hand, is less willing to pay for training.

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[6] The discussion above is for a small (actually, infinitessimal) increase in $\hat{T}_t$. Since $\partial\mu_t/\partial\hat{T}_t < 0$, there is thus some discrete increase in $\hat{T}_t$, say x*, that will just drive μ_t to zero. Any further increase in $\hat{T}_t$ would lead to an increase in the wage w_t as indicated by equation (16). Of course,

III. *Training Information in the National Longitudinal Survey of Youth*

The model in the preceding section suggests that given real world contracting restrictions one should not be surprised to see employers sharing the costs and returns to general as well as specific training investments. Is there any evidence of this? Recent data from the National Longitudinal Survey of Youth (NLSY) can help us to answer this question.[7] Unlike other data sets, these data have information on who bears the explicit costs of training.

Each year the NLSY obtains information on an individual's wage and tenure in his current or most recent job and on the training that he received since the last interview. We utilize data from the 1988 through 1991 NLSY surveys because these data contain information on who paid for training. Another advantage of these data is that they contain information on all training spells regardless of their duration.[8] To ensure that unobserved spells of previous training due to left censoring of jobs in progress at the 1988 interview do not bias upward the coefficients on previous training in our wage regressions, we have restricted our sample to individuals who start a new job within one year of the 1988 survey or later. This leaves us with a sample of individuals aged 23-34 who each contribute between one and four years of data.[9] After discarding observations with

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even if $\Delta\hat{T}_t > x$, the resultant increase in the worker's productivity, $\Delta P_t = \int_0^{x^*} \psi'(\hat{T}_t + x)dx$, must still exceed the increase in the employer's wage offer, $\Delta w_t = \int_0^{x^*} \frac{\partial w_t(\hat{T}_t + x)}{\partial \hat{T}_t} dx$.

[7] The NLSY is a survey of 12686 individuals who were aged 14 to 22 in 1979. These youths have been interviewed annually since 1979, and the response rate has been 90 percent or higher in each year. The sample size was reduced to 11607 in 1985 when interviewing of the full military sample ceased. In 1991, the sample was further reduced to 9964 persons when the economically disadvantaged white supplemental sample was eliminated. The survey's wealth of information on individuals' demographic characteristics and ability offers a great advantage for studying the acquisition of and the returns to training.

[8] There were no training questions in the 1987 survey and the questions about who paid for training were not asked in 1979, 1980, 1981, 1985, nor 1986. Prior to 1988, the NLSY only obtained information on training spells that lasted longer than one month. Data from 1988-1991 indicate that 64.5 percent of training spells are less than four weeks in duration.

[9] Because persons with more than one year of tenure in 1988 who do not change jobs between 1988 and 1991 are omitted from our sample, this restriction likely results in a sample with an above average proportion of high turnover individuals.

either missing data or where the individual is self employed, we end up with a final sample of 5492 individuals who in total contribute 14801 person-year observations.

The training questions from the NLSY survey are listed in Table 1.[10] In our sample of 14801 person-year observations, there are 12.32 percent "yes" responses to the training incidence question #1 in table 1. Of all training spells reported, 19.74 percent are reported in response to question #2 to be in the aggregate category of business school, apprenticeship program, vocational or technical institute, or correspondence course, 46.00 percent are listed as formal company training, 16.23 percent are classified as seminars at work run by someone other than the employer, 17.32 percent are reported as seminars outside of work, and 8.44 percent fall into the aggregate category of vocational rehabilitation or other.[11] The reader should keep in mind that since only 12.32 percent of individuals report training in a given year, the cell sizes for some of our training components are somewhat small. However, in light of our interest in the distinct effects of specific and general training, it is not entirely clear a-priori exactly how we should group the various components. Rather than attempt to aggregate the data, we have therefore decided to stick with our five training components (and the resultant small cell sizes).

IV. *Employer Cost Sharing and Rent Extraction - Empirical Evidence*

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[10] We should note that the NLSY interviewers manual states that "Business school" (in question #2) is "not to be confused with business classes in college or graduate school. It does not contribute to an undergraduate or professional degree." [Emphasis in the original] Questions about formal schooling are asked in another part of the survey and are not explicitly part of the training data collected in the NLSY. Vocational rehabilitation is defined as a "facility offering specialized training to prepare disabled persons to enter or re-enter the work force." We should also note that there is some uncertainty as to how individuals with informal training answer the NLSY training questions, but one suspects that the survey will generally not pick up informal training.

[11] Our sample restrictions appear to have a minimal impact on the incidence of training and its distribution by type. In the full sample of 12686 individuals, the average annual incidence of training over the period 1988-1991 is 12.21 percent. Of those individuals in the full sample that report training in the past year, 19.64 percent report the aggregate category of business school (etc.), 40.89 percent report formal company training, 20.33 percent report seminars at work, 21.30 percent report seminars outside of work, and 7.38 percent report the aggregate category of vocational rehabilitation or other. The incidences of the components sum to more than 100 percent because some individuals had more than one type of training in a given year.

From the responses to question #3 in Table 1, it is straightforward to ascertain the proportion of training spells that are employer paid. Table 2 provides this information for each of the different training categories. In interpreting Table 2, one should bear in mind that the table only includes information on the explicit cost of training; an employer who incurs this cost may pass it on to the worker in the form of a lower wage (we will examine this below). Still, the table is highly suggestive. One's intuition suggests that formal company training is likely to have a large specific component. Accordingly, the data in the NLSY indicate that employers pay for nearly all spells of formal company training. Similarly, employers pay for over 90% of seminars at work. In contrast, because training in the form of seminars outside of work are likely to have a somewhat higher general component (otherwise it does not make sense for it to be offered outside of the employer's workplace), one would expect a lower percentage of outside seminars to be employer financed. This is indeed the case. Still, it is somewhat surprising that over 80% of these spells are employer paid.

Perhaps even more surprising is the fact that over 40% of all training spells in the business and vocational school category are employer financed.[12] Since this training is almost surely general, this observation does not seem consistent with the standard human capital model prediction that workers should pay for all the costs to general training investments.[13] In contrast, our model in the

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[12] 46% of the spells in this aggregate category are at a vocational or technical institute, 20% are correspondence courses, 17% are business school spells, and 17% are apprenticeship spells. Employers pay for 30% of vocational institute spells, 57% of correspondence courses, 37% of business school spells, and 67% of apprenticeship spells.

[13] In light of our relatively small cell sizes, the reader may object that the phenomenon of employer-financed general training is not really very important. However, as noted above, the NLSY training questions miss most informal training and intentionally exclude school training. School training is the labor economist's prototypical example of general training. However, analyzing the January 1991 Current Population Survey training supplement, Loewenstein and Spletzer (1993) report that of the 13.6% of workers who received school training after starting employment at their current job, 56% had at least some of their educational costs paid for by the employer. Sixty percent of these individuals had all their educational costs paid for by the employer and twenty percent had less than all but more than half their educational costs paid for by the employer. Similarly, Altonji and Spletzer (1991) report that 9.4 percent of all workers in the 1986 follow-up to the National Longitudinal Survey of the High School Class of 1972 received employer provided financial assistance to attend school after work.

previous section suggests that contracting rigidities make it possible for employers to obtain some of the returns to general training investments, which in turn means that they are willing to incur some of the costs.

We can use wage regressions to analyze whether employers are able to obtain some of the returns to general training. The regression equation in column 1 of Table 3 has a worker's log wage as its dependent variable. As independent variables in the equation, we have included variables indicating whether the worker has received each of the different types of training in the current year, whether or not this training is employer financed, and whether or not this training is completed. Also included are variables indicating whether the worker has received training in previous years from the current employer and whether the worker has received training in previous years from a previous employer.

In addition to the various training variables, the regression contains individual and job characteristics in order to control for the heterogeneity that may exist between those who receive training and those who do not. Individual characteristics include not only the worker's age, sex, race, education, job tenure, and labor market experience, but also his score on the armed forces qualifying test (which serves an indicator of the worker's ability). Job characteristics include industry and occupation, whether the worker is in a union, whether the worker's job is part-time, the size of the employer's establishment, and whether the employer has more than one establishment.

As expected, the wage regression in column 1 of Table 3 indicates that there is a positive wage return to completed spells of employer financed training. Nearly all the coefficients on completed spells of employer financed training are positive and quite a few of these coefficients are significantly different from zero. In contrast to employer financed training, completed spells of most types of non-employer financed training [not reported in the table] do not yield a positive wage return. One possible explanation for this is that individual workers are not particularly adept on their own in choosing training activities that have a high positive return. Another possible explanation is that individuals answering the survey may be misreporting some primarily self-financed leisure time activities as training. At any rate, the rest of our discussion will focus on employer financed training, which is more germane given our current concerns.[14]

As discussed above, the NLSY data indicate that besides nearly always bearing the explicit costs of specific training, employers also frequently incur the explicit costs of what appears to be general training. The question that naturally arises is whether these costs are partially passed on to workers in the form of lower wages during the training period. Interestingly, the wage regression in column 1 of Table 3 does not provide much evidence of this. The coefficients labeled "marginal effects of uncompleted spells" indicate the differential wage returns between uncompleted and completed spells of employer financed training in the current year. As expected, most of these coefficients are negative, and the ones that are positive are small in magnitude. However, none of the coefficients are statistically different from zero. The returns to uncompleted spells of training (as compared to no training) can be obtained by adding the returns to completed spells of training to the marginal effects of uncompleted spells. While the estimated returns to uncompleted spells of formal company training and outside seminars are negative, these estimated returns are both statistically insignificant and economically small (-.014 and -.012). Of course, our finding that uncompleted spells of training do not have a negative effect on wages should be viewed with some caution since the number of uncompleted training spells in our sample is quite small. However, as alluded to in the introduction, a host of other studies have obtained the same result.[15]

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[14] We also will not have anything to say about "other training" except to note that analysis of "other training" responses in the full sample 1993 Computer Assisted Personal Interview reveals that this training variable is quite a hodgepodge. Four of the individuals responding "other" in 1993 indicated that they had received informal on the job training, 14 indicated that they received "on the job training", 14 indicated that they attended seminars or vocational-technical programs (training which should have been placed in a preceding category), 22 indicated that they received some form of schooling such as adult education or classroom training, 17 indicated some form of government training, 10 indicated that training occurred in prison, and 40 responses could not be classified.

[15] We might note that the NLSY does not provide information on a worker's wage at the beginning of a training period. It is possible that training lowers a worker's wage at the beginning of the training period, but that the wage is increased through the training period as a worker becomes more productive. However, Barron, Black, and Loewenstein (1989) find that the amount of on-the-job training in the first three months has no statistically significant effect on the starting wage. And Barron, Berger, and Black's (1993) results indicate that the estimated effect of training on the

Employers should only be willing to pay the costs of training if they are able to realize some of the returns. Is there any evidence to suggest that employers extract any of the returns to general training? While the costs of a training spell occur contemporaneously, the returns occur in the future. To determine the worker's return to training, we thus look at the effect of completed spells of past training on the current wage. While we do not have a direct measure of the employer's return, we can make some inferences about employers' rent extraction by comparing the wage return to training when a worker remains at the employer providing the training with the return when he moves to a new employer.

When one examines the returns to employer financed training, one sees that the coefficient on previous spells of formal company training at the current employer is .0654, but the coefficient on previous spells of formal company training at a previous employer is only .0087. Thus, while a spell of employer financed formal company training in a previous year has a positive and significant effect on a worker's current wage if the worker obtained the training at his current employer, it has essentially no effect on his wage if it was obtained at a previous employer. This is consistent with our hypothesis that formal company training is primarily specific. By way of contrast, the coefficient on business or vocational school training at a previous employer is .1410 and significantly different from zero, which is consistent with the fact that a substantial component of this training is likely to be general. Similarly, the statistically significant positive coefficients on outside and inside seminars at a previous employer (the coefficients are .2599, and .0802, respectively) suggest that a substantial part of this training is general as well.

Unlike business and vocational school training at a previous employer, previous employer financed training in business and vocational schools at the current employer does not appear to

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starting wage may be somewhat sensitive to the exact specification of the starting wage equation, but if it is negative, it is certainly very small. Barron, Black, and Loewenstein suggest that their inability to obtain compensating differentials may stem in part from unmeasured differences in worker ability. This is less of a problem in the National Longitudinal Survey of Youth, which contains richer individual data. Using the NLSY data through 1983, Lynch (1992) also fails to obtain a significant negative effect of uncompleted training on the wage. And using NLSY data from 1979 to 1982, Parsons (1989) does not find any evidence of a compensating differential for jobs with greater learning opportunities.

have a positive effect on the current wage (the coefficient is an insignificant -.0673). A similar result holds for outside and, to a lesser extent, inside seminars: while previous employer financed outside seminars at the current employer have a significantly positive effect on the current log wage, the returns (.1463) are smaller than those associated with employer financed outside seminars while at a previous employer. This result is consistent with our hypothesis that employers extract some of the return to general training.

The coefficients in column 1 of table 3 indicate that the differential return between employer financed formal company training at a previous and current employer is -.057, which is statistically different from zero at the 10% confidence level. For inside and outside seminars, the differential returns are .049 and .114, respectively. And the differential return for business and vocational school is .208, which is statistically different from zero at the 5% confidence level. These estimated differential returns are listed in table 4. As one would expect, the difference between the return to training at a previous and current employer is smaller the more specific is the training. However, it is difficult for the conventional model to explain the large positive differential for general training. Indeed, the only convincing explanation we can find is that employers are extracting some of the returns to general training.

At first glance, one might suspect that the estimated positive differential for general training might be due to a bias introduced by individuals' endogenous separation decisions. It is indeed true that the returns to previous training at previous employers are estimated from the sample of individuals who switch jobs. Because persons switch jobs when they find an alternative that is more attractive than their previous job, our estimated returns to training in previous jobs may overstate the return that a worker who does not switch jobs can expect. However, we should expect a similar bias in the estimated returns to previous training at the current employer because these returns are estimated from the sample of individuals who do not switch jobs and these individuals will on average be in an unusually good job match. In short, our estimated returns to previous training at the current employer and previous training at past employers are both confounded by individuals' endogenous separation decisions, but there is no reason a priori to expect the estimated differential to be biased in any particular direction.

As initially pointed out by Barron, Black, and Loewenstein (1989), individuals who are more able may be more likely to receive training. While our regression equation includes a host of individual and job characteristics in an attempt to control for heterogeneity that may exist between those who receive training and those who do not, it is still possible that the training coefficients may be biased upward because of unmeasured heterogeneity. Although it is difficult to imagine how this would bias the differential return between training at a current and previous employer, we can provide an additional check on our results by estimating a fixed effects wage equation.

While a fixed effects wage equation will obviously eliminate any bias introduced by unobserved personal characteristics, it is not so apparent how a fixed effects equation controls for unobserved match characteristics. To help get a handle on this, consider the simple error components model:

$$(18) \qquad W_{ijt} = T_{ijt}\beta_1 + \hat{T}_{ijt}\beta_2 + \tilde{T}_{ijt}\beta_3 + u_i + v_{ij} + e_{ijt},$$

where W_{ijt} is individual i's wage on job j at time t, T_{ijt} is individual i's training during the current period t, $\hat{T}_{ijt}$ is individual i's accumulated training on the current job j at the beginning of period t, $\tilde{T}_{ijt}$ is individual i's training accumulated at jobs previous to job j, u_i is an individual fixed effect, v_{ij} is an individual-job match fixed effect, and e_{ijt} is a transitory mean zero error term uncorrelated with $(T_{ijt},\hat{T}_{ijt},\tilde{T}_{ijt},u_i,v_{ij})$. Barron, Black, and Loewenstein worried about the unobserved individual heterogeneity u_i and its correlation with the training variables $(T_{ijt},\hat{T}_{ijt},\tilde{T}_{ijt})$. Our further concern is the unobserved job match heterogeneity v_{ij} and its possible correlation with the training variables. First differencing the wage equation (18) gives us after several steps of algebra

$$(19) \qquad (W_{ijt} - W_{ijt-1}) = T_{ijt}\beta_1 + T_{ijt-1}(\beta_2 - \beta_1) + (e_{ijt} - e_{ijt-1})$$

if the individual is in same job j during periods t and t-1,

$$(W_{ijt} - W_{ikt-1}) = T_{ijt}\beta_1 + T_{ikt-1}(\beta_2 - \beta_1) + \hat{T}_{ikt}(\beta_3 - \beta_2) + (v_{ij} - v_{ik}) + (e_{ijt} - e_{ikt-1})$$

if the individual is in job j during period t and job k≠j during period t-1.

For individuals who do not change jobs, T_{ijt} and T_{ijt-1} are uncorrelated with the error $(e_{ijt} - e_{ijt-1})$ and the estimated coefficients β_1 and β_2 are unbiased. The coefficient β_3 is not estimated from this sample of non-movers. Wage growth for individuals who change jobs can occur in three ways. First, wages can increase the "conventional" way through contemporaneous human capital accumulation as seen by the term $T_{ijt}\beta_1 + T_{ikt-1}(\beta_2 - \beta_1)$. Second, the term $\hat{T}_{ikt}(\beta_3 - \beta_2)$ indicates how wages can increase or decrease depending on how the returns on the stock of human capital acquired at the previous employer may differ at the new employer and the previous employer. Finally, wages may increase as a result of a better match at the new employer as seen by the term $(v_{ij} - v_{ik})$.

There are two reasons why accumulated training $\hat{T}_{ikt}$ may be correlated with the error component $(v_{ij} - v_{ik})$. First, the expected value of $(v_{ij} - v_{ik})$ for those who change jobs is negatively correlated with the magnitude of v_{ik}. In other words, we expect to observe higher wage growth for those who are leaving a poor job match compared to those who are leaving a good job match. If the stock of training $\hat{T}_{ikt}$ is positively correlated with the individual-job match fixed effect v_{ik}, this will cause the estimated coefficient $(\beta_3 - \beta_2)$ to be downward biased.

A second possible source of bias arises from the endogeneity of individuals' separation decisions. Recall from the model presented in section two that individual i's expected valuation of job j at the beginning of period t is

$$(20) \qquad V_{ijt} = \hat{T}_{ijt}\beta_2 + \tilde{T}_{ijt}\beta_3 + u_i + v_{ij} + \varepsilon_{ij} + R_{ijt},$$

where ε_{ij} denotes the non-pecuniary value that individual i receives from job j, and R_{ijt} denotes the discounted expected value of all future pecuniary and non-pecuniary returns at employer j from period t onward. An individual voluntarily moves from job k in period t-1 to a new job j that he locates in period t if the new job has a higher expected value, that is, if $V_{ijt} > V_{ikt}$.[16] Using (20), worker i's quit decision at the beginning of period t may be written as

$$\text{(21)}\qquad \text{Switch Jobs if}\quad \hat{T}_{ikt}(\beta_3 - \beta_2) + (v_{ij} - v_{ik}) + (\varepsilon_{ij} - \varepsilon_{ik}) + (R_{ijt} - R_{ikt}) > 0.$$

For persons who quit job k in favor of job j, equation (21) implies that the training accumulated at job k, $\hat{T}_{ikt}$, is correlated with the improvement in the value of the match $[(v_{ij} - v_{ik}) + (\varepsilon_{ij} - \varepsilon_{ik}) + (R_{ijt} - R_{ikt})]$. This latter term is decomposed into the pecuniary improvement, the non-pecuniary improvement, and the improvement in the present value of expected future returns. Each of these three components is unobserved by the econometrician. As is immediately obvious from (21), the direction of the correlation between the stock of training and the improvement in the value of the match is dependent upon the sign of the coefficient $(\beta_3 - \beta_2)$. If $\beta_2 > \beta_3$, as would be expected for specific training, then the improvement in the value of the match necessary to induce a quit is positively correlated with accumulated training $\hat{T}_{ikt}$. If $\beta_2 = \beta_3$, then the improvement in the value of the match necessary to induce a quit is uncorrelated with accumulated training $\hat{T}_{ikt}$. If $\beta_2 < \beta_3$, as would be expected if the current employer is extracting rents from general training, then the improvement in the value of the match necessary to induce a quit is negatively correlated with accumulated training $\hat{T}_{ikt}$. Provided that $[(\varepsilon_{ij} - \varepsilon_{ik}) + (R_{ijt} - R_{ikt})]$ is not strongly negatively correlated with $(v_{ij} - v_{ik})$, the correlation between training and the pecuniary improvement in match quality $(v_{ij} - v_{ik})$ has the same sign as the correlation between training and the improved value of the match $[(v_{ij} - v_{ik}) + (\varepsilon_{ij} - \varepsilon_{ik}) + (R_{ijt} - R_{ikt})]$. Under this assumption, $(\beta_3 - \beta_2)$ in equation (19)

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[16] Our discussion focuses on quits rather than dismissals in part because the former seem to be more common (for example, as reported by McLaughlin (1990), PSID data for the period 1976-1984 indicate that quits occur 1.88 times more often than dismissals). A dismissal is caused by a negative productivity shock and is not affected by a worker's alternative wage. Thus, for workers who are dismissed, $E[\hat{T}_{ikt}(v_{ij} - v_{ik})] = -E(\hat{T}_{ikt}v_{ik})$. Dismissals will therefore cause the fixed effects estimate of $(\beta_3 - \beta_2)$ to be biased downward if the stock of training is positively correlated with the individual-job match fixed effect v_{ik}.

will be biased upward from its true negative value if $\beta_2 > \beta_3$ and will be biased downward from its true positive value if $\beta_2 < \beta_3$.

The estimates from the individual fixed effects wage equation are presented in column 2 of tables 3 and 4. We have controlled for the non-zero mean of the unobserved error component (v_{ij} - v_{ik}) by including a dummy variable equal to one when the individual changes jobs. The estimated coefficient [not reported in the table] is .0336 (and its standard error is .0201). Our other results are in large part similar to those in column 1. Note in particular that the coefficients in table 3 on employer financed business and vocational school training and outside seminars at a previous employer exceed the coefficients on employer financed business and vocational school training and outside seminars at the same employer. Indeed, the coefficients on employer financed business and vocational school training and outside seminars at a previous employer are statistically different from zero, while the coefficients on employer financed business and vocational school training and outside seminars at the same employer are not.

Table 4 indicates that the estimated differential return between past business and vocational school training at a current and previous employer falls in the fixed effects equation, as does the estimated differential return to outside seminars.[17] This finding is consistent with the previous econometric exercise which suggested that the fixed effects estimate of (β_3 - β_2) is downward biased if $\beta_3 > \beta_2$. In any case, the differential returns to outside seminars and business and vocational training are still quite large, as both exceed 10 percent.

V. *Conclusion*

Recent NLSY data provide information on who bears the direct costs of training. The 1988-1991 NLSY data indicate that employers nearly always pay the explicit cost of training that the

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[17] The estimated differential return between past company training at a current and previous employer rises from -.057 in the level equation to essentially zero in the fixed effects equation. Unlike all the level coefficients and the first differenced coefficients on inside seminars, outside seminars, and business and vocational schools, the first differenced formal training coefficients are quite sensitive to specification.

worker receives on the employer's premises. Even more strikingly, the employer often pays for the explicit costs of what appears to be general training: seminars or training programs outside of work and training that a worker receives in business school, an apprenticeship program, a vocational or technical institute, or a correspondence course. Evidence from at least two other data sets also indicates that employers pay for general training, an observation that is contrary to the conventional human capital model.

We have argued that employers pay for general training because they are able to obtain some of the returns. This hypothesis is supported by our wage regressions which indicate that completed spells of general training paid for by previous employers have a larger effect on the wage than completed spells of general training paid for by the current employer. Given the small cell sizes of our five training components, the evidence is not entirely conclusive. Although we could have reduced the variances of our parameter estimates by aggregating the data, we were unsure of the appropriate way to aggregate. We chose to work with the disaggregated training components in order to minimize possible differences in specificity within a given category of training.[18]

Worker mobility costs are an important feature of the theoretical model that we presented in Section II. As suggested by Bishop (1988) and Parsons (1990), a liquidity constraint facing workers is another factor that may affect the division of the returns and costs to training. However, we may note that mobility costs and a high worker discount rate are not sufficient to induce employers to incur any of the costs of general training. Employers will be willing to incur some of the costs of general training only if they realize some of the returns. But in the absence of a binding wage guarantee, the first-order condition for the employer's post-training wage offer already takes mobility costs and discount factors into account and thus implies that all the returns

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[18] General training spells are likely both to have a higher wage return than specific training spells and to be associated with higher subsequent turnover. Thus, including specific and general training spells in the same training category could by itself cause us to estimate a higher wage return for training received at a previous employer than for training received at a curent employer. For this reason, we have attempted to ensure that our general training categories really include only general training. (For example, it is hard to imagine how business school training could possibly be specific).

to general human capital will be passed on to workers in the form of higher future wages. This result is quite robust and holds in both the full commitment and the self-enforcing model. The prediction that employers pay for all general training is also not affected by tax considerations. If employers are better able than workers to write off the costs of general training investments, then we should see employers bearing the explicit costs of training and passing these costs entirely onto workers in the form of lower wages during the training period; workers should still receive all the returns to general training. However, as is the case with other data sets, there is no evidence in the NLSY that workers bear the costs of training in the form of a lower wage.[19]

One can obtain the prediction that employers share in the returns and costs to general training investments only by expanding on the set of contracts that employers are allowed to offer.[20] Two contracting assumptions are common in the literature. At one extreme, it is often assumed that an employer can credibly commit to any future wage profile and at the other extreme, it is sometimes assumed that an employer must offer a contract that he will not have an incentive to alter after the employment relationship has begun. We find it more reasonable to assume that at the time of hire the employer guarantees some minimal future wage (or rate of wage growth), but is free to offer a higher wage if he so desires. The future wage guarantee serves the purpose of assuring a newly hired worker that the employer will not extract excessive rents from him should it turn out that he places a relatively high valuation on the employer's job. When the wage guarantee is binding, an increase in the worker's productivity caused by an increase in his stock of human capital will not cause the employer to pay a higher wage. The employer will thus share in the returns to general as well as specific training.

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[19] In the self-enforcing model, the result that workers realize all the returns to general training is also not affected by a legal minimum wage during the training period. In any case, most of the workers in our sample earn a starting wage that exceeds the legal minimum wage.

[20] Katz and Ziderman (1990) argue that an employer can realize some of the return to a general training investment if competing firms have imperfect information about generality of this investment and Pichler (1993) points out that a worker will stay with a firm paying a wage below his alternative if the prospect of future wage growth from continued general training outweighs the short-run gain from quitting.

Our analysis implicitly assumes that the wage guarantee is set before training is determined. If training is entirely determined before the wage guarantee is set, then this information will be incorporated in the optimal wage guarantee; as discussed above, this would likely result in workers realizing all the returns to general training. The justification for our assumption that training is not known with certainty before the wage guarantee is set is that the returns and costs to training investments vary among workers. If information about the returns and costs to training a worker comes out belatedly over time, some training decisions will likely be postponed until after the match has started. As we discuss in a recent paper (Loewenstein and Spletzer (1995)), this hypothesis is supported by the NLSY data. Analysis of the data indicates that a substantial amount of training is belated.

Besides its potential use as a means of preventing employers from extracting excessive rents from workers, there are other possible reasons for a future wage guarantee. In accordance with the efficiency wage literature, a wage guarantee might arise from employers' efforts to deter shirking by workers. Alternatively, the constraint may reflect a "social norm" that the employer must adhere to if he does not want to hurt the morale of his workers. No matter what its cause, a binding wage guarantee breaks the link between a worker's future productivity and wage rate, which in turn implies that employers will extract some of the returns to general training.

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Table 1: NLSY Training Questions

1) Since [date of the last interview], did you attend any training program or any on-the-job training designed to help people find a job, improve job skills, or learn a new job?
2) Which category best describes where you received this training?
   - Business school
   - Apprenticeship program
   - A vocational or technical institute
   - A correspondence course
   - Formal company training run by employer or military training
   - Seminars or training programs at work run by someone other than employer
   - Seminars or training programs outside of work
   - Vocational rehabilitation center
   - Other (specify)
3) Who paid for this training program? [Check all that apply]
   - Self or family
   - Employer
   - Job Training Partnership Act
   - Trade Adjustment Act
   - Job Corps Program
   - Work Incentive Program
   - Veteran's Administration
   - Vocational Rehabilitation
   - Other (specify)

Table 2: The Probability that a Training Spell is Employer Paid

Type of Training	Percentage of Spells that are Employer Paid
Formal Company Training	95.71%
Seminars at Work	91.22%
Seminars Outside of Work	81.96%
Business School, Vocational Institute, etc.	42.22%
Other	45.45%

Table 3: Wage Regressions

	Mean	(1)	(2)
Employer Paid Training: Incidence Current Year			
Formal Company Training	0.0543	0.0271	0.0346 *
		(0.0173)	(0.0193)
Seminars at Work	0.0182	0.0656 **	0.0367
		(0.0277)	(0.0286)
Seminars Outside of Work	0.0175	0.1221 **	0.0417
		(0.0289)	(0.0304)
Business School, Vocational Institute, etc.	0.0103	0.0081	0.0532
		(0.0401)	(0.0424)
Other	0.0047	0.0151	0.0620
		(0.0595)	(0.0620)
Employer Paid Training: Incidence Current Year, Marginal Effect of Uncompleted Spells			
Formal Company Training	0.0094	-0.0409	-0.0101
		(0.0372)	(0.0332)
Seminars at Work	0.0016	0.0131	0.0624
		(0.0874)	(0.0734)
Seminars Outside of Work	0.0011	-0.1338	-0.1324
		(0.1018)	(0.0835)
Business School, Vocational Institute, etc.	0.0026	0.0274	0.0524
		(0.0740)	(0.0639)
Other	0.0014	-0.0849	0.0224
		(0.1073)	(0.1067)
Employer Paid Training: # Spells Previous Years, Same Job			
Formal Company Training	0.0330	0.0654 **	0.0419
		(0.0203)	(0.0276)
Seminars at Work	0.0101	0.0316	0.0350
		(0.0357)	(0.0451)
Seminars Outside of Work	0.0090	0.1463 **	0.0454
		(0.0380)	(0.0484)
Business School, Vocational Institute, etc.	0.0060	-0.0673	0.0278
		(0.0446)	(0.0603)
Other	0.0028	-0.0129	-0.0150
		(0.0723)	(0.0973)
Employer Paid Training: # Spells Previous Years, Other Jobs			
Formal Company Training	0.0181	0.0087	0.0521
		(0.0257)	(0.0342)
Seminars at Work	0.0049	0.0802 *	0.0256
		(0.0487)	(0.0597)
Seminars Outside of Work	0.0039	0.2599 **	0.1481 **
		(0.0562)	(0.0736)
Business School, Vocational Institute, etc.	0.0058	0.1410 **	0.1423 **
		(0.0463)	(0.0694)
Other	0.0014	-0.0433	-0.0732
		(0.0912)	(0.1228)
Individual Fixed Effects		No	Yes

Standard errors in parentheses. Sample Size = 14801.
** implies statistically significant at the 5% level (two tailed test).
* implies statistically significant at the 10% level (two tailed test).
Mean (standard deviation) of dependent variable is 1.8851 (0.4945).
All equations control for an intercept, non-employer paid training spells, multiple training spells in the current year and in previous years, indicators for whether no training is observed in previous years at the same or other jobs because of left censored data, tenure, year, AFQT, race, gender, age, marital status, number of children, residence in an urban city, SMSA size, local labor market unemployment rate, union status, firm size, experience, education, school attendance in the previous year, multiple-site firm, number of previous jobs ever held, part-time work, government employment, and industry and occupation.

Table 4: Differential Returns to Training at Current and Previous Employers (Calculated from Coefficients in Table 3)

	(1)	(2)
Employer Paid Training		
Previous Years, Other Jobs - Same Job		
Formal Company Training	-0.0566 *	0.0102
	(0.0325)	(0.0338)
Seminars at Work	0.0486	-0.0094
	(0.0602)	(0.0599)
Seminars Outside of Work	0.1136 *	0.1027
	(0.0688)	(0.0783)
Business School, Vocational Institute, etc.	0.2083 **	0.1145 *
	(0.0637)	(0.0688)
Other	-0.0304	-0.0581
	(0.1133)	(0.1273)
Individual Fixed Effects	No	Yes

See notes to table 3.