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**UNDERINVESTMENT
IN
ON-THE-JOB TRAINING ?**

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UNDERINVESTMENT IN ON-THE JOB TRAINING ?

If the Germans had any secret weapon in the post-1973 economic difficulties, it is the technical competence of their work force, which is in turn **the product of their apprenticeship system.**

--Limprecht and Hayes, 1982, p.139.

I think that the Japanese education system is not very good....**employer training is much more effective.**

--Yutaka Kosai, President, Japan Center for Economic Research, 1989

The heart of this new [flexible] manufacturing landscape is the management of manufacturing projects: selecting them, creating teams to work on them, and managing workers' intellectual development.

--Ramchandran Jaikumar, 1986, p. 75.

A growing number of commentators are pointing to employer sponsored training (OJT) as a critical ingredient in a nation's competitiveness. American employers appear to devote less time and resources to the training of entry level blue collar, clerical and service employees than employers in Germany and Japan (Limprecht and Hayes 1982, Mincer and Higuchi 1988, Koike 1984, Noll et al 1984, Wiederhold-Fritz 1985). In the United States, only 33 percent of workers with 1 to 5 years of tenure report having received skill improvement training from their current employer (Hollenbeck and Wilkie 1985). Analyzing 1982 NLS-Youth data, Parsons (1985) reports that only 34 to 40 percent of the young workers in clerical, operative, service and laborer jobs reported that it was "very true" that "the skills [I am] learning would be valuable in getting a better job." The payoffs to getting jobs which offer training appear to be very high, however. In Parson's study, having a high learning job rather than a no learning job in 1979 increased a male youth's 1982 wage rate by 13.7 percent. While the 1980 job had no such effect, the 1981 job raised wages by 7.2 percent when it was a high learning job rather than a no learning job.

If the payoffs to such jobs are so substantial, why aren't such jobs more common? If one were to put this question to an employer, he would point to the high turnover rates of youth as the primary reason why he cannot afford to train new employees more intensely. For American workers with less than one year of tenure, the probability of a separation in the next 12 months is 59 percent. Since comparably defined turnover is only 20 percent in the United Kingdom and 24 percent in Japan, national differences in turnover could be a major reason for the low levels of training investment in the US, if the employer's explanation is right (OECD, 1984, Table 33 and 34).

The theory of on-the-job training says, however, that if training is general, turnover propensities should not matter. The worker pays the full costs of the training and reaps the full benefits whether or not there is subsequent turnover, so the decision to undertake training should be independent of prospective turnover. The problem with this prediction is that analyses of large representative data sets generally fail to confirm it. In Parson's (1985, table 7.6) study, when a youth reported that it was "very true" that "the skills [I am] learning would be valuable in getting a better job", his job paid on average 2.4 to 14 percent more than when the above statement was "not at all true" even with an extensive set of controls for schooling and academic achievement included in the model. Bishop and Kang (1988) have conducted another test of this hypothesis in the 1984 follow up of the High School and Beyond seniors by regressing the log of the deflated starting wage of the current or most recent job on indicators of the receipt of employer sponsored training. Here again, the jobs offering some training rather than none or which offer greater amounts of training paid higher starting wage rates even when a whole array of human capital characteristics were controlled. For females the positive effect of receiving training on the starting wage was statistically significant. Adding dummies for occupation and industry did not change the results appreciably.

It could be argued, however, that these findings do not constitute a decisive refutation of the proposition that workers pay all of the costs of general training. Hiring decision makers are probably better at assessing the ability of job candidates than econometricians who are limited to the information in the NLS or HSB data file. The positive association between wages and training arises, it could be argued, because workers who are highly able (in ways not observed by the analyst) are both paid more and also recruited for jobs that require large amounts of training.

Unobserved heterogeneity no doubt contributes to the positive association between training and starting wage rates, but to transform a large negative structural relationship into the statistically significant positive relationships just described, sorting of more able job applicants into high training jobs would have to be very powerful indeed. If such a selection process were operating, access to training should depend on ability factors that are visible to the analyst as well as on factors that are not visible to the analyst. Yet models estimated by Parsons (1985) and by Bishop and Kang (1988) failed to find large effects of ability proxies such as test scores, grades, and being a disciplined student on the probability of receiving training.

One possible explanation of these anomalous findings is that the training is specific and the employer is financing all of its costs. But standard models of the sharing of the costs of specific training do not predict that employers pay all of its costs and some of the new revisionist theories--Salop and Salop's (1976) adverse selection theory--predict that employers pay none of the costs of specific training. A specific training explanation of these findings is particularly perplexing when to all outward appearances the training is largely general.

Empirical tests of the theory of on-the-job training have been severely hampered by the absence of data on the key theoretical constructs of the theory--general training, specific training and productivity growth. Data on wage growth and turnover have been used to test various propositions of the theory, but definitive results have been elusive because the large number of unobservables result in there being at least two explanations for any given set of phenomena (Garen, 1987). This paper strives to overcome some of the limitations of previous research by analyzing the first large-scale data set to contain measures of the time devoted to training activities during the first three months on the job, who does the training, the generality of training and the productivity and wage rates of the employees both during and after the receipt of training.

Part I of the paper is an analysis of American data on on-the-job training (OJT) of new hires. Tabulations of OJT costs and outcomes by occupation and establishment size are presented in section 1.1. Training's impact on productivity growth is analyzed in section 1.2 and its impact on wage growth is analyzed in section 1.3. The discussion centers on how the productivity effects of training compare with its wage rate effects and how these comparisons depend on who provides the training and its generality. Section 1.4 summarizes the findings for the United States. The analysis clearly implies that employers are contributing to the costs of training that develops skills which are useful at many firms. Studies of apprenticeship programs in Germany and Great Britain confirm this finding.

Part II of the paper begins by offering an explanation of why American employers invest less in the training of their employees than Japanese and German employers. It concludes with a discussion of the reasons why, from society's point of view, employers and employees underinvest in on-the-job training.

Part III of the paper discusses how the government might encourage workers and employers to increase their investments in on-the-job training.

PART I--ANALYSIS OF AMERICAN DATA ON TRAINING

1.1 Estimates of the Magnitude of On-the-Job Training of New Hires

Let us begin by examining the magnitude of training investments in newly hired workers. The data which form the basis of discussion come from a survey of 3,412 employers sponsored by the National Institute on Education (NIE) and the National Center for Research in Vocational Education (NCRVE) conducted between February and June 1982. Most of the respondents were the owner/manager of small firms who were quite familiar with the performance of each of the firm's employees. Seventy percent of the establishments had fewer than 50 employees, and only 12 percent had more than 200 employees.

How Training Varies with Occupation

The impact of occupation on the amount of on-the-job training typically received by a new employee is examined in table 1. The first four rows of the table describe the average number of hours devoted to four distinct training activities during the first 3 months after being hired. Even jobs that are thought to require little skill--service jobs--seem to involve a considerable amount of training during the first 3 months: an average of 33 hours of watching others, 5.7 hours of formal training, 35 hours of informal training by management and 17 hours of training by coworkers. Other occupations devote considerably more time to training. The distribution of training activities is similar across occupations, however. The typical trainee spends most of his training time watching others do the job or being shown the job by a supervisor. Roughly equal amounts of time are spent in each. Informal training by coworkers is next most important and formal training provided by specialized training personnel accounts for an average of only 5 to 10 percent of the time new hires are engaged in a training activities.

These estimates of the incidence and extent of skill upgrading training are much higher than those generated by surveys of corporate training directors and workers. Training directors are able to describe the formal training programs offered by their company but are typically not aware of the full extent of the informal training that occurs on the shop floor. Surveys of workers about their training experiences have been handicapped by the way questions were posed. The January 1983 CPS, for example, asked "Since you obtained your present job, did you take training to improve your skills." The problem with this question is that one does not take informal training. Most informal training occurs in the context of normal supervision

or in response to a worker's request for an explanation or assistance from coworkers or supervisor. As one might anticipate, this question results in a significant under estimate of the extent of informal training; only a third of the respondents reported they had received any skill upgrading training and only about 40 percent of the skill training taken was reported to be informal. This suggests that the CPS survey fails to pick up much of the informal OJT that workers receive.

The fifth row of the table merges the information on time devoted to particular types of training into a single overall estimate of investment in training during the first 3 months on the job. The index values the time that managers, coworkers and the trainee devote to training and express it in terms of hours of trainee time. Training investment for service jobs is estimated to be 130 hours implying that the time invested in training a typical newly hired service worker in the first 3 months is equal in value to about 25 percent ($130/520$) of that worker's potential productivity during that period. Investments in training are considerably greater in other occupations. Retail (and service sector) sales and blue collar jobs have a mean index of 185 to 200 hours respectively or 35 to 38 percent of the new employee's potential productivity. Clerical jobs typically required the equivalent of about 235 hours of training or about 45 percent of the new worker's potential output. Professional, managerial and sales representatives outside the retail and service sectors required the equivalent of about 300 hours of on-the-job training or nearly 60 percent of the new worker's potential output.

The sixth row of the table reports the geometric mean of the answers to the question "How many weeks does it take for a new employee hired for this position to become fully trained and qualified if he or she has no previous experience in this job, but has the necessary school-provided training." Service jobs are reported to require an average of only 3 to 4 weeks of training, retail sales and clerical jobs slightly under 7 weeks, and professional and managerial over 10 weeks.¹

The reported productivity of new employees increases quite rapidly (by roughly a third) during the first month or so at the firm (see row 7). Despite the much greater time interval, the percentage increases between the first quarter and the end of the second year (see row 8) are smaller than those during the earlier period for blue collar, service, clerical and sales jobs. For these occupations training investments and learning by doing seem to be large in the first few months on the job but to diminish rapidly thereafter. In the higher level, managerial and professional jobs, reported increases in productivity are larger between the third and 24th month than in the first few months. This reflects the more prolonged

training period for these occupations. The occupations which devote the least time to training--the service occupations--are the occupations with the smallest increase in productivity with tenure. The reported productivity of service workers improves an average of 28 percent in the first month or so and a further 17 percent in the next 21 months. Occupations for which a lot of time is devoted to training in the first 3 months--professionals, clerical workers, managers and sales representatives outside of retail and service industries--also seem to have larger than average increases in reported productivity as the worker gains in tenure. Clerical workers, for instance, are reported to be improving their productivity by 40 percent in the first month or so and by a further 32 percent by the end of the second year on the job.

These very rapid rates of productivity growth suggest that the total rates of return (combining both worker and employer benefits and costs) may be extremely high during the first months of employment. For clerical workers the total costs of training during the first 3 months are 235 hours or .113 of a year's output by a worker whose skill level is equal to that of a new employee. Since this figure is an upper bound on the investment that contributed to the 40 percent gain during the first months on the job, the average rate of return must be above 354% per year ($.40/.113$). Since the intensity of training investment falls with tenure at the firm, the cost of training investment during the next 21 months cannot have exceeded .7875 ($1.75*235/520$) of a year's productivity by a newly hired worker. This implies that the average rate of return to training investments during this 21 month period exceeds 40% per year ($.32/.7875$). However, marginal rates of return to training investment are lower and some of the gain in productivity results from learning by doing and not from training. Multivariate cross section models of productivity growth which yield evidence on the marginal productivity of training are presented in section 2 of the paper.

How Training Varies with Establishment Size

The relationship between establishment size and the time devoted to training typical new employees is curvilinear (see table 2). The very largest and very smallest (10 or fewer employees) establishments invest the greatest amount of time in training. Managers average 59 hours training a new employee at the smallest establishments and only 44 hours at establishments with 11 to 50 employees. The very smallest establishments invest 43 percent of a new hire's potential productivity (224 hours) during the first 3 months in training while the next largest size category (11-50 employees) invests only 35 percent of the new hire's time. Those with more than 200 employees invest 48 percent of the new hires time in

training. The curvilinearity remains when other determinants of training are controlled. Reflecting the pattern of investment in training, wage increases also exhibit a curvilinear pattern being bigger in the very smallest and very largest establishments.

Reported increases in productivity do not, however, have a curvilinear pattern. Rather there is a consistent tendency for the reported increases in productivity to be larger at the larger establishments. The very smallest establishments report a 29 percent productivity increase in the first few months and a further 26 percent increase by the end of the second year. The largest establishments report a 49 percent increase in the first few months and a 34 percent increase during the next 21 months. Such a dramatic contrast between the pattern of training investments (input) and training outcomes is unusual. The relationship between training investment measured in time units (line 5 of tables 1 and 2) and returns to that investment, the increase in productivity (line 7 or line 8) is described by:

$$(1) \quad \frac{P_{2YR} - P_{1Q}}{P_{1Q}} = \% P = AR_j \Theta_j (\text{Total Training Investment})$$

where

AR_j is the average rate of return on dollars of investment in the training of stayers in the j^{th} job/establishment and

Θ_j is the opportunity cost of training time in the j^{th} job/establishment.

The lower percentage productivity growth to investment ratio of tiny establishments implies that either they have a lower AR_j or a lower Θ_j . It is unlikely that tiny establishments have lower AR_j for they have higher turnover and poorer access to capital markets. The probable explanation of their small $\% P$ is a lower opportunity cost of time devoted to training (Θ_j). Opportunity costs are likely to be lower because small establishments are unable to spread the risk of stochastic demand as well as larger establishments and so must typically operate with a higher ratio of capacity (staff on hand) to demand (staff interacting with a customer or engaged in production). Scheduling of training is also probably more flexible so training can be done during periods of slack work when opportunity costs are low.

1.2 Impact of Training on Worker Productivity

New employees experience dramatic increases in productivity in the first 2 years of employment at a firm. A part of this productivity increase is due to learning by doing and would occur even if no training is provided. Formal and informal training is responsible for a major portion of the productivity growth, however. In this section, an effort will be made to determine which training methods are most effective and to measure the marginal impact of an increase in training investment.

The 1982 Employer Survey distinguished four different types of employer-provided training: (1) formal training (provided by a training professional), (2) time spent watching others do the job, (3) informal on-the-job training by supervisors, and (4) informal on-the-job training by co-workers. The impact of training on productivity growth of typical new employees was estimated by regressing productivity growth during the first 2 years on the hours spent in each training activity. Since diminishing returns are to be expected, the square of the total cost of training was included in the model. Productivity growth during the first 2 years was defined in 2 different ways: the log of the productivity growth ratio and the change in productivity ratings on a 0-100 scale.²

The measures of time spent in specific training activities in the first 3 months on the job are measures of training intensity rather than of aggregate training investment during the first 2 years on the job. Consequently, the reported required length of training--the log of the number of weeks it takes for a new employee to become fully trained and qualified--was also included in the model. A large set of controls for job, occupation, and firm characteristics was included in each model: dummies for occupation, the specific vocational preparation (SVP), and the general educational development (GED) that the Dictionary of Occupational Titles (DOT) specified is necessary for the job, percent of work force skilled, percent of work force who are crafts workers, the importance of vocational education in selection, cost of machinery, unionization, hours worked per week, and characteristics of the hires (i.e., percent under age 25), and an employer response that it is hard to find reliable unskilled workers. When outcomes for particular individuals were being modeled, the new hires' education, sex, and work experience were included in the structural model.

The specification used was the following:

$$(2) \quad P_{2YR} - P_{2WK} = \underline{AX} + a_1 \ln L + a_2 T_F + a_3 T_S + a_4 T_C + a_5 T_W + a_6 T^2 + u$$

where \underline{X} = a vector of control variables (\underline{A} is a vector of coefficients on these control variables)

$\ln L$ = logarithm of the required length of training

T_F = Hours devoted to formal training during the first 3 months ('00s).

T_S = Hours spent in informal training by supervisors during the first 3 months ('00s).

T_C = Hours spent in informal training by coworkers during the first 3 months ('00s).

T_W = Hours spent in training by watching others do the work during the first 3 months ('00s).

T = Training Intensity is a weighted sum of the four different types of training where the weight reflect the assumed costliness of this form of training.

$$T = 1.8 * T_F + 1.5 * T_S + T_C + .8 * T_W.$$

P_{2YR} = Productivity of the typical worker at the end of 2 years. In the linear models P_{2YR} is the productivity rating on the 0 to 100 scale divided by 80, the mean productivity rating for workers with two years of tenure. In the logarithmic models, P_{2YR} is the logarithm of the productivity rating plus 5.

P_{2WK} = Productivity of the typical worker during the first 2 weeks. In the linear models P_{2WK} is the productivity rating on the 0 to 100 scale divided by 80, the mean productivity rating for workers with two years of tenure. In the logarithmic models, P_{2WK} is the logarithm of the productivity rating plus 5.

The results of estimating various versions of equation 2 are reported in table 3. The regression with the logged productivity growth as dependent variable is in column 1. Regressions predicting the linear measure of productivity growth are in columns 2 and 3. In both models, the coefficient on the square term is negative and statistically significant indicating that there are diminishing returns to training intensity. When the square of total training intensity is included in the model, all four of the linear terms for a particular form of training have positive and statistically significant effects on productivity growth. The effect of training intensity on productivity is quite large. An increase in any of the training activities from 0 to 100 hours raises the worker's productivity by 13 to 15 percent in the logarithmic models and by 4.6 to 7.7 percent (calculated at the mean level of productivity at the end of two years) in the linear models. Clearly when training intensity is low, increases in its intensity will produce large increases in worker productivity.³

An alternative approach to estimating the impacts of training is to examine the productivity growth of particular new hires. Column 3 of Table 3 presents results using productivity data on a particular new hire rather than a typical new hire. Missing data

reduces sample sizes by about 100. The variance of productivity growth across firms is larger when actual individuals are the data rather than typical individuals. R squares of the models are slightly higher, however, because characteristics of the worker (age, schooling, gender, previous relevant work experience and relevant vocational training) and the worker's tenure at the time of the interview are included in the structural model of productivity growth. The training variables used in these models were for a typical new hire rather than for that particular new hire. Comparisons of the coefficients in column 3 and 2 reveal that substituting data on productivity growth outcomes of particular individuals for data on typical hires and controlling for personal characteristics does not change the estimated effects of training.

The impacts of each type of training are remarkably similar. This was not anticipated because some forms of training (e.g., formal training) have higher hourly costs than others (e.g., watching others do the work), and this was expected to result in the more expensive forms of training having larger impacts on productivity than the cheaper forms. Measured in the units of productivity of a worker with 2 years of tenure on the job, the hourly cost of learning by watching others is .8. Formal training with a cost factor of 1.8 is the most expensive because it requires the time of both the trainee and the trainer. The cost of informal training by supervisors (a cost factor of 1.5) and by co-workers (cost factor of 1.0) lies between these two extremes because the trainee is engaged in production, and only the time of the supervisor and co-worker must be charged off as a cost of training. Given these estimates of the relative costs of different forms of training, the results presented in column one imply that informal training has higher rates of return than formal training. A further implication is that within the informal training category, co-worker training and training yourself by watching others have the highest rate of return.⁴

Factors Influencing the Marginal Payoff to Training

Theory suggests that the impact of an additional hour of training on productivity growth, $P'(I_j)$, will be higher at companies with high required rates of return (r_j), high separation rates (s_j), high skill obsolescence rates (δ_j) and high opportunity costs of training time (Θ_j). Since workers reap benefits from training even when there is a separation, training investments should, in theory, be carried further (ie. to a point where marginal benefits are lower) when a job requires general skills rather than specific skills (ie. as $g \rightarrow 1$). This suggests that an hour of general training will typically have a smaller effect on productivity

growth than an hour of specific training. On the other hand, training that is general must, in theory, be financed by the worker not the firm. Since young entry level workers are generally liquidity constrained, the rates of return required by workers are likely to be considerably higher than the rates of return required by employers. This has the opposite implication. The inability of workers to finance general training may substantially depress such investment and marginal payoffs to such investment may be very high as a result. The relative importance of these two effects can be tested by interacting training intensity with a measure of the proportion of skills that are general (g).

Another job characteristic that is likely to influence the marginal product of an hour of training is the size of the establishment. Large establishments are likely to have higher opportunity costs of training time (Θ) and to be more efficient trainers (because of economies of scale).

This suggests that marginal impacts of training may be higher at large establishments than small establishments. Formal training is considerably more common at large establishments and this suggests that the marginal impact of formal training may be particularly high at these establishments. To examine these issues, the models were respecified so as to allow for interactions between training intensity and the generality of training, the size of the establishment, and the share of training that was formal, watching others, and informal OJT by a co-worker. The specification used was the following:

$$(3) \quad P_{2YR} - P_{2WK} = \underline{BX} + b_1 \ln L + b_2 \ln T + b_3 \ln T * E + \underline{b_4 \ln T * S} + b_5 \ln T * g + v$$

where \underline{X} = a vector of control variables

$\ln L$ = logarithm of the required length of training

$\ln T$ = logarithm of training intensity during the first 3 months

E = logarithm of (Employment/18.5)

\underline{S} = a vector of shares of training that are formal, watching others, and informal OJT by co-workers. The excluded category is informal OJT by managers and supervisors.

g = the proportion of the skills learned useful at other firms.

The results of estimating various versions of equation 3 are reported in tables 4. These models provide evidence on the effect of the generality of training and establishment size on the marginal product of training. The coefficient on the interaction between the

generality of training and training intensity is positive but very close to zero. The two effects discussed above appear to have canceled each other out. It appears that the difficulties that workers face in financing general training are as severe a barrier to investment in general training as high separation rates are to investments in specific training.

The coefficient on size interacted with training is positive and highly significant in both the logarithmic (column 2) and linear (column 5) model of productivity growth. The logarithmic results imply that the elasticity of productivity with respect to training is 0.092 at establishments with 19 employees and about 0.115 for companies with 200 employees. The positive and significant coefficient on interactions between intensity of training and the share that is part of a formal training program or that is watching others do the work implies that these forms of training have significantly larger effects on productivity growth than OJT by supervisors, the excluded training category. Clearly, the earlier conclusion that marginal rates of return to watching others and to co-worker OJT are higher than marginal rates of return to supervisor OJT is pretty robust with respect to substantial changes in specification (alternative ways of defining the independent variable, alternative ways of specifying the training variables and the use of productivity growth of particular new hires rather than a typical new hire as the dependent variable). Findings regarding the payoff to formal training, on the other hand, appear to depend upon specification.

Table 4 also presents tests of the hypothesis that the size of the establishment differentially affects the rate of return to training. While coefficients on interactions between training and size are not significant in the particular worker models, interactions between formal training and size are significant in the typical worker specifications. As hypothesized, the payoff to formal training increases more rapidly with establishment size than the payoffs to other forms of training. These results help explain why formal training programs are more common at large companies than at small companies. In the linear typical worker specification, watching others do the work seems to be a less effective learning technique at large companies than at smaller companies. The coefficients on this variable in other specifications are negative but not significantly different from zero.

Illustrative estimates of marginal rates of return for each form of training are reported in table 5. Because the period for which training intensity is measured is much shorter than the period over which productivity growth is measured, these estimates must be based on a maintained assumption about how changes in our measure of training intensity during the first 3 months relate to changes in total hours in that training activity over the course of the rest

of the 2-year period. When the two year productivity gain of the typical new hire is being analyzed, a unit increase in a training activity during the first 3 months was assumed to be associated with a further 2-unit increase in that training activity during the rest of the 2-year period.⁵ When the productivity gain during the first fourteen months for a particular new hire is being analyzed, a unit increase in a training activity during the first 3 months was assumed to be associated with a 1.2 unit increase in that training activity during the remainder of the first year on the job.

The RORs are the ratio of the yearly increase in productivity divided by an estimate of the cost of the training investments that produced the productivity increase. Turnover and skill obsolescence are not incorporated into the estimate. As an example of the calculation, the formula for formal OJT using the coefficients from the linear model in table 3 for training intensity equal to 300 hours was as follows:

$$[(.046 - .0049*3*2)*2000] / [3*100*1.8] = .0615$$

where 3 is the change in training over the 2-year period that is associated with a 1-unit change in training intensity during the first 3 months and 1.8 is the assumed cost factor for formal training.

The estimated marginal rates of return diminish as the intensity of training increases. The mean training intensity for the first 3 months expressed in units of the time of trained workers is 148 hours. As intensity during the first 3 months rises from 100 hours to 300 hours (double the mean), the marginal rate of return (ROR) for informal OJT by co-workers drops from 43-45 percent to 16-32 percent in the two linear models for new hires presented in table 3 and 4. The linear model's ROR drops from 36-59 percent to 18-20 percent for watching others and from 26-28 percent to 9-17 percent for training by supervisors. The ROR of formal OJT is estimated to drop from 13-27 percent at 100 hours to 6-9 percent at 300 hours. Estimated rates of return for particular workers are generally slightly higher than those calculated for the typical worker. Estimated rates of return calculated from models based on logarithmic specifications are considerably higher than those based on linear specifications of productivity growth. At the training intensities that typically prevail during the first quarter, marginal rates of return seem to be very high. These marginal RORs are not adjusted for turnover or obsolescence and are, therefore, not directly comparable to the real rates of return to schooling and financial assets that typically lie in the range from 5 to 10 percent. If all training investments are specific to the firm and must, therefore, be written off

if there is turnover, RORs of 30 percent or more may be required to induce the firm to invest in specific training.

1.3 Impact of Training on Wage Growth

The costs and benefits of investments in on-the-job training are shared by employer and employee. This implies that jobs with a great deal of training will tend to have lower starting wage rates than would otherwise be predicted and higher wage rates once the training is completed. In other words, jobs with a heavy training component--either because it requires great skill or because the people being hired for it are completely inexperienced--will have higher rates of wage growth than other jobs. The more general the training the greater will be the share of training costs that is paid by the new employee and the greater will be the resulting rate of wage growth. Since some types of training are more effective than others, some are more general than others and some are more visible to other employers than others, one would expect different types of training to have different effects on wage growth. Are the impacts of different types of training on wage growth similar in pattern to their impacts on productivity growth? Or, is the pattern of wage growth responses to different types of training more influenced by the generality and visibility of the specific type of training?

These issues were addressed by estimating wage growth counterparts to the productivity growth models presented in tables 3 and 4. The first dependent variable studied was the log of the ratio of the firm's current wage for a worker with 2 years of tenure to the actual starting wage of a person who had recently been hired for the position. Models predicting this variable control for the effects of wage inflation by including the date of hire and its square in the specification. The results are presented in column 4 of table 3.

The second dependent variable is the log of the ratio of the current wage rate (or most recent wage if there has been a separation) and the starting wage rate for a particular new employee who was hired on average 14 months earlier. The models predicting this variable are presented in column 5 of table 3, column 3 and 4 of table 4. The third dependent variable is the difference in dollars and cents between the current (or most recent) wage rate and the starting wage rate of a particular new hire. These models control tenure of the worker on the date for which wages are reported. The results of predicting this measure of wage growth are reported in column 6 of table 4. All three models contain controls for the characteristics of the new hire, the occupation, SVP, and GED of the job, percent of craft workers and percent of skilled workers at the firm, the cost of machinery used

in the job, unionization, importance of vocational training in selection, percentage of the firm's work force under age 25, and reported difficulty in finding reliable unskilled workers.

The first conclusion that can be drawn from an examination of the wage growth results is that training does have the hypothesized positive effect on wage growth. The effect is statistically significant in almost all of the models. Comparisons of these coefficients with the estimates of the impact of training on productivity growth, however, reveal that training has a much smaller impact on wage growth than it has on productivity growth. In table 3, an increase in informal training from 0 to 100 hours raises productivity of typical employees by 13 to 15 percent in the logarithmic model and 5.3 to 7.7 percent in the linear model, but raises wage rates by only 0.1 to 2.0 percent. A doubling of the length of training raises productivity by 2.2 to 4.8 percent, but wage rates rise only 0.7 percent.

In Table 4's logarithmic models for a particular individual, doubling the length of training increases productivity growth by 3.6 percent and increases wage growth by only 0.5 percent. Doubling the intensity of training, increases productivity growth by 8 percent but raises wage growth by only 1.1 percent. Productivity growth effects of training are also considerably greater than the wage growth effects in the linear models reported in column 5 and 6.

For findings such as these, the first explanation that comes to mind is that the training is specific and the firm is paying most of its costs and reaping most of its benefits. Since skills are thought to be more specific at large companies, the fact that the gap between the productivity and wage effects of training was largest at big establishments provides further support for the skill specificity explanation. Furthermore, table 4 indicates that wage effects of training were indeed smaller when the skills being taught were reported to be specific to the firm as Becker's theory predicts. The problem with this explanation, however, is that most employers reported that most of the skills developed were useful at other firms. When training was done by managers and the skills were reported to be entirely general, doubling training intensity raised productivity by 6.7 percent but wages by only 0.8 percent in the logarithmic model reported in columns 2 and 4 of table 4. In the linear model in column 5 and 6 of table 4, doubling training intensity raised productivity by 3 percent while increasing wage growth by only 0.96 percent. Analysis of data on the typical new hire produces very similar findings. These results appear to contradict an important prediction of Becker's theory-
-when training is general, its impact on wage growth should equal or exceed its impact on productivity growth. Even though employers claim the skills they are teaching are

general, the labor market is not treating these skills as if they were general. How can these puzzling results be explained?

One explanation of the phenomenon is that different firms require different mixes of general skills. The firm that does the training concentrates on those skills it needs the most, some of which may not be as highly valued by alternative employers. Skills that would be highly valued by an alternative employer may not be taught because others on the staff already fulfill that function. As a result, the package of general skills that workers develop are always more valuable at the training firm than at other firms even when each individual skill is correctly perceived to be useful elsewhere.

A second reason why the market behaves as if general skills are effectively specific to the firm is that other employers will generally be ignorant of the exact character of a new hire's general skills and, consequently, will often not assign the worker to a job that puts the skills to work. Even when a worker's next job makes use of the general skills learned, there is no guarantee that new hires with better than average skills will be offered comparably higher entry wages. These phenomena have the effect of transforming some skills which are technically general into skills which are effectively specific to the firm. To the extent training is effectively specific, wages will rise more slowly than productivity net of training cost (Bishop and Kang 1984, 1988).

Support for this signaling/visibility explanation of the gap between productivity and wage rate effects of training comes from comparing the gaps for specific types of training. In table 3, all forms of training had roughly equal effects on productivity growth. For wage growth, however, formal training has much larger effects than other forms of training and OJT by co-workers has no effect. Apparently, formal training is either less specific to the job or more visible to the employee and other employers, and thus workers are more willing to contribute to its costs. The importance of OJT provided by co-workers is apparently underestimated by all concerned, the employee, the supervisor, and other employers.

The third reason why general training masquerades as specific training is the inability/unwillingness of most young workers (the ones who have the greatest need for general training) to finance large amounts of general on-the-job training. Most of these workers are liquidity constrained--that is they are unable to shift as much consumption from the future into the present as they would like because they have neither assets which can be depleted nor access to credit at reasonable terms.⁶ Half of households headed by someone under the age of 25 have less than \$746 in financial assets and 19 percent have no financial assets at all.

Half of households headed by someone between 25 and 34 have less than \$1514 in financial assets and 13 percent have none (Survey of Consumer Finances 1984). Subsidized or guaranteed student loans are not available to finance on-the-job training and banks will not lend money for this purpose without collateral. Borrowing against the equity in one's home is a possibility for some but only 34 percent of households with heads under the age of 35 own a home and many of the houses have been owned for only a short while, so the equity that can be borrowed against is small. Even with collateral, the loans available to individuals usually carry higher interest rates than those charged businesses. Studies of the willingness of consumers to substitute consumption over time have all concluded that the intertemporal elasticity of substitution is no higher than one and most studies conclude it is .5 or below (Friend and Blume 1975; Hall 1988; Hubbard and Judd 1986). A substitution elasticity of .5 implies that reducing a liquidity constrained worker's wage by one half (in order to pay for general training) roughly quadruples the worker's marginal utility of consumption. Such a worker would be willing to give up four dollars of future income in return for one dollar of current income. The liquidity constraint phenomenon has little effect on the wage profile of jobs requiring no general training and which, therefore, have a flat productivity profile. Where significant general training is occurring, however, it comes into play and may result in an employment contract in which the employer shares the costs of general training (Glick and Feuer 1984; Feuer, Glick and Desai 1987).

1.4 Summary of Empirical Findings

The major findings derived from the analysis of the data on new hire training presented in the first part of the paper may be summarized as follows:

- * Training investments in new hires are substantial even for jobs that are generally considered unskilled.
- * Formal training provided by specialized training personnel accounts for only a small portion of the training received by new hires.
- * Productivity rises substantially during the first year on the job.
- * Large establishments invest more in the training of their new hires than small and medium sized establishments because (1) they have lower turnover, (2) they have better access to capital markets, (3) the marginal product of an hour of training time is higher at large establishments and (4) training lowers turnover more substantially at large establishments.
- * Informal training by coworkers and training by watching others do the job appear to have a higher benefit cost ratio than informal training by management.
- * Estimates of rates of return to training derived from this data should be treated with a great deal of caution. Nevertheless, **marginal rates of return to training appear to be quite high.**
- * The estimated benefit cost ratio for formal training depends on how the model is specified. The productivity growth effects of formal training are bigger at large establishments. Formal training has significantly larger effects on wage growth than informal training. **Formal training's tendency to have larger effects on wage growth and quit rates than informal training probably results from the fact that formal training is better signaled to the labor market.**
- * The reported generality of training has no significant effects on its marginal productivity.
- * When training is reported to be highly general, training has a larger effect on wage growth than when training is reported to be specific. Nevertheless, **training that is reported to be entirely general has much larger effects on productivity growth than wage growth implying that the labor market treats this training as if it were at least partly specific to the firm.**

These results provide support for the view that workers do not pay the full costs of general training and do not receive wage increases equal to the full productivity effects of general training. This conclusion is also supported by three different studies of who pays

the costs of apprenticeship training in Germany, Great Britain, and the United States (Noll et al 1984; Ryan 1980; Jones 1985; Weiderhold-Fritz 1985). Despite the transferable character of the training and high turnover rates, these studies concluded that employers made large investments in general training that were not recovered during the apprenticeship. A welding apprenticeship program at a major U.S. shipyard was the subject of the first of these studies (Ryan 1980). The wage profile was quite flat--starting at \$3.99 and topping out at \$5.26 after about two years on the job--even though the investments in general training were very considerable. Inexperienced new hires spent 36 days in vestibule training before beginning work. During the first week following vestibule training, the trainee's output net of repair requirements was less than 10 percent of an experienced worker's output. Thirty-seven weeks after being hired it reached a level of 55 percent and at 60 weeks a level of 80 percent of an experienced worker's output. Despite the fact that the local economy was in deep recession, separation rates were extremely high: 10.8 percent per month for beginners and 6.3 percent per month for those with 12 to 24 months of tenure. The shipyard accounted for about one-fifth of the welding jobs in the area. When trained welders left the shipyard, they typically found better paying welding jobs at other local employers. This evidence clearly establishes that the shipbuilding company was contributing to the costs of general training.

The study of German apprenticeship training by the Bundersinstitut fur Berufsforschung found that in 1980 training costs ranged from a high of 25,200 DM per year for telecommunications technician apprentices to 2400 DM for apprentice gardeners and averaged 10,300 DM or \$5668 per year at 1980 exchange rates. The apprentice's contribution to output, which was netted out to arrive at the above figure, averaged 6700 DM per year (Weiderhold-Fritz 1985). Jones's (1985) study of apprentice training in the engineering industry in Great Britain found that the employer's training costs were 1.31 times the annual payroll costs of a skilled worker and the apprentice's contribution to output (which was netted out in calculating the estimate of employer costs) was 1.26 times the payroll costs of a skilled worker. Thus even major upward revisions of these estimates of the apprentice's contribution to output would not change the basic conclusion that employers appear to be sharing the costs of general training.

The empirical results also lend support to our hypothesis that the outcomes of training, particularly informal training, are poorly signaled to the labor market. Because other employers are unaware of its exact character and unable to assess its quality prior to making hiring decisions, training that is technically general often becomes effectively specific to the

firm and employers choose to share the costs and benefits of investments in general training [see Bishop and Kang (1984, 1988) for a formal proof of this statement]. The second hypothesized reason why shared financing of general training may be in the joint interest of employees and employers is the fact that young workers are typically liquidity constrained while employers are not.

PART II--IS THERE UNDERINVESTMENT IN ON-THE-JOB TRAINING ?

2.1 Why do German and Japanese Workers Receive More Training than American Workers ?

Japanese and German workers receive substantially more training from their employers than American workers. In the automobile industry , for example, newly hired assembly workers receive 310 hours of training in Japan and 280 hours of training in Japanese managed plants located in the US, but only 48 hours of training at US owned plants in the US (Krafcik 1990). Averaged over all auto assembly workers, annual training time is nearly three times greater in plants located in Japan and about 80 percent greater at Japanese plants located in the US. German employers train their youthful apprentices much more thoroughly than American employers train their teenage workers. Why does this occur? This section of the paper addresses this question. It is proposed that this phenomenon is caused by four structural differences between the US labor market and Japanese and German labor markets: high turnover, high costs of capital, lower trainability of American workers, and the absence of government sponsored signals of skills obtained from training on-the-job.

Turnover

If employers are paying part of the costs of general training, turnover becomes a more important determinant of training investments than previously thought. In the standard model, turnover propensities influence the amount of specific training supplied but not the amount of general training undertaken. However, if employers finance some of the costs of general training (or general and specific training are joint products of the same training activity), worker's with high turnover propensities are likely to find it hard to obtain jobs that offer general as well as specific training. For those with less than one year of tenure, the probability of staying at the firm for at least 12 additional months is over 80 percent in the United Kingdom, 76 percent in Japan but only 41 percent in the US (OECD, 1984, Table 33 and 34). The high rates of turnover in America, then, help explain why investments in both specific and general on-the-job training of new hires are lower in this country than in Japan and Germany.

One important reason why turnover is so high in the US youth labor market is job shopping and tryout hiring. When the match is first arranged, both the employer and the job seeker are poorly informed about each other, so they spend the first months learning

about each other and, if they do not like what they discover, they terminate the relationship. If they knew more about each other going into the match, there would be fewer surprises, fewer quits and fewer dismissals. There are good reasons why try out hiring is so prevalent in the US. There are major institutional barriers to the free flow of information about job applicants--such as EEO testing guidelines, the failure of high schools to send out transcripts and the threat of law suits if bad recommendations are given--that do not exist in other countries. German and Japanese employers are much more careful in their selection of blue collar and clerical employees than American employers (Rosenbaum and Kariya 1987; Koenig 1987).

A second reason why turnover is higher in the US is that there are fewer legal and contractual obstacles to layoffs in the US (Sengenberger 1985; Flanagan 1986). Thirdly, turnover appears to be less costly for young American workers than for young German and young Japanese workers. It has already been noted that specific training is more extensive in Japan, and the loss of these investments is a disincentive to turnover. Transition costs also discourage turnover (Bishop and Kang 1988) and there is reason to believe that there may be differences across countries in the magnitude of these transition costs . In some countries, quitting or being laid off does serious damage to the worker's reputation and the likelihood of finding another good job. The best Japanese employers hire straight out of high school and are said to discriminate against those with work experience. The reverse prevails in the US. Quitting appears to be much less stigmatizing in the US than in Japan particularly for young workers.

In Germany, the apprenticeships have a three month probationary period during which either party may opt out of the contract without serious consequences. Nevertheless, only 5 percent of apprentices change employers during this period. An apprentice who quits his apprenticeship after the probationary period will find it very difficult to get another one. As a result, about 95 percent of those who finish the first 3 months of their apprenticeship stick with it for the full three years and pass the performance exam that comes at the end. While, apprentices are not subject to layoff when there is slack work, journeymen are. Who is laid off is often based on job performance not seniority, so being laid off is more stigmatizing than it is in the US. To protect themselves from this stigma, German workers bargain for employment contracts which reduce the probability of layoffs by front loading compensation and mandating severance pay.

The result is lower turnover, a higher payoff to employer investments in specific and general training, greater training investment and, as a result, strong productivity growth. Mincer and Higuchi (1988) correctly point out that causation also runs in the opposite direction--high rates of investment and technological progress increase the returns to training and raise the disincentives for turnover.

Cost of Capital

Turnover is not the only reason for the low levels of training investment in the United States. The benefits of training often take a while to be realized. Companies are less willing to make long term investments of all kinds when the cost of capital is high. Because of the large budget deficit and low savings rate, costs of capital are particularly high in the US, so long term training investments are discouraged. Japanese corporations face much lower costs of capital, and this is one of the reasons why they invest so heavily in training. When they move production abroad they take this practice with them. Japanese corporations operating in the US spend a good deal more on training than American companies in the same industry provides (Mincer and Higuchi 1988).

Trainability of Workers

Young school leavers in Germany and Japan have a considerably better general education than their American counterparts. This means that they do not require remedial instruction in reading and mathematics, learn new skills more rapidly, and require less instruction. They are more likely to be able to learn by doing or by reading. With a very capable work force, employers feel they are able to introduce technologies and methods of operation (eg. small-lot production and flexible manufacturing systems) which require that workers be both highly trained and cross trained in a variety of skills (Prais 1989).

Transmitting Information about a Worker's General Skills

In the U.S. labor market, hiring decision makers have a very difficult time assessing the quality of the general human capital obtained from on-the-job training. This fact increases turnover, lowers wages, and lowers productivity. Since part of the reason for getting general training is to improve the worker's marketability with other employers, not recognizing the benefits of this training reduces the incentive to invest in general on-the-job training.⁷ Doing an especially good job of training employees will benefit the trained workers when they leave

the firm only if the firm develops a reputation for being a good trainer.⁸ Past experience with the former employees of a firm is probably the primary determinant of a firm's reputation as a trainer. As a result, small firms, firms with very low rates of turnover, and firms that are new in the community are likely to be unknown quantities. Large firms that turn over a reasonable share of their trainees are likely to develop a reputation (good or bad) for the training that they provide. It is well known, for instance, that IBM and General Electric provide excellent training to their newly recruited junior executives. This positive reputation helps their separating employees find better jobs, and this in turn helps the firm recruit the best possible candidates when it is hiring. Even though a good reputation as a trainer forces them to pay higher wages in the post-training period, most firms have a strong interest in establishing such a reputation. The armed forces are aware of this, and thus they spend millions of dollars advertising the quality and civilian usefulness of their training.

The lack of full reward for improvements in general skills if one leaves one's current employer affects the incentives for the trainer to devote time and energy to learning general skills. The higher the worker's likelihood of leaving the firm, the lower is that worker's incentive to devote himself or herself to learning general (or specific) skills that are not immediately visible to other employers. This means that the underinvestment in general OJT is greatest for temporary and seasonal employees and for young people as a group.

The poor quality of the information about a job candidate's general skills and the resulting underinvestment in general training (both on the job and in schools) is a major institutional flaw of U.S. labor markets. Formal systems for certifying the competencies gained through on-the-job training exist in the United States, but they have not achieved the widespread usage they deserve. The apprenticeship systems of Switzerland, Austria, and Germany are probably the best examples in the world of a widespread and effective system of on-the-job training and competency certification. One of the most important features of these apprenticeship systems is the requirement that the apprentice pass written and practical examinations in all the skills that are part of the occupation's curriculum. The master/teacher must arrange for the apprentices to receive instruction at another firm or at a special employer-run school if training cannot be provided in all the skills that are included in the curriculum. The examinations are set and scored by a local committee of masters (skilled workers) and employers so the quality of the training provided by the firm and the master is put to a public test. Passing this apprenticeship exam is of benefit not only to the trainee, it is important to the masters as well, for both their reputation amongst their peers and their

ability to recruit high-quality apprentices depends upon it. As a result, 90 percent of German apprentices remain at 1 employer for the full 3-year apprenticeship period, and 90 percent of these pass their test (on the first or second try). The apprenticeship systems of the English-speaking nations are based on time served rather than competencies achieved and are considerably less successful in standardizing and upgrading the training that occurs.

The examination at the end of the training process is the key to maintaining quality control. In the late 19th century, the Swiss educational/training system went through a period of crises and self-examination not unlike what is now happening in the United States and the United Kingdom. The nation had to export to survive but the quality of workmanship was low and deteriorating. The Swiss assigned blame to their apprenticeship system and proceeded to reform it by ending apprenticeship based on time served and instituting written and practical examinations set by local committees of employers and workers. The high standards of workmanship for which Swiss workers are renowned are not an inherent trait of national character but rather are the consequence of the institutions that teach, test, certify, and publicize this workmanship.

The standardized curriculums and the proficiency exam at the end of the apprenticeship mean that the quality and nature of the training is well signaled to employers in Germany, Switzerland and Austria. The result is that the worker can count on benefiting from doing a good job in their apprenticeship even if the training employer does not keep them on. Since the future payoff is certain, German apprentices are willing to start out at a wage that is only about one-quarter of the wage they will be able to command at the end of the apprenticeship. If the apprentices were adults, they could not afford to accept so low a wage. They are, however, teenagers who because they live at home are heavily subsidized by their parents. Consequently, the liquidity constraint that is such a barrier to heavy investments in general training in the US is much less of a problem in Germany.

2.2 From Society's Point of View

"Do Most US Employers and Workers Underinvest in On-the-Job Training?"

Spillovers

The primary justification for public control and subsidy of schooling and public involvement in other forms of education and training is the fact that the individual who gets the education and training receives only part of its benefits. When deciding on the type and amount of education and training to undertake and how hard to study while at school, most individuals are taking only private benefits into account. The private benefits of an educational experience are many: the enjoyment derived from being a student or pleasing mom and dad, the higher after-tax income, the prestige and consumption benefits of having an education (or a job that requires heavy on-the-job training), the private benefits of improved health, and so forth. These private benefits account for only part of the total benefits to society of education and training, however. People who have received more or better education and training or who achieved more during the experience benefit others in society by paying higher taxes, by making discoveries or artistic contributions that benefit others in the society, by being more likely to give time and money to charity, by being less likely to experience long periods of hospitalization that are paid for by insurance or government, and in many other ways (Haveman and Wolfe 1983). Economists call social benefits such as these "spillovers" or "externalities." Private decisions will lead to an insufficient quantity and insufficient quality of education and training and insufficient achievement by students, unless public agencies intervene and partially subsidize the cost or ~~add~~ to the rewards. The appropriate amount of public subsidy is closely related to the size of the spillover or externality benefits of education and training. Two kinds of spillovers can be identified:

Poor Signalling of General Skills to Other Employers--The training provided by one employer benefits other employers and consumers, not just the trainee and his/her employer. The worker is more productive in future jobs, but these employers do not perceive accurately the quality of the general OJT received by the worker and, as a result, do not fully compensate the trained worker for their higher productivity. This reduces the payoff to worker investments in OJT. The ultimate cause of this problem is the lack of effective signals of the quantity and quality of training.

The Progressive Income Tax--Progressive income taxation tends to discourage investment in general on-the-job training. The worker's costs of investing in OJT is the

lower wage he or she must accept during the training period. These costs are expensed in the year they are incurred, so if all individuals paid taxes every year and faced the same marginal tax rate every year, the tax system would have neutral effects on OJT investment. However, investments in OJT are typically made at a time when the individual has no tax liability or a lower-than-normal marginal tax rate and the benefits are received when earnings and marginal tax rates are higher. As a result, the after-tax benefits of an OJT investment are reduced more than the after-tax costs and this discourages such investments. ~~This is particularly true for potential trainees who are disadvantaged and who would otherwise be receiving unemployment insurance or other income transfers.~~

Firms, on the other hand, train continuously, so the marginal tax rates faced when the costs of training are incurred and expensed are no different from those faced during the payoff period.

High Borrowing Costs and Liquidity Constraints

The second reason why society subsidizes schooling is the failure of the free market (in the absence of publicly funded loan guarantee programs) to offer loans to young persons seeking to invest in their education. The government recognized long ago that people going to school needed access to low-interest, government-guaranteed loans. Workers investing in general on-the-job training have a similar need but are not eligible for such loans unless they happen to be part of a training program run by an accredited educational institution. Because of the fear of turnover, employers are reluctant to pay for general training that is visible and useful in other firms. If the employer is not pay for general training, it will be offered only to those workers who pay for it by accepting a lower wage during the training period than could be obtained elsewhere. The more intensive the training, the greater the required reduction in wages will be. Many workers are unwilling to accept a large reduction in their current standard of living, and, since they are unable to borrow at reasonable interest rates, they forego the investments in general on-the-job training. If they do fund such investments, they do so only if extremely high rates of return are obtained.

These two factors result in firms being more willing than workers to trade off future earnings for present earnings. The compensation packages that result from the asymmetric access to capital markets and the progressive tax structure reflect the worker's strong preference for compensation now rather than later. In effect, firms offer new hires a loan that will be canceled if a separation occurs. Firms do not require repayment of the loan

when separations occur for the same reasons that banks do not offer large unsecured loans without a government guarantee of payment. The administrative costs of obtaining repayment are extremely high and bankruptcy is a real option for someone with zero assets. Firms, however, undertake to finance general OJT only when their investment yields a return that is sufficient to pay for both the cost of capital and the risk of turnover. This inevitably reduces employer investments in general on-the-job training.

Repairing Government Created Distortions

A third justification of public efforts to encourage greater on-the-job training is to undo the damage done by other government interventions in the labor market which discourage on-the-job training. With respect to investments in on-the-job training, the two most significant such interventions are the minimum wage and barriers to employer use of basic skills tests and high school grades as devices for selecting new workers.

Minimum Wage--The minimum wage prevents unskilled American workers from offering to pay for general training by accepting a sub-minimum wage during the training period. Providing training to a new employee is costly. The new employee is not very productive at first, and other workers must take time away from their regular activities to give instruction to the new hire. Many of the skills that the new employee learns have application in other firms as well. To avoid losing the worker to another firm, the employer that is providing the training must raise the wage as the trainee's productivity increases. Jobs that offer training and the prospect of future wage increases are more attractive than those that do not. The competition for these jobs will enable employers offering general training to obtain workers at lower wage rates.

Minimum wage legislation, however, prevents wage rates from falling below the legislated monetary figure. Lacking the ability to get new employees to pay a major share of the costs of general training (by accepting a low wage during the training period), employers will adopt production technologies that minimize the skill requirements of the job. The evolution of the diner and the small, family-operated restaurant into franchised fast food operations using specially designed machines and prepackaged food is an example of how this is accomplished. By reducing the skills required to do the job, the employer shortens the time it takes for new employees to reach maximum productivity. The same people may have the job but they are taught less, and what is taught is useful only in that

firm--not elsewhere. Opportunities for promotion are minimal and wage increases are small or nonexistent.

Two studies have found that the minimum wage discourages on-the-job training of inexperienced and unskilled workers (Hashimoto 1982, Leighton and Mincer 1981). A second impact of the minimum wage is that the rise in the starting wage is partially compensated by a fall in the wage rate in the post-training period. This increases the quit rate, which in turn reduces the payoffs that employers receive from training and, therefore, its amount.

Barriers to Careful Selection of Entry Level Workers--Governmental institutions and regulations are an important reason why American employers do a poor job of selecting entry level workers and experience very high rates of turnover. Employers are not able to obtain good information on the skills and competencies of young job applicants. Employers believe that school performance is a good predictor of job performance⁹, but they have great difficulty getting such information. If a student or graduate has given written permission for a transcript to be sent to an employer, the Federal Education Rights and Privacy Act obligates the school to respond. Many high schools are not, however, responding to such requests. In Columbus Ohio, for example, **Nationwide Insurance sent over 1,200 requests for transcripts signed by job applicants to high schools in 1982 and received only 93 responses.**

An additional barrier to the use of high school transcripts in selecting new employees is that when high schools do respond, it takes a great deal of time. In most high schools, the system for responding to transcript requests has been designed to meet the needs of college-bound students rather than the students who seek jobs immediately after graduating. The result is that a 1987 survey of a stratified random sample of small-and medium-sized employers who were members of the National Federation of Independent Business [NFIB] found that transcripts had been obtained prior to the selection decision for only 14.2% of the high school graduates hired.¹⁰ Only 15% had asked high school graduates to report their grade point average. The absence of questions about grades from most job applications reflects the low reliability of self reported data, the difficulties of verifying it, and the fear of EEO challenges to such questions.

Hiring on the basis of recommendations by high school teachers is also uncommon. In the NFIB survey, when a high school graduate was hired, the new hire had been referred or recommended by vocational teachers in only 5.2% of the cases and referred by someone else in the high school in only 2.7%.

Tests are available for measuring competency in reading, writing, mathematics, science, and problem solving, but, after the 1971 Griggs decision, almost all firms were forced to stop employment testing by EEOC guidelines which made it prohibitively costly to demonstrate the validity of tests assessing competence in English and mathematics.¹¹ Before such a test could be used, the firm had to conduct a very expensive validity study of the proposed test and alternative tests at their own work sites. Separate studies had to be done for men and women, blacks, hispanics and whites. Most firms did not have enough workers in each category to do a reliable study (Friedman and Williams 1982). Litigation costs and the potential liability are enormous, so companies became extremely cautious about testing. The result has been to greatly diminish the use of tests for employee selection. The 1987 NFIB survey found that basic skills tests had been given in only 2.9 % of the hiring decisions studied.

Other countries handle the signaling of high school accomplishments to prospective employers much more effectively and have much lower turnover rates as a result.

Evidence of Underinvestment from the High Rates of Return to OJT

If there is underinvestment in general OJT, we would expect to find private rates of return to OJT to be very high. The studies that have estimated the return to OJT investments by workers find that rates of return are very high. For instance, after adjusting for inflation, the real rate of return to OJT investments by the worker was 12.6 percent per year for those who went to college and 19 percent for those who did not attend college (Rosen 1982). These rates of return are considerably higher than the real rates of return of about 4 percent on corporate bonds and of about 5 percent for schooling. Some estimate the rates of return to be even higher (Mincer 1974).

Our data also support a conclusion that total rates of return (combining both worker and employer benefits and costs) to OJT in the first few months of employment are extremely high. The marginal rates of return on the training investments presented in table 5 appear to be significantly higher than the real rates of return to corporate bonds and schooling.

From the point of view of public policy, the most important conclusion from the preceding empirical analysis of on-the-job training is that from society's point of view, employers and employees underinvest in general on-the-job training.¹²

2.3 Can Vocational Training in Schools Substitute for Employer Training ?

Many societies try to deal with the tendency of employers and workers to underinvest in skill training by establishing school based occupational training programs. Table 6 contrasts the advantages of employer provided and school provided occupational skill training. While high quality occupational training offered by schools ameliorates the problem of under provision of skill training, school based training cannot replace some kinds of employer training and is generally less effective than employer provided training in the same skills.

Often, training in a skill can only be organized by the employer. This is obviously the case when skills are specific to the firm or partially specific to the firm, but is also sometimes the case for completely general skills as well. General skills are often easier to learn when they are integrated into a training program that is specific to the context of a particular firm. The need for particular general skills is often generated by the introduction of new technology and new equipment or a reorganization of the business. The firm must select which skill is to be taught and when. Since firms quite reasonably desire to have all employees use the same word processing and financial analysis programs, the selection of such a program must be centralized. IBM first developed the FORTRAN computer language and then taught it to its employees and customers. Colleges and universities eventually offered courses in FORTRAN, but it took many years for schools to take over the bulk of the teaching of this very general skill.

Even when the same skills are to be taught, employer provided training is generally more effective than school based training? Seven reasons appear to account for it. First, most individuals who obtain occupational training from a school do not obtain jobs in the occupation they studied in school, while most of those trained by an employer stay in the occupation. For graduates of vocational training programs in the US, only 43 percent of the employed graduates out of school between one and ten years had a training related job (broadly defined) in the 1985 National Longitudinal Survey of Youth (Campbell et al., 1987). Other studies of high school vocational education using the same methodology obtain similar results. Felstehausen's (1973) study of 1981 vocational graduates in Illinois found training related placement rates of 27 percent in business occupations, 17 percent in trade and industry, 52 percent in health, and 20 percent in agriculture. Conroy and Diamond's study (1976) of Massachusetts graduates obtained a training related placement rate of 29 percent for business and 37 percent for trades and industry. High school vocational education is not the only occupational skills training program with low training related placement rates. The

proportion of CETA participants whose occupational field 12 months after completion of classroom training matched their field of training was only 41 percent for clerical training, 39 percent for training in operative occupations and 29 to 32 percent for professional and craft training (Barnow 1985).

When, on the other hand, employers are heavily involved in providing occupational training, it is much more likely to be used. Mangum and Ball (1986) found in their analyses of NLS data that employer controlled training institutions have much higher training related placement rates. Using a procedure of matching training fields against jobs, they found that the proportion of male graduates who had at least one job in a related field was 85 percent for company training and 71 percent for apprenticeship but only 52 percent for vocational-technical institutes and 22 percent for proprietary business colleges. The rates for females were 82 percent for company training but only 59 percent for nursing schools, 61 percent for vocational-technical institutes and 55 percent for proprietary business colleges. Six months after passing a German apprenticeship examination, 68 percent of those with civilian jobs were employed in the occupation for which they were trained (much more narrowly defined) (Federal Institute for Vocational Training, 1986).¹³

If the skills and knowledge developed in a training program are not used, they will rapidly deteriorate. In one set of studies, students tested 2 years after taking a course had forgotten 1/2 of the college psychology and zoology, 1/3 of the high school chemistry, and 3/4 of the college botany that had been learned (Pressey and Robinson, 1944).

The second reason why learning skills on a job is to be preferred to learning those skills in a classroom is the fact that trainees are well-motivated because skills developed are almost certain to be used, and because promotions and pay increases go to those who do well. Third, the training is generally tutorial in nature and this is known to be an effective teaching method. Fourth, since training is generally done by supervisors and coworkers who are aware of the trainee's progress and can give necessary corrective instruction. Fifth, the equipment and materials necessary to the training are generally readily available at the work site and time on the machine for the trainee can generally be arranged without disrupting production. When schools provide the training, equipment must be specially purchased and keeping the equipment up-to-date is often prohibitively expensive. Sixth, the trainer (not just the trainee) is held accountable for success since the training is designed to increase productivity and supervisor/trainers are held accountable for the productivity of the work group. Finally, when employers provide training the trainees time tends to be used much more efficiently. Because

they are paying for both the trainer and the trainee's time and receive most of the benefits, employers have much stronger incentives to select cost effective training strategies than schools which neither pay the time costs of the trainee nor receive any of the direct benefits of the skills that are developed.

III. POLICIES TO ENCOURAGE ON-THE-JOB TRAINING

Evidence has been presented that on-the-job training produces spillover benefits just as schooling does. When an individual receives extensive, high-quality on-the-job training, they also benefit others in the society by paying higher taxes, by being less likely to require welfare and unemployment insurance, by being more likely to make scientific and technological advances, and by being more productive on their job (and not being compensated for it). In addition, labor market distortions, such as the minimum wage, lack of access to loans, and lack of certification of OJT, cause individuals and firms to choose less OJT and lower quality OJT than is desirable from society's point of view. There would appear to be a need for the government to promote increases in on-the-job training.

How might government induce firms and workers to increase investments in general on-the-job training? Table 7 provides a check list of factors which influence employer and employee decisions regarding the type and extent of on-the-job training. Many of the factors which influence the profitability of training investments are not under the control of government. Others are. Since the returns to training cannot be distinguished administratively from other labor earnings and profits, lowering the rates of taxation on these returns is not a feasible policy option. Policies that promote general on-the-job training either remove artificial barriers or subsidize the costs of the investment. Seven policy options are reviewed in this section.

- . Lower turnover.
- . Improve systems of certifying the quality of on-the-job training.
- . Allow jobs that offer considerable general training to pay wage rates below the legal minimum.
- . Make workers who are undergoing a significant amount of general on-the-job training eligible for low-interest guaranteed student loans.
- . Encourage public educational institutions to provide training at the work site that is customized to the needs of the particular employer.
- . Mandate that firms invest a specified share of their wage bill on training if they are to avoid paying a tax.
- . Subsidize a firm's training expenditures above a certain threshold.
- . Subsidize the training for certain critical shortage occupations.

3.1 Removing Barriers to On-the-Job Training

Lowering Turnover

If rates of turnover were lower, the rate of return to specific training (and employer rates of return to their investments in general training) would rise and the amount of such investments would increase. Particular efforts should be made to lower turnover in jobs that offer considerable training. This can be done by being more careful in hiring selections and by designing compensation schemes that induce people with low quit propensities to seek the job in the first place. The analysis of the time and care employers invest in making and selecting new employees found that they are more careful when filling jobs that offer or require considerable on-the-job training. When OJT was considerable and job security provisions substantial, more people were interviewed, references were more likely to be checked, and more time was spent per applicant. Nevertheless the total amount of time that American employers devote to making selections--about 10 hours per position filled--is very low and the crucial interview stage has been proven to have very low validity.

Hiring selections would be improved if less emphasis were placed on the interview and more emphasis placed on aptitude tests and job knowledge tests that examine the individual's prior knowledge of the occupation. Tests of general mental ability such as the General Aptitude Test Battery and the Armed Services Vocational Aptitude Battery are highly valid predictors of both success in on-the-job training and later job performance. The primary reason these tests are such good predictors of job performance is that they measure the capacity and speed of learning new things. Job knowledge tests should also be used to make hiring selections both because they are good predictors of job performance and because they can be used to identify the skills and competencies the job candidate already has, so that the firm's training does not repeat material already known. Another approach to making better hiring selections is developing referral relationships with vocational teachers at local high schools, technical institutes, and colleges and giving preference to young people coming directly from a school experience over young workers who have been out of school a while and have been hopping from job to job.

Another way to reduce turnover is to design incentives into the job that (1) induce those who have high quit propensities to look elsewhere and (2) make it attractive to stay with the firm. This can be accomplished by setting lower wage rates in the training period and promising rapid increases in compensation and greater job security as the worker becomes

more productive. Despite the fact that during the training period new hires are often less than half as productive as experienced workers, the entry wage in many American jobs is not far below the top wage for that job. The starting wage for apprentices in Switzerland and Germany is almost always less than half and sometimes less than one-fifth of the wage that will be received after the 3-year training period is completed. Their apprenticeship training is much broader and more thorough than training typically received by U.S. workers. New employees at Japanese firms also receive a much more comprehensive and well-rounded training. They start at a low wage but their wages increase rapidly with tenure at the firm. The U.S. labor market would be more efficient and total investments in OJT would be greater if firms competed for new hires by advertising the training that will be offered and the high wage rates that can be had in the future rather than by offering high wage rates for entry-level jobs.

Certification of On-Job-Training Accomplishments

Incentives to offer more and better OJT would be strengthened if employers advertised the training opportunities available at their firm, discussed the training to be received with the new hire on the first day, and awarded certificates for completion of formal training programs or achieving competence in a specific line of work through informal OJT. Such a system would probably result in both the supervisor and the employee taking the training function much more seriously. The certificate and the recognition it signified would be a source of pride to the worker and his family. The certificates would also signal to other employers what has been learned on the job and improve the worker's marketability if he or she should leave the firm.¹⁴ The amount and quality of OJT would be better recognized by the labor market, resulting in better matches and more effective use of people's skills and stronger incentives to provide broader and higher quality training.

An industry wide system with common standards across firms would, of course, be the preferred way of certifying training experiences. Trade associations in banking and construction and a variety of other industries have sponsored the development and dissemination of competency tests that are necessary to create a truly uniform system of certification. Competency tests have also been developed by the National Occupational Competency Testing Institute, American Institutes for Research, and Departments of Education in Florida and Ohio (Chalupsky, Phillip-Jones, and Danoff 1981). Although most of these tests have been designed for certifying the vocational training provided by schools, they could be adapted for use in certifying apprenticeships and other forms of on-the-job training. The

federal government could encourage the development of these competency certification schemes by awarding development contracts to trade associations. The highly developed systems of competency certification in Germany, Austria, and Switzerland that are administered by joint employer-union boards are examples of what is possible in the right setting.

Exemptions from the Minimum Wage

The minimum wage reduces on-the-job training in certain jobs. Exemption of jobs that offer considerable general on-the-job training would remove a barrier to greater OJT. At present jobs and internships that are part of an occupational training program run by an educational institution can be exempted from the minimum wage and often pay no wages for up to a year. This exemption should be extended to apprenticeships and other jobs that offer considerable training. Eliminating the minimum wage, however, might not end or dramatically reduce the underinvestment in general OJT, for the minimum wage is probably a binding constraint for only a small minority of jobs.

Low-Interest Loans for General OJT

Since lack of access to loans at reasonable interest rates is one of the most important reasons for worker underinvestment in OJT, solving this problem would automatically stimulate investment in general OJT. If there were an administratively practical way of defining populations of workers who are heavily investing in general OJT, such individuals could be made eligible for guaranteed student loans. The need for loans is greatest when training period wages are extremely low, so it would probably be desirable to limit eligibility to training slots or jobs which pay the minimum wage or less. To eliminate from eligibility the millions of secondary labor market jobs that provide little or no training, there would also probably have to be a requirement that the training prepare the individual for a job that paid at least 50 or 100 percent more than the minimum wage. At the completion of training the trainee would have to receive a certificate attesting to the skills acquired. Although such rules would limit the number of eligible jobs, there would also probably have to be a requirement that some minimum proportion of training period be spent in a training activity. This would require that some employers be audited regarding the actual time employees spent in training.

Customized Training

Since general OJT typically gets mixed together with specific OJT and both occur simultaneously with actual production, the primary difficulty in promoting general OJT is finding a practical way of measuring it. One way to promote on-the-job skill training without having to solve the measurement problem is for community colleges (or some other public

agency) to establish cooperative training ventures with specific local employers in which teachers on the college's payroll or trainers contracted by the public agency provide training that meets that employer's specifications but is also useful at other firms (Office of Technology Assessment 1990, 144-150; Creticos, Duscha and Sheets 1990). Many states and localities now offer this kind of aid to companies that open or expand plants in the community. The purpose of these cooperative efforts is not just to subsidize and promote on-the-job training. Proponents of customized training contend it serves as an inducement for new high-tech companies to locate in the state and as an aid to local firms struggling to keep up with fast-changing technology (New York State Education Department 1984). Another benefit of customized training is that the involvement of an educational institution facilitates the award of credentials that will make the skills gained more visible to other employers.

Publicly subsidized institutions are becoming increasingly important providers of skill training that is customized to a particular employer's needs. Not clear, however, is whether publicly controlled institutions are always the best providers of such training and whether, lacking the public subsidy, they would be effective competitors in this market. Often the best provider of specific types of customized training will be a private technical college or institute, an individual hired on a contract basis, or another firm (e.g., the maker of equipment that is being installed at a firm). If these alternative providers are to be given a chance, the public funds set aside for customized training should be administered by a public agency that can select the best local provider and contract for the training in an expeditious manner. The responsibility for administering such a program could be assigned to education agencies, as in New York; to the state Department of Labor, as in California; or councils representing the social partners as occurs in the Job Training Partnership Act. Creticos and Sheets study (1990) study of these programs concluded that improvements in business performance did result at the 24 companies studied.

These improvements were due not to training alone: the training was part of a broader effort to improve productivity, quality and profitability. For example, Northwestern Steel and Wire Co. in Sterling Illinois, wanted to raise profits by bringing its costs down to meet those of other U.S. mini-mills. (An industry study had shown that Northwestern's maintenance costs were much higher than the industry average). The company used the state grant to cross-train its maintenance workers; at the same time, Northwestern changed its product mix and took other steps to reduce maintenance costs. Taken together, all of these actions, including the training, succeeded in reducing maintenance costs. The 24 case studies also showed that the State funds allowed the firms to train more workers more quickly than was possible using company funds and that top

managers in all companies came to view training much more positively (OTA, p. 145)

Cooperative arrangements of this type are desirable, but they will probably not become general enough to solve the general problem of underinvestment in OJT. Cooperative arrangements will probably never account for a large share of on-the-job training for two reasons: limited budgets and the high costs of customizing the training to the employers needs, and difficulties inherent in determining who is to provide the training and how costs are to be shared. If customized training is to be attractive to firms, these costs-- staff time, paperwork, and delay--must be kept to a minimum. State programs in California, Illinois and New York have demonstrated that it is possible to negotiate and contract for training quickly and at reasonably low cost. Since most of the administrative costs of participation are unrelated to the number of people trained, these costs are particularly significant for small firms and as a result they typically do not participate in such programs. Most of the establishments participating in these state programs have between 200 and 500 employees (OTA 1990, p. 144). Consequently, when firms have the option of using their own staff to do training, these costs will loom large and probably result in most firms choosing to do their own training.

3.2 Tax and Subsidy Schemes

Although the adoption of all five of the previously mentioned proposals would, in all probability, significantly increase OJT, each one addressed only one cause of the general problem of underinvestment. A more direct attack on the underinvestment problem through a direct subsidy of OJT necessitates a practical administrative mechanism for defining what is to be subsidized. The problem of measurement is a difficult one but it can be solved and three practical proposals for subsidizing on-the-job training are presented. The first of the proposals is the French mandate to spend on training. The second proposal is a marginal subsidy of the firm's training expenditures. The third proposal is a subsidy of on-the-job training in certain critical shortage skills.

The French Mandate to Spend

In France every employer with 10 or more employees must expend 1.1 percent of its wage bill on retraining or pay a tax equal to the difference between its obligated and actual training expenditure. Every employer regardless of size must also expend .5 percent of its

wage bill on apprenticeship training or pay a tax equal to the difference between its obligated and actual training expenditure. The obligation to spend can be fulfilled by expenditures on the firm's own formal training program, by contributions to training insurance fund agreed to by management and labor or by contributions to a government approved training program for the unemployed.¹⁵

In-firm training accounts for about 75 percent of the expenditures reported to French authorities. In-firm training must have a curriculum, develop a skill that is useful at other firms and be located away from the trainees normal work station. Each firm with more than 100 employees must have or labor management committee overseeing its training program.¹⁶ The auditing of the firm's reports of training expenditure is accomplished by a staff of 120 controllers. About two thirds of retraining expenditure is for occupational advancement and refresher courses to maintain skills. The French mandate to spend has the following advantages:

- . Employer needs for skilled workers determine the allocation of funds so the risk that people will be trained for jobs that don't exist is small.
- . Training funds are available to the employed as well as the unemployed.
- . Decision making is decentralized.

The French system also has some important disadvantages, however:

- * Sixty percent of the 120,000 French firms subject to tax report spending more than 1.1 percent of their payroll on re-training. These firms employ more than 80 percent of the workers in firms with 10 or more employees. At these firms, the system provided no incentive to expand training expenditures beyond 1.1 percent of payroll.
- * Firms whose training expenditures are below 1.6 percent of their wage bill, save in taxes the full amount of any increase in expenditures on training. This will inevitably induce a careless attitude toward costs and reduce the efficiency of training.
- * Expenditures on formal training reduce the firm's tax liability; but the costs of informal training do not. This is unfair to small firms which tend to do their training informally because they do not have the scale necessary to make formal training cost effective. Small firms must join together in cooperative efforts to achieve the scale necessary to make formal training feasible. The second unfortunate result of this is that a strong incentive is produced to substitute formal training for informal training despite the fact that there is no evidence (either of an empirical or theoretical variety) that formal training is to be preferred over informal training.

These problems with the French mandate to spend can be ameliorated by appropriate modifications of its basic design. A subsidy scheme that addressed these problems is described in the next section.

Marginal Training Subsidy

A marginal training subsidy (MTS) would offer a partial subsidy of a firm's training expenditures above a threshold level. The rate of subsidy or tax credit would be set between 10 and 33 percent. The training costs that would be eligible for subsidy would include payments to industry training funds, tuition reimbursements for job-related training, contributions of materials or staff time to vocational-technical institutions, the budgeted costs of the firm's formal training of new and continuing employees, and certain costs for informal training of new and upgraded employees. Although the measurement of the costs of informal training is difficult, it must be attempted if choices between formal and informal training are not to be distorted. The subsidizing costs of informal training would be limited to trainee time and trainer time during the first year of employment or during the first 3 months before or after a major promotion and change in job responsibility. If the training is formal, certain additional expenses--books and materials, rental of teaching machines and equipment or office space dedicated entirely to training, and payments to training vendors--would be eligible for subsidy. Formal training would be subsidized regardless of length of tenure or whether the worker received a promotion.

Participating companies with more than 100 employees would be required to have a training advisory committee with worker representation. At the outset of the training the trainee would have to be given a written description of the purposes and nature of the training. At the conclusion of the training program or the firm's fiscal year, the employer would be required to award each trainee a certificate describing the number of hours of formal or informal training, skills taught, and the competence achieved.

The threshold that must be exceeded before a subsidy or tax credit would be paid would be equal to 10 percent of the firm's or establishment's wage payment to employees with less than 1 year of tenure at the firm plus 1.5 percent of wage payments to all other employees. The threshold is higher for firms with many new employees because (1) new employees tend to receive more training than continuing employees, and (2) the costs of informal training are subsidized only during the first year on the job and for a short period

after a promotion. A subsidy above a threshold has some important advantages over an obligation to spend a minimum amount on training (as currently in operation in France):

- . Firms that are big trainers (and therefore probably efficient trainers) of skilled workers would always face an incentive to expand their training.
- . A subsidy above a threshold faces every firm with an incentive to increase training, not just some firms as with the French mandate to spend.
- . Paper work is reduced because most firms would not apply for a subsidy in most years. Year-to-year variations in training expenditures are likely to be large at small firms. Such firms would most likely spend above the threshold only in years in which there is a major expansion of employment of the installation of new equipment.
- . Employers who feel that the administrative burdens of the subsidy are too high are free no to participate.

All employers--profit making, nonprofit, and governmental--should be eligible for the marginal training subsidy if their training expenditures exceed the threshold defined for their organization.¹⁷ In order for incentive effects to be maximized, employers must feel they are assured a larger subsidy payment if they increase their training investment. Together these two considerations imply that the MTS should be administered as a subsidy entitlement, as a tax credit against a broad-based tax on the firm's wage bill like Federal Unemployment Insurance Tax or social security tax, or as a tax credit against income taxes that can be sold to other firms.¹⁸ The MTS would be financed either out of general revenue or a special training tax on the wage bill of all employers. In order to give firms time to set up the accounting procedures to record training expenditures, it would be phased in at least a year after the legislation is passed.

The MTS has a number of important advantages.

- * The social benefits of on-the-job training are probably just as large as the social benefits of occupationally specific training provided by schools. The MTS would create an incentive for firms and workers to generate more of such benefits and would reduce currently prevailing distortions of the choice between these two modes of providing occupationally specific training.
- * Since the employer pays 67-90 percent of the cost of training, there is always an incentive to be efficient.
- * The choice of which jobs to train for and how to do the training is made by the employer, not by a school or government official or the trainee. The employer is the person best able to project the firm's future need for skilled workers and to select the best method of training for those skills.

- * The certificates awarded at the end would probably be a source of pride for employees. By signalling to other employers what had been learned, the certificates would improve the trainees' marketability.
- * The inclusion of the costs of informal training in the definition of subsidizable training expenses is fair-to-small business and reduces the tendency of the subsidy to distort choices between formal and informal training. Although the MTS is not directly targeted to the unemployment. The MTS reduces unemployment in two ways:
 - It encourages firms to hire and train new workers and to retrain rather than lay off workers whose skills are becoming obsolete.
 - It encourages the firm to expand the supply of skilled workers rather than engage in a bidding war for the limited supply of already trained workers, thus producing an acceleration of inflation.
- * The MTS should discourage turnover. A firm with high rates of turnover will have a higher threshold and will as a result receive a smaller subsidy payment.

The MTS has as its objective expansion and intensification of on-the-job training. Only 2 small reforms of current practice are proposed--setting up training advisory committees at firms with more than 100 employees and providing trainees with a certificate describing the training that has been received.¹⁹ All the really important decisions--who is to be trained, what is to be taught, and how it is to be taught--are made by the employer and to a lesser extent by the worker. Worker influence these decisions by bidding for jobs that require training, by selecting an employer who provides the desired training, and by the commitment that is given to learning the material that is presented.

Employers and workers probably invest over 100 billion of time and resource in formal and informal on-the-job training each year. Consequently, covering all employers and all kinds of training means costs can be kept down only if the subsidy rate is set relatively low, the definition of subsidizable expenditure is restrictive, and the threshold is set relatively high.

A Critical Skills Training Incentive (CSTI)

An alternative approach to promoting more private investment in on-the-job training is to target certain critical occupations that are experiencing severe shortages. A subsidy would be offered for training newly hired and transferred employees in a few selected occupations.

Selecting skills for which to provide training incentive. Legislation would restrict the subsidy to a limited number of industries that currently export a major share of their output

or are service firms that provide specialized high-tech services.²⁰ To be eligible for a training subsidy, an occupation or skill would have to involve considerable initial on-the-job training, be required at many firms, and be in shortage. The determination of whether an occupation is in shortage would be based on current data on changes in relative wage rates, changes vacancy rates or newspaper advertising if available, and recent and projected growth of demand for the skill.²¹ The Department of Labor would be given a fixed budget and would select a limited number of skilled jobs for which training subsidies would be available.

Once an occupation had been selected as a potential candidate for subsidy the Labor ministry would appoint an industry-labor committee to make recommendations regarding the definition of the critical skill, the competencies that a trained individual would be expected to have, and possible mechanisms to ensure that subsidized trainees achieve these standards. The Department of Labor would do a small survey of the costs of training and the length of the training period that would serve as a basis for calculations for median training cost.²² The secretary of Labor would be empowered to make competency certification (under the auspices of a multiemployer or union umbrella organization) a part of the mechanism for defining eligibility for a critical skills training subsidy.²³

Administration of the training incentive. Application for a subsidy of a particular trainee must be made within 1 week of the start of the training (within 1 week of the date of beginning work in the case of a new hire).²⁴ The requirement of immediate application for the training subsidy has three purposes: (1) the firm is forced to be aware of the subsidy when it begins the training, which maximizes the subsidy's incentive effect; (2) it allows the Department of Labor to monitor continuously the number of trainees its program has stimulated and to project future costs and the fulfillment of its goals; and (3) for the firm, it locks in the terms and conditions of subsidy that prevailed at the date training was commenced. If the Department of Labor determines that more or less training is being undertaken than was needed or budgeted, it has the right without advance notice to restrict or liberalize the definition of subsidizable jobs skills, lower or raise the training cost allowance, or end that occupation's eligibility. Changes in rules would apply to all training programs begun 1 week or more after the announcement of the change.

There would be no limit to the number of trainees for which an employer could be subsidized, and the firm would not have to obtain advance agreement from the department as to this number. The employer would only have to certify (1) that the training provided resulted in the worker's attaining the critical skill, and (2) that the trainees did not have that

skill prior to the training. This certification would be audited on a random basis.²⁵ Workers who complete training would be awarded a certificate attesting to the skills they have achieved.

The CSTI has a number of attractive features:

- * It is limited in scope to occupations in critical shortage.
- * Great flexibility is given to program administrators. (This is essential because the CSTI is a new concept and it must respond quickly to the changing needs of the economy.)
- * Workers who complete training are awarded a certificate that describes the skills they have gained.
- * The firm always faces a marginal incentive to expand its training of targeted skills. It does not have to get prior agreement from Department of Labor about how many people to train (an administrative hassle that would be a major barrier to participation).
- * The firm is given an incentive to retain the workers it trains.
- * Despite the almost "entitlement" nature of the training subsidy, its total cost is capped by the monitoring of usage and Department of Labor ability to lower subsidy amounts and tighten eligibility.
- * A sunset provision automatically ends a skill's eligibility for subsidy.
- * Costs could be further reduced by requiring that firms already employing people in the targeted skilled occupations exceed a given level of training before being eligible for subsidy. It could be assumed that in the normal course of events such firms would have to replace 10 percent of their stock of workers with the targeted skills anyway. The subsidy could be paid for trainees above this threshold.
- * The firm's administrative costs are kept low. The firm does not have to calculate and report how much it is spending on training.
- * Eligibility for subsidy is a function of an output--the number of people trained for certain specific jobs--not a measure of input. This creates a strong incentive to be as efficient as possibly in doing the training.

The Critical Skills Training Incentive has some important drawbacks, however. Its success depends upon the wisdom and timeliness of the selection of skills for which training subsidy is provided. Experience with federally funded graduate fellowships should remind us how difficult it is for government to forecast future demand for a specific skill and implement decisions to extend or withdraw training subsidies in a timely manner. Graduate fellowships

were originally targeted to a few shortage fields thought to be critical to national defense. However, other fields campaigned to be included and new programs were started until almost every field of study was included in at least one agency's fellowship program. The number of fellowships expanded even after the shortages of Ph.D.s in the field turned into a surplus. The CSTI has features--the sunset provision, great administrative flexibility, and a fixed budget--that are intended to prevent a recurrence of the poor timing that characterized the graduate fellowships programs. There is always the possibility, however, that the projections of future demand will be wrong or that politics will result in the wrong occupations being selected and that the selective nature of the training incentive would increase rather than decrease market distortions. For this reason, the MTS seems to be the preferred mechanism for promoting on-the-job-training.

APPENDIX ON TRAINING AND PRODUCTIVITY GROWTH DATA

The analysis is based on data from a survey of 3,412 employers sponsored by the National Institute on Education and the National Center for Research in Vocational Education conducted between February and June 1982. The survey was the second wave of a two-wave longitudinal survey of employers from selected geographic areas across the country. The first wave was funded by the U.S. Department of Labor to collect data on area labor market effects of the Employment Opportunity Pilot Projects. The survey encompassed 10 pilot sites and 18 comparison sites selected for their similarity to the pilot sites. The ES-202 lists of companies paying unemployment insurance taxes provided the sample frame for the survey. Because of the interest in low wage labor markets, the sample design specified that establishments in industries with a relatively high proportion of low-wage workers be over sampled. The tax paying units were stratified by the estimated number of low wage employees and the number of establishments selected from each strata was roughly in proportion to the estimated number of low wage workers at the establishments in that strata. Within strata the selection was random. The survey was conducted over the phone and obtained a response rate of 75 percent.

The second wave attempted to interview all of the respondents in the first-wave survey. About 70 percent of the original respondents completed surveys for the second wave. Most of the respondents were the owner/manager of small firms who were quite familiar with the performance of each of the firm's employees. Seventy percent of the establishments had fewer than 50 employees, and only 12 percent had more than 200 employees. In large organizations the primary respondent was the person in charge of hiring, generally the personnel officer. If the primary respondent was unable to answer questions about the training received by newly hired workers in the sampled job, that part of the interview was completed by talking to a supervisor or someone else with line responsibility.

The employers who received the full questionnaire were asked to select "the last new employee your company hired prior to August 1981 regardless of whether that person is still employed by your company." Only 2594 employers had hired someone in the time frame requested and these employers constitute the sample used in the study.

The respondent was asked to report how much time typical new hires for this job spent during the first three months of employment in four different kinds of training activities: (1) watching others do the job rather than doing it themselves, (2) formal training programs,

(3) informal individualized training and extra supervision by management and line supervisors, and (4) informal individualized training and extra supervision by co-workers. For the sample of firms and jobs, the means for the typical worker were 47.3 hours watching others do the job (WT), 10.7 hours for formal training programs (FT), 51 hours for informal training by management (MIT), 24.2 hours for informal training by co-workers (CT). A copy of the relevant portions of the questionnaire is available from the author.

A training time index was constructed by first valuing trainer and trainee time relative to that of workers with two years of tenure in that job and then combining the time invested in training activities during the first three months on the job. The employers reported that workers with two years of tenure in the job averaged between 22 and 50 percent (depending on occupation and other worker characteristics) more productive than new hires during their first three months on the job. This ratio was calculated for each job/worker category and used to place a relative value on coworker time devoted to training.²⁶ The management staff members who provide formal and informal training were assumed to be paid 1.5 times the wage of coworkers with 2 years of tenure. Formal training involves both the trainer and trainee's time. Sometimes it is one-on-one and sometimes it is done in groups. It was assumed that the average ratio of trainees to trainers was 3 and that the value of the trainer's time (including the amortized cost of developing the training package) was three times the wage of a coworker with two years of tenure. When supervisors and coworkers are giving informal training to a new employee, the trainee is almost invariably directly involved in a production activity. Employers report that for informal training, the trainees are typically as productive while being trained as they are when working alone (Hollenbeck and Smith 1984). Consequently, informal training is assumed to involve only the investment of the trainer's time. Thus in units of coworker time the value of trainer time is:

$$(1) \text{ Valued Trainer Time} = CT + 1.5*MIT + FT$$

In units of trainee time, the time the trainee spends not producing because of training activities is:

$$(2) \text{ Trainee Time} = WT + FT$$

The total investment in training in trainee time units²⁷ is:

$$(3) \text{ Total Training Investment} = WT + FT + (CT + 1.5*MIT + FT)/RP.$$

where

RP = the productivity of the average new hire during the first 3 months relative to the productivity of typical worker with two years' tenure

$$= .167*PROD2 + .833*PROD312 \\ PRODYP$$

PROD2 = reported productivity of typical new hire during the first 2 weeks

PROD312 = reported productivity of typical hire during the next 10 weeks

PRODYP = reported productivity of typical worker in same job with 2 years' tenure

WT = time watching others over the first 3 months

FT = time spent in formal training over the first 3 months

CT = co-worker time spent training new hire informally over the first 3 months

MIT = management time spent training new hires informally over the first 3 months.

The arithmetic mean of this index is 209 hours, implying that the value of the time invested in training a typical new employee in the first three months is about 40 percent of the output that the trainee can produce working full-time during the first three months on the job.²⁸

The survey asked the employer (or in larger firms the immediate supervisor) to report on productivity of the typical individual hired in the job after two weeks, during the next 11 weeks and at the end of two years at the firm. The supervisor was asked to do the rating on a "scale of zero to 100 where 100 equals the maximum productivity rating any of your employees in (NAME'S) position can obtain and zero is absolutely no productivity by your employee." For the full data set at the mean values of these indexes of reported productivity were 49.0 for the first two weeks, 64.6 for the next 11 weeks and 81.4 at the time of the interview. The questions asking for a rating of the productivity of particular workers have remarkably low nonresponse rates. Only 4.4 percent of respondents asked about a particular new hire's productivity during the first 2 weeks responded with a "don't know" or refused to answer. Comparably defined nonresponse rates for other questions were 8.2 percent for previous relevant experience, 3.2 percent for age, 6.7 percent for education, 8.6 percent for time spent in informal training by supervisor, and 5.7 percent for a three-question sequence from which starting wage rate is calculated. The low-nonresponse rate implies that our respondents felt that they were capable of making such judgments and augur well for the quality of the data that results.

The interview questions about the productivity of recently hired employees do not measure productivity in any absolute sense and therefore are not comparable across firms or across jobs in a firm. Rather, they are intended as ratio scale indicators of the relative productivity of a typical (or a particular) worker at different points in their tenure at a firm. Under an assumption that these productivity indexes are proportional transformations of true productivity plus a random error, percentage differences in cell means of the productivity index will be unbiased estimators of percentage differences in true productivity. If the variations in the productivity scores assigned by supervisors exaggerate the proportionate variations in the true productivity, our estimates of percentage differences in productivity between two workers will be biased upward. Even though it is possible for a worker's true productivity to be negative, the scale was defined as having a lower limit of zero. Floors and ceilings on a scale typically cause measurement errors to be negatively correlated with the true value. If this is the case, then our estimates of percentage differences in productivity between two workers will be biased downward. This latter type of bias appears to be more likely than the former.

Further evidence that the proportionality assumption results in an understatement of percentage differences in productivity between individual workers doing the same job comes from comparing the coefficients of variation of productivity in this and other data sets. If pairs of workers who are still at the firm are used to construct a coefficient of variation for this data set, it averages .13 for sales clerks, clerical, service and blue collar workers. This estimate of the coefficient of variation is smaller than the estimates of the coefficient of variation for yearly output derived from analysis of objective ratio scale measures of output. These estimates were .35 for sales clerks, .144 for semi-skilled blue collar workers, .28 in craft jobs, .164 for workers in routine clerical jobs and .278 in clerical jobs with decision making responsibilities (Hunter, Schmidt and Judiesch 1988). This means that the estimates of the effect of training on productivity growth reported in this paper are probably conservative. The fact that the employer is reporting on the past productivity of particular employees may also generate biases in data but it is not clear how estimates of productivity growth rates might be influenced by this problem.

ENDNOTES

1. If the arithmetic mean were being reported these numbers would be considerably larger. Nevertheless these numbers seem low especially for professional and managerial jobs.
2. Because a number of employers reported that productivity was zero during the first 2 weeks on the job, 5 was added to all productivity index values before the productivity growth ratio was calculated.
3. To test for possible effects of measurement error and simultaneity bias, instrumental variables estimates were obtained for a simple model containing only three training variables-- logarithm of training length, training intensity, and training intensity squared. The variable used as instruments for length and intensity of training were: the number of alternative employers, dummies for industry, the growth rate of employment, the growth rate of sales, the number of employees at the establishment, the size of firm, the wage rate, a dummy for wage at or below the minimum wage, a dummy for temporary job, dummies for no probationary period, the log of length of the probationary period, dummies for not knowing if there is a probationary period, a measure of the difficulty of firing a worker after the probationary period is ended, a measure of the importance of seniority in determining who is laid off, and characteristics of the local labor market. It appears that measurement error is a problem in the training intensity variable, for the IV estimates for this variable remain highly significant and become about three times larger. The IV estimates for length of training have a negative sign.
4. Measurement error may bias these coefficients in a way that makes these findings stronger. Our respondent (generally a boss, supervisor, or personnel manager) probably had better knowledge of time spent in formal training and informal training by supervisors than of time spent in other forms of training. This should have resulted in the coefficients on these forms of training having a smaller measurement error bias than the coefficients on informal training by co-workers and time spent watching others. Thus, correcting for measurement error in the individual indicators might raise the coefficients on these last two forms of training by more than it raises the coefficients on formal training.
5. If training intensity in each of the other seven quarters were identical to the first quarter's training intensity, the cost multiplier would be seven rather than two. The correct multiplier is significantly less than seven because training investments in the later period are not perfectly correlated with training investments in the first quarter and because most employers report the training period to be less than 6 months. Given these facts, the two for one ratio is an assumption that magnifies the cost of the reported differences in training intensity quite dramatically and reduces calculated rates of return by a factor of three.
6. Becker clearly recognized the existence of liquidity constraints in his 1962 paper. "Since employer specific skills are part of the intangible assets or good will of firms and can be offered as collateral along with tangible assets, capital would be more readily available for specific than for general investments (p.42)." He did not, however, explicitly analyze how such constraints might influence the tenure profile of wages and

thus induce employers to share the costs of general training. Parsons (1972) points out that "The worker's ...discount rate will affect the firm's choice of wage policies....It can be shown that firms will decrease the worker's share of specific investment as the workers discount the future more heavily (p.1129)."

7. Lack of information about the quality of general OJT received can increase investment in general OJT only under the very unlikely circumstances of very high retention rates and large differentials between the rates at which employers and employees trade off present before-tax income for future before-tax income. Under these circumstances the employer's desire to invest in general training may be stronger than the worker's desire. Because the wage will have to be increased by an equivalent amount, employers cannot benefit from (and therefore do not pay for) general training that is visible to other employers. Consequently, as such training becomes more visible to other employers, the calculus that determines the amount of training shifts to give greater weight to the very high discount rates faced by the worker, possibly reducing investment in general training. The condition that would have to be satisfied is that the retention rate would have to be equal to or greater than the ratio of the firm and worker discount factors. Even if the worker were to face yearly interest rates that were double the firm's rate (e.g., 30 percent rather than 15 percent), the retention rate would have to be above 85 percent. Retention rates for the first year at a job are seldom above 50 percent and average yearly retention rates for all employees new and old seldom exceed 85 percent. Yearly retention rates of employees who have been at the firm for many years may exceed 85 percent, but these more mature workers will typically have better access to capital markets than younger workers and face a tax regime that is neutral to OJT.
8. Well-trained employees who leave the firm that provided the training may benefit if their new employer eventually learns of their greater-than-anticipated productivity and makes later adjustments to the wage or bases a promotion on it. In the model just analyzed, high renegotiation costs prevent such adjustments from occurring at the first employer. If a third period was added to the model and retention in the second job modeled the same assumption of high renegotiation costs, it would prevent the worker from benefiting from better-than-expected training in the second job. If one were to relax the assumption that post-training wage rates are prespecified and analyze a multi-period model, the size of the distortion to training investment decisions would be reduced, but it would not disappear. Productivity is measured with error so one could never expect the new employer to perceive the full value of the worker's greater-than-anticipated training. Furthermore, other employers remain ignorant of greater-than-anticipated productivity. To all intents and purposes this greater productivity is specific to the firm, so the worker will only receive a small share of this greater productivity in higher wage rates.
9. Policy capturing experiments have found that employers give substantially higher ratings to job applicants with high grade point averages (Hollenbeck and Smith 1984).
10. The survey was of a stratified random sample of the NFIB membership. Larger firms had a significantly higher probability of being selected for the study. The response rate to the mail survey was 20 percent and the number of usable responses was 2014.

11. The Supreme Court's decision in the Wards Cove Packing Case has made it easier for employers to defend the use of selection methods that produce adverse impact and has therefore opened the door for increased use of employment tests. It appears that employers will be able to justify the use of employment tests without having to undertake costly validity studies in their own firm by citing validity research done for similar jobs in other firms. Congress is considering legislation that would reverse Wards Cove and make it even harder to defend the use of selection procedures which have adverse impact than under the Griggs precedent. If this legislation passes, the ability of firms to make wise hiring decisions will deteriorate even more.
12. If the interest rates facing employers are higher than the social discount rate, there will also be underinvestment in specific training. The degree of underinvestment in specific training is considerably smaller than the underinvestment in general training.
13. The U.S. rate of training related placement might have been somewhat higher if measured 6 months after high school graduation. However, the German definitions of relatedness are more rigorous and applying them to U.S. data would have lowered training related placement rates. High unemployment rates no doubt contribute to the low rates of training related placement in the U.S. However, aggregate differential between the countries in training related placement cannot be attributed to differentials in the general tightness of labor markets.
14. Such a change clearly makes the worker better off. General training would be recognized better and new equilibrium would result with higher wages after training and lower wages during training. The firm would be able to lower the starting wage by enough to ensure that it benefitted as well.
15. To ensure that only training gets subsidized and not vacations or motivational sales meetings, subsidizable expenditures might be defined to exclude: (1) travel to a remote site other than the company's national or the appropriate regional headquarters; (2) housing and food expenses of more than \$100 a day; (3) costs of training non-employees, part-time employees working less than 50 hours a month, or employees for whom more than 50 percent of compensation comes from commissions; and (4) payments to speakers or presenters of a training session of more than \$100 or \$200 per contact hour, whichever is higher. The costs of developing a training package or system for use in training one's own staff would be an allowable expense.
16. A trainee would be considered to be engaged in formal or informal training if he or she is receiving group instruction, being instructed by a computer, reading manuals or instruction booklets, watching others do the work, or being shown the work. A trainer's, supervisor's or co-workers's time would be considered to be engaged in a training activity only if 100 percent of the trainer's attention is devoted to the training purpose. If any output is produced during a training activity, it would have to be given to the trainee, discarded, or given away. The following tests could be used to define a promotion for purposes of calculating subsidizable training expenses: there would have to be a new job title, noticeably different job duties, a wage increase of at least 6 percent above the standard seniority or cost of living increment, and the individual could not have held that particular job before. In order for new employee training to

be subsidizable, it would have to be associated with a wage increase by the end of that year of at least 10 percent over and above the rise in the cost of living.

17. To ensure that employers who receive an MTS subsidy were aware of the program at the time, it might influence their behavior if it could be required that the employees make a preliminary application before July 1 of the calendar year for which a subsidy is sought.
18. If the MTS is a subsidy, subsidy payments would be taxable income. If the MTS is a tax credit, the firm would have to reduce its reported social security or FUTA tax payments by the amount of the tax credit.
19. To the extent that the accounting rules used to distinguish training activities from production activities affect the way training is conducted, this is an unfortunate unintended consequence of the necessity of defining a dollar quantity of training expenditure for each firm.
20. Examples might be communications, machinery, instruments, chemicals, pharmaceuticals, electronics, computer service, and R&D laboratories.
21. For a skill to be eligible, both recent and projected rates of growth would have to be high. Projections of future growth should be based on a methodology that can be updated on a quarterly basis and that uses contemporaneous market signals (such as current or forward prices of the industry's product, new orders, or current industry sales or employment) to project future employment. The methodology must be capable of giving timely warning of industry turnarounds like the one that occurred in 1981 in oil drilling and exploration. A projection of rapid growth would be sufficient on its own (in the absence of high past rates of growth) only if the evidence is particularly strong (e.g., Congressional passage of obligational authority for a huge multiyear contract). Where classroom training at schools or colleges substitutes for OJT, information on the number of graduates of such programs (recent and projected) would have to be compared to growth of demand.
22. The survey would not be very costly and would not take long, once a sample of employers who have trained such workers was obtained. Although visits to establishments by specialized staff would be the preferred mechanism, it could be done over the phone. A telephone interview approach to measuring on-the-job training costs for specific jobs has been developed by the National Center for Research in Vocational Education and implemented by the Gallup Organization at a cost of less than \$75 per interview. The training costs that would be measured by this survey would include--
 - . payments to outside vendors such as a training institution,
 - . depreciation on machinery devoted 100 percent to training,
 - . time of specialized training personnel that is spent in contact with the trainee or preparing lessons.
 - . time of supervisors or co-workers spent giving formal or informal training to the nonworker above a 40 hour minimum, and
 - . time of the trainee that is spent in a formal or informal training activity that is not directly productive.

The survey would also serve as a basis for developing an operational definition of the job or skill for which training subsidies would be provided and of the levels of the skills. The results of the survey would be reviewed by DOL staff and the industry labor committee. DOL staff would make a formal recommendation to the Secretary that the advisory committee could endorse or take exception to as it wished. Training costs allowed in future years would be indexed to the economy's average hourly wage, so the survey would only need to be done once.

23. Systems for competency certification currently exist in construction, telecommunications, banking, and a variety of other industries. In some industries and occupations, an existing system(s) could be adopted "as is" or modified; in other industries and occupations, a new system would have to be developed. Since an occupation is eligible for a critical skills training subsidy for only a limited period, a judgement would have to be made as to whether the benefits of competency certification would outweigh the inevitable costs and delays that such a requirement would impose. In addition, in certain fast-changing fields codifying what must be learned in this way might not be desirable. There would be an expectation that the organization sponsoring the competency certification would continue the service after the end of the period of the occupation's eligibility. Conditioning the CSTI on the existence of competency certification would continue the service after the end of the period of the occupation's eligibility. Conditioning the CSTI on the existence of competency certification would tend to encourage industry groups seeking designation of one of their job or skills as a critical skill to create a certification process for that job.
24. The application form could be quite simple, requiring only the name and social security number of the trainee, employer ID number, the training establishment's name and address, the firm's name and address, the skill for which training is being provided, the trainee's wage, and a description of the job (including its wage) for which he or she is being trained.
25. An advance opinion as to the eligibility of a proposed training program (binding on DOL) would be available to employers who request it. The calculated amount of subsidy would be paid in equal semiannual installments over the training period that has been established for the skill. If the worker is employed at the firm for less than the full training period, the subsidy payment would be prorated for the period he or she was at the firm. The payments would be taxable income. Training establishments would submit semi-annual bills to DOL for the subsidy payments due to it. The payment would be made to the training establishment (even when the establishment is part of a multiestablishment firm) because auditing would be carried out at the establishment level and because the payment then shows up in the right place in multiestablishment firms with divisional profit centers.
26. The use of the ratio to estimate the relative productivity implicitly involves an assumption that the productivity reports received from employers are a proportional transformation of true productivity plus a random error. It is assumed that the unknown factor of proportionality can be different for every job, every firm and every respondent but a single respondent always uses the same proportionality factor when answering our questions. If alternatively it were assumed that these reports exaggerate the rate of growth of productivity with tenure by a factor of 2, estimates of training

investment would be 7 to 15 percent lower. Comparisons across occupations or of new hires with different qualifications would not change appreciably.

27. The index was constructed under an assumption that the four training activities were mutually exclusive. This implies that if the sum of the hours devoted to individual activities is greater than 520, that a reporting error has occurred which overstates investment of training. In the few cases where the sum of hours devoted to training exceeded 520, the training time index was adjusted downward by the ratio of 520 to the sum of the hours reported for individual activities. This procedure reduces the mean of the index by about 10 percent. The cost of the trainer and amortization of training package development costs was assumed to be two-thirds of the foregone productivity of a supervisor, since formal training often spreads fixed costs over more than one trainee. Thus $1.8 = (2/3)1.5 + .8$.
28. The Becker/Mincer definition of investment in on-the-job training is the difference between the new hires productivity net of training costs in a job that offers learning opportunities and that same worker's wage in an alternative job that results in no learning or training. Investment in training time as defined above corresponds to the Becker/Mincer definition if it is assumed that the alternative no training wage is equal to the workers average productivity during the first 3 months of employment. If, instead, it was assumed that the alternative no training wage was equal to reported productivity during the first two weeks, estimates of training investment measured in units of trainee time equivalent would be 15 to 26 percent higher.

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TABLE 1
 TRAINING AND PRODUCTIVITY GROWTH OF TYPICAL NEW EMPLOYEES
 BY
 OCCUPATION

	Profes- sional	Mana- geral	Sales not Retail	Retail Sales	Clerical	Blue Collar	Service
<u>Hours Spent in Training in First 3 Months</u>							
Watching others do the job	60.0	65.0	82.8	39.2	50.4	48.1	32.7
Formal training programs	9.1	12.1	23.9	8.2	13.5	9.1	5.7
Informal training by management	76.6	80.4	71.8	48.5	54.6	49.3	35.1
Informal training by co-workers	31.8	23.0	33.9	23.9	26.2	26.8	16.7
<u>Investment in Training Time</u>	293	295	350	185	235	200	130
Weeks to become fully trained if no previous experience	11.1	13.4	9.2	6.5	6.7	9.0	3.4
<u>Increase in Reported Productivity (%)</u>							
Betw. first 2 wks. & next 10 wks.	28	32	50	30	40	32	28
Betw. first 3 mo. & end of year 2	38	33	36	25	32	23	17
<u>Increase in Real Wage in First 2 Yrs. (%)</u>	5.0	7.7	22.6	9.7	11.5	11.5	3.7
Number of cases	95	112	76	203	429	649	334

NOTE: Sample is limited to jobs for which all the necessary questions on wage rates, training time, and productivity were answered.

TABLE 2
 TRAINING AND PRODUCTIVITY GROWTH OF TYPICAL NEW EMPLOYEE
 BY
 ESTABLISHMENT SIZE

	0-10	11-50	51-200	201+
<u>Hours Spent in Training in First 3 Months</u>				
Watching others do the job	48.7	45.4	48.3	55.4
Formal training programs	11.8	7.4	9.2	17.0
Informal training by management	59.1	44.4	52.8	48.0
Informal training by coworkers	23.3	24.3	27.5	32.4
<u>Investment in Training Time</u>	224	1835	213	248
Weeks to become fully trained if no previous experience	185 8.1	6.4	6.1	8.3
<u>Increase in Reported Productivity (%)</u>				
Betw. first 2 wks. & next 10 wks.	29	33	37	49
Betw. first 3 mos. & end of year 2	26	24	26	34
<u>Increase in Real Wage in First 2 Yrs. (%)</u>	12.1	7.3	8.7	9.6
Number of cases	792	678	296	123

NOTE: Sample is limited to jobs for which all the necessary questions on wage rates, training time, and productivity were answered.

Table 3
Impact of Training on Wage and Productivity Growth

	Productivity Growth			Wage Growth (log)	
	Typical Worker (log 2 Yrs.)	Typical Worker (linear 2 Yr.)	Particular Individual Linear (1.1 Years)	Typical (2 Yrs)	Particular Individual (1.1 Year)
Log Length of Training	.068*** (6.43)	.032*** (6.09)	.025*** (4.36)	.010*** (2.84)	.008** (2.49)
<u>Hrs. of Training in first quarter</u>					
Formal Training (100's)	.133*** (3.06)	.046** (2.14)	.048** (2.10)	.043*** (3.13)	.027** (2.05)
Training by Supervisors (100's)	.130*** (3.85)	.067*** (4.01)	.043** (2.44)	.020* (1.83)	.017 (1.61)
Training by Co-workers (100's)	.145*** (4.92)	.077*** (5.30)	.057*** (3.70)	.001 (.15)	-.002 (.25)
Watching Others (100's)	.149*** (7.37)	.053*** (5.30)	.046*** (4.32)	.017** (2.54)	.016** (2.55)
Training Intensity Squared (10,000's)	-.0085** (2.27)	-.0049** (2.61)	-.0050* (2.53)	-.0011 (.92)	-.0011 (.97)
Standard Error of estimate	.597	.295	.308	.187	.178
R ²	.171	.129	.135	.198	.233
Number of Observations	2116	2116	2002	1986	1963

Table 4

Impact of Training on Wage and Productivity Growth
of a Particular New Hire

	Productivity Growth (Log)		Wage Growth (Log)		Productivity Growth (Linear)	Wage Growth (Linear)
Log Training Weeks	.053*** (4.55)	.051*** (4.44)	.0073** (2.19)	.0067* (1.93)	.019*** (3.38)	.0046 (.90)
Log Training Intensity	.115*** (9.35)	.092*** (6.82)	.015*** (4.26)	.0089*** (2.92)	.041*** (5.46)	.0064 (.96)
Log Tr. Intensity x Size		.0099*** (4.11)		-.0001 (.12)	.0064*** (5.48)	.0007 (.68)
Log Tr. Intensity x General		.0043 (.45)		.0029 (1.08)	.0018 (.40)	.0073* (1.76)
Log Tr. Intensity x Formal		.064*** (3.66)		.014*** (2.86)	.011 (1.24)	.022*** (2.86)
Log Tr. Intensity x Co-Worker ²		.025 (1.51)		-.001 (.23)	.011 (1.37)	-.004 (.52)
Log Tr. Intensity x Watch		.038*** (2.70)		.007* (1.82)	.009 (1.34)	.017*** (2.71)
Tenure	.083*** (2.58)	.104*** (3.20)	.099*** (10.35)	.098*** (10.15)	.091*** (5.78)	.098*** (6.31)
Tenure Sq.	-.0078* (1.73)	-.0094** (2.11)	-.0024* (1.76)	-.0023* (1.71)	-.0088*** (4.07)	-.0045** (2.15)
Standard Error of Estimate	.628	.622	.178	.178	.303	.269
R Square	.164	.181	.233	.238	.162	.126
Number of Observations	2002	2002	1963	1963	2002	1963

Table 5
Sensitivity of Marginal Gross Rates of Return Estimates to Specification

	<u>Formal Training</u>		<u>Training by Supervisors</u>		<u>Training by Co-Workers</u>		<u>Watching Others</u>	
	100 hrs	300 hrs	100 hrs	300 hrs	100 hrs	300 hrs	100 hrs	300 hrs

Table 3

Typical Individual Linear	13%	6	28	17	45	32	36	20
Logarithmic	43	30	50	35	85	63	110	65
Particular Individual Linear	19	9	26	14	43	25	41	18

Table 4

Typical Individual Logarithmic	65	30	66	32	112	53	128	71
Linear	24	10	28	11	48	19	62	25
Particular Individual Logarithmic	87	38	73	35	130	59	182	80
Linear	26	9	25	9	47	16	58	20

Estimates of the marginal gross rates of return to increases in the intensity of training at two different levels of training intensity: a 100 hour investment during the first quarter of the job and a 300 hour investment during the first quarter on the job. Results are calculated from the regressions reported in tables 8, & 9. Cost factors are assumed to be 1.8 for formal training, 1.5 for training by supervisors, 1.0 for training by coworkers, and 0.8 for watching others. When productivity growth over 2 years for the typical individual is being modeled, this cost factor is multiplied by 3 for the reasons given in the text. When productivity growth of a particular individual during the first 14 months is modeled, the cost factor is multiplied by 2.2. Obsolescence of skills and turnover mean that these cash flows do not have an infinite duration and should therefore be compared to $r + \frac{g}{1-g}$ of equation 10.

Table 6
ADVANTAGES OF EMPLOYER INITIATED/SPONSORED TRAINING

1. Many skills must be learned by almost everyone in the enterprise. Training and organizational learning go hand in hand.
2. Learning by doing is more effective than learning by READING, LISTENING or WATCHING.
3. Avoids problems of transferring learning from school setting to work setting.
4. Necessary equipment & materials are available.
5. Skills are more likely to be used if skills are not used they are forgotten.
6. Trainees time is used more efficiently.
7. Learners are more motivated.
8. Strong incentives for trainers to be effective.

ADVANTAGES OF SCHOOL BASED OCCUPATIONAL TRAINING

1. It is feasible to offer individuals the right to select which occupation to prepare for and to pursue the program of study on whatever schedule is convenient to the individual.
2. If trainers with the necessary expertise are scarce, schools are a way to get the maximum out of a limited supply of teachers.
3. Many enterprises are too small to mount training by themselves and so are forced to rely on training programs organized by schools and trade associations.
4. Certification of skills is made easier by the centralization of the training function into a smaller number of institutions.