Federal Reserve Bank of Chicago

Should We Teach Old Dogs New Tricks? The Impact of Community College Retraining on Older Displaced Workers

Louis Jacobson, Robert J. LaLonde and Daniel Sullivan

WP 2003-25

November 2003

Should We Teach Old Dogs New Tricks? The Impact of Community College Retraining on Older Displaced Workers

Louis Jacobson
Westat, Inc.

Robert J. LaLonde
University of Chicago and NBER

and

Daniel Sullivan
Federal Reserve Bank of Chicago

We thank the Washington State Training and Education Coordinating Board for providing the data and technical assistance for this project. We have benefited from comments by Eric French, James Heckman, Alan Kruegar, Derek Neal, Soloman Polachek, Madeline Zavodny and seminar participants at Chicago, Princeton, Cornell, the Federal Reserve Banks of Chicago and New York and the Bureau of Labor Statistics. Some of this research was funded by the Washington State Workforce Training and Education Coordinating Board and by the U.S. Department of Labor Employment and Training Administration under contract numbers 99-0-0584-75-055-01 and K-6307-7-00-80-30. The views expressed in this paper are solely those of the authors and do not necessarily represent the views of the Washington State Workforce Training and Education Coordinating Board, the U.S. Department of Labor, the Federal Reserve Bank of Chicago or the Federal Reserve System.

Should We Teach Old Dogs New Tricks? The Impact of Community College Retraining on Older Displaced Workers

Abstract

This paper estimates the returns to retraining for older displaced workers--those 35 or older--by estimating the impact that community college schooling has on their subsequent earnings. Our analysis relies on longitudinal administrative data covering workers who were displaced from jobs in Washington State during the first half of the 1990s and who subsequently remained attached to the state's work force. Our database contains displaced workers' quarterly earnings records covering 14 years matched to the records of 25 of the state's community colleges.

We find that older displaced workers participate in community college schooling at significantly lower rates than younger displaced workers. However, among those who participate in retraining, the per-period impact for older and younger displaced workers is similar. We estimate that one academic year of such schooling increases the long-term earnings by about 8 percent for older males and by about 10 percent for older females. These per-period impacts are in line with those reported in the schooling literature.

These percentages do not necessarily imply that retraining older workers is a sound social investment. We find that the social internal rates of return from investments in older displaced workers' retraining are less than for younger displaced workers and likely less than those reported for schooling of children. However, our internal rate of return estimates are very sensitive to how we measure the opportunity cost of retraining. If we assume that these opportunity costs are zero, the internal rate of return from retraining older displaced workers is about 11 percent. By contrast, if we rely on our estimates of the opportunity cost of retraining, the internal rate of return may be less than 2 percent for older men and as low as 4 percent for older women.

I. Introduction

During the last decade there has been rising interest in polices that foster human capital investments in pre-school aged children.[1] Proponents of these policies point to evidence that such investments produce impressive social returns, even though much of their benefits are not apparent until children reach adolescence or become young adults. The long time periods over which these benefits accrue, the low opportunity costs of children's time, and the possibility that the young acquire many skills more efficiently than the old are compelling reasons to believe that policy should be biased toward investments in the young.

At the same time that evidence has accumulated on the benefits of investments in the young, policy makers have directed more of their workforce development expenditures towards older, more established workers.[2] In addition to those participating in formal government-sponsored workforce programs, significant numbers of prime-aged workers have sought retraining on their own in the nation's two-year community colleges. These heavily subsidized public institutions now report that upwards of 30 percent of their students are over 30 years old (Kane and Rouse, 1999). Despite increased public expenditures on retraining older workers, there is no body of evidence showing that these investments have a significant payoff (Leigh 1990, Corson et. al. 1993). Moreover, this policy change runs counter to evidence that business firms invest much less in the skills of prime-aged and older employees than they do in the skills of younger

[1] These studies include Heckman (2001), Carneiro and Heckman (2003), Barnett (1993), Barnett and Masse (200), Currie and Thomas (1995), Currie, Garces, and Thomas (2001), Karoly et. al. (1998. 2002), Olds, (1997), Reynolds et. al. (2001).

[2] For a discussion of the history of employment and training polices in the U.S., see LaLonde (2003). A significant portion of public expenditures on classroom training in these programs subsidizes classroom training in community colleges. Over time, community colleges have shifted their emphasis toward

workers (Ashenfelter and LaLonde, 1997). Presumably, firms invest less in on-the-job training of older workers, because its net benefits are less than for their younger employees.

This paper provides evidence on the returns to retraining for older workers by estimating the impact that community college schooling has on the earnings of displaced workers who seek retraining around the time of their job losses.[3] We compare these impacts for displaced workers who are 35 and older to impacts for younger displaced workers who enroll in similar courses or programs and to estimates reported in the schooling literature.

Our analysis relies on a longitudinal data base containing 14 years of administrative quarterly earnings records for displaced workers matched to the records of 25 community colleges in Washington State. These records detail when and for how long individuals were enrolled in school, how many credits they completed and the subject matter of the courses. Our sample contains over 65,000 displaced workers who lost jobs during the first half of the 1990s and who remained consistently attached to Washington State's work force throughout the fourteen year period studied. Fifteen percent of these workers enrolled in and completed community college courses around the time of their job loss. More than one-half of these students were 35 or over when they enrolled in school.

We find that older displaced workers participate in community college schooling at significantly lower rates than younger displaced workers. This evidence suggests that

---

providing vocational education to their students (Freeman, 1974; Grubb 1993; Kane and Rouse 1999; Jacobson, LaLonde, and Sullivan 2003).

[3] This paper adds to the literature on the returns to community college schooling by reporting impacts for students who are on average 43 years old and therefore much older than community college students

older workers do not expect to benefit as much from retraining. However, among those who do participate, the per-period impact of community college schooling on subsequent earnings is comparable for older and younger displaced workers. Moreover, these gains are comparable to those reported in the literature for schooling acquired by children and young adults. In addition, we find that these gains persist and show no sign of depreciating. Indeed, it is more likely that these gains will appreciate over time as the follow-up period lengthens.

These results on community college retraining indicate that old dogs can learn new tricks. But when we consider the differences among displaced workers' remaining work lives and in their opportunity costs of retraining, we find that the social internal rates of return from investments in retraining are likely smaller for older displaced workers than for their younger counterparts. As we discuss below, whether policy makers should teach old dogs new tricks depends to a considerable extent on how we measure the opportunity costs of retraining.

An important caveat to our findings is that we must "cope" without the benefit of an experimental design (Ashenfelter, 1978, p. 47). In his seminal evaluation of the Manpower Development and Training Act (MDTA) program, Orley Ashenfelter observed that providing evidence that econometric methods replicate the results of a social experiment that used randomized trails was important in producing credible estimates of the impacts of training programs. To produce this evidence, he introduced into the training evaluation literature the practice sometimes referred to as "backcasting"--examining whether training appears to affect outcomes before it occurs (Ashenfelter

---

studied elsewhere. See Grubb, 1993a,b; Kane and Rouse, 1995, 1999; Leigh and Gill, 1997)

1978; LaLonde 1986; Heckman and Hotz 1989; Angrist and Newey, 1991; Heckman, LaLonde, and Smith, 1999).

Although backcasting cannot indicate conclusively whether non-experimental estimates replicate those from an experiment, Ashenfelter argued that this exercise "may serve as a signal of serious problems with the maintained hypotheses (associated with the underlying econometric model)." (Ashenfelter, 1978, p. 51). Because our Washington State sample of displaced workers contains both a large number of trainees and comparisons and covers many time periods both before and after training, we can perform similar checks with our data. These checks indicate that, despite our rich econometric specification, our model may still be misspecified. Therefore, our estimates may be subject to bias. However, we argue that our backcasting evidence suggests that we are no more likely to have overstated than we are to have understated the impact of retraining. Indeed we have some evidence that our estimates of long-term impacts, especially for older displaced workers, maybe too low.

The rest of this paper is organized as follows: We present a framework for interpreting estimates of the impact of community college schooling in section II. In Section III, we introduce our data and discuss the characteristics of our samples of older and younger displaced workers. The empirical relationship between displaced workers' age and measures of participation in community college schooling is presented in Section IV. In Section V, we present our econometric model and introduce several alternative specifications of the impact of community college schooling. In Section VI, we present our main empirical results along with the results from two extensions of our model. These extensions include consideration of the impact of different types of schooling on

earnings and the results of the backcasting specification test. Some discussion and concluding remarks follow in Section VII, here we also present some alternative calculations of the net-benefits and internal rates of return from investments in community college schooling.

II. A Model of Community College Participation

Motives for enrolling in community college schooling following job loss vary. Individuals may enroll to enhance their skills. Their decision to invest in more schooling depends on its impact on future earnings, their rate of time preference, the time remaining in their work lives, and the direct and indirect costs of going to school. Besides the human capital motive, individuals also may enroll in school in order to facilitate their search for a new job (Heckman, LaLonde, and Smith, 1999). Both exposure to new skills and to new networks may facilitate their job search. Finally, some schooling may constitute consumption. During a period of unemployment, the cost of acquiring such schooling might be especially low. These differing motives affect the likely impacts of community college schooling on individuals' earnings.

The human capital motive suggests one framework for assessing the relationship between a person's age, their decision to enroll in school, and the average impact of such schooling for those who choose to enroll (Heckman, LaLonde, and Smith, 1999). For purposes of illustration, we characterized the decision to enroll in retraining by the following simple formulation of the benefits and costs of schooling:

$$(1)\quad \delta_i \left(1 - (1/(1+r))^{N_i}\right)/r \; - C_i > 0.$$

In (1), the term δ_i denotes the per-period impact of retraining on person i's annual earnings. The subscript i indicates that the impact of schooling varies among individuals in the population. We assume that these impacts are drawn from a probability distribution $F(\delta_i)$. The term $(1 - (1/(1+r))^{N_i})/r$ is the present value of \$1 paid annually to an individual annually for N_i years, where N_i denotes the number of remaining years in their work life, and r is the real interest rate. C_i denotes the costs of schooling. These costs include both the direct costs of schooling, such as tuition, supplies and transportation, as well as the opportunity costs of schooling connected with spending less time working or searching for a new job. This formulation may be modified in the conventional way to account for the possibility that the impact of schooling either depreciates or appreciates over time.

This framework implies that if the distribution of per-period impacts is the same for all displaced workers, and the cost of participating in retraining is comparable or larger for older persons, then older displaced workers are less likely to enroll in school following the loss of a job. However, among those who enroll, the per-period impact of this schooling is likely to be larger for the older trainees than it is for their younger counterparts. Older workers are less likely to enroll in schooling because they have fewer remaining years left in their work lives and because they likely face higher opportunity costs of schooling due to their higher foregone earnings. However, because of these factors, given that they enroll, the average impact of schooling must be larger in order to offset their shorter remaining work lives and possibly their higher opportunity costs of retraining. Therefore, even if older workers learn as efficiently as younger workers (i.e. their draw of δ_i comes from the same distribution) the decision process summarized by (1) implies that we may find that community college schooling has a greater per-period

impact on the earnings of older trainees than on the earnings of comparable younger trainees.

The possibility that older workers do not learn as efficiently as younger persons does not necessarily change the foregoing result. Suppose we assume that the impact of a unit of schooling for an older worker is less than it is for a younger worker in the sense that $F^{old}(\delta_i) > F^{young}(\delta_i)$. Under these conditions, even though in a random sample of older workers few expect large earnings gains from schooling, it is still the case that the average impact of schooling among those who enroll in school is likely to be larger for older than for younger trainees. If older workers also have higher costs of attending school, this result is reinforced.

Therefore even if older individuals in the population do not learn as efficiently as younger individuals, among workers who choose to become trainees, we expect that, under reasonable conditions, the average impact of schooling should be larger for older trainees than it is for younger trainees. Instead, differences in the distribution of impacts for older and younger displaced workers should manifest themselves in differences between older and younger displaced workers' participation rates in retraining (cf. Heckman and Honoré, 1990). If older workers do not learn as efficiently as younger workers, a smaller percentage should enroll in school in the first place. But this lower enrollment rate does not imply that we should estimate that the average impact of schooling among those who enroll is smaller for older workers than for younger workers.

The foregoing framework does not capture an important dimension of displaced workers' decisions to enroll in community college schooling. As we observe in the next section, displaced workers decide not only whether to enroll but also how much training

to acquire. The above framework makes sense if community college consists of one course. In fact, degree and certificate programs require students to complete many courses. The problem with the framework as stated is that as long as it makes sense to enroll in community college, it makes sense to enroll and complete as many courses. However, we do not observe this behavior in our data. Most displaced workers who enroll in community college courses complete only a few classes. One modification to our framework that is consistent with this pattern of behavior is to allow for the possibility that impacts are concave in number of credits completed or that the costs are convex in the number of credits completed.[4] We explore the former possibility in our empirical work below.

III. Administrative Earnings and Community College Data

A. The Benefits of Administrative Data in Studies of Retraining

The value of large longitudinal databases like the one that we use in this paper has been long recognized in the training evaluation literature. Ashenfelter's study of the 1964 MDTA cohort began a long tradition among U.S. academic evaluators of using longitudinal administrative data to evaluate employment and training programs (Ashenfelter, 1975,1978; Heckman and Robb, 1985, Heckman, LaLonde, and Smith, 1999). In his study, Ashenfelter merged annual administrative earnings data from the Social Security Administration to the administrative records from the MDTA program.

[4] The possibility that there are fixed costs associated with attending school during any given quarter also does not address the foregoing shortcoming of (1). The presence of fixed costs of attending school makes it more likely that those who enroll complete many classes. Suppose that older workers face higher fixed costs associated with their participation in school. In this case we expect that among those who enroll, older workers complete more classes than their younger counterparts. However as we show below, this prediction is inconsistent with the participation patterns observed in our data. Our data suggest that, all other things equal, the fixed costs associated with acquiring retraining are relatively small and similar for older and younger workers.

This merged data set contained relatively large samples of trainees and of comparison group members. Each observation in his data set contained annual earnings for more than 5 years prior to and 5 years after the year of training.

Ashenfelter observed that such administrative data addressed two key problems that arose when estimating the effect of training and informing public policy discussions of the merits of these programs as social investments. (Ashenfelter, 1978, p. 47) First, because public investments in these programs are usually relatively small on a per-person basis, we expect that training should have small impacts on annual earnings and hourly wages. The task of precisely measuring these expected small impacts are complicated because outcomes of interest, especially earnings, exhibit high variance in the population, even for the subset of the population likely to participate in training. Administrative data address this problem by allowing researchers relatively inexpensive access to the outcomes for large samples of trainees and non-trainees.

The second problem that Ashenfelter identified arises because these programs when successful have benefits that should accumulate over a long period of time. Estimates of the impact of training in the short-term likely provide an incomplete picture of the impact of these programs. It may be that even successful programs appear to have little or no effect during the first year or two after the program ends. Unfortunately, it is usually expensive to locate and survey training participants over long periods of time. Administrative data provide a relatively inexpensive way to follow trainees and non-trainees for relatively long periods before and after training.

B. The Washington State Administrative Data

Our sample is drawn from the records of all persons who lost jobs in Washington State and who filed a valid claim for unemployment insurance (UI) benefits.[5] To construct our sample we used three sources of administrative data:

(1) Unemployment insurance claims records from 1990 to 1994

(2) Quarterly wage records covering 1987 to 2000

(3) Community College transcript records covering 1989 to 1996.

We matched these three sets of administrative records using individuals' social security numbers. From the unemployment insurance claims records, we identified the quarter of workers' job loss. These records also include a modest set of demographic characteristics taken from individuals' application for unemployment insurance benefits, including birth year, race, gender and prior education. From the wage records, we obtain information about workers' quarterly earnings in jobs covered by the state UI system, their job tenure at separation, and for each calendar year their primary employer's 4-digit SIC code and county. Individuals' earnings when they were self-employed or when they work outside Washington State are not reflected in these records. The community college records contain information on the credit and noncredit courses that displaced workers enrolled in, when and where they enrolled, and the grades that they received in courses taken for credit.

In this study, we limited this sample of UI claimants in two important ways. First, our sample consists only of workers who had three or more years of job tenure when they

[5] These data differ from those used in an earlier paper (Jacobson, LaLonde, and Sullivan, 2003.) In this paper we have obtained an additional five years of quarterly earnings histories. Because we study only individuals who remain attached to Washington State's wage and salary workforce throughout the sample period, the longer sampling frame implies that we study a smaller number of displaced workers. See

were permanently laid off. We excluded "low-tenure" displaced workers, because public policy has been most concerned about the long-term consequences of job loss by experienced workers (Jacobson, LaLonde, and Sullivan, 1993b).

Second, our sample consists only of workers who had a history of strong attachment to Washington State's workforce.[6] We defined attached workers to be those who never had more than 8 consecutive quarters between 1987 and 2000 during which they had no earnings or were not enrolled in community college courses. We use this definition of attachment, because many workers, including those enrolling community college courses, never have positive UI covered earnings after they lose their jobs (Jacobson, LaLonde, and Sullivan, 2000). Because of the numbers of individuals involved, we believe that it is unlikely that all these individuals actually had no earnings. When we include them back into our sample, our estimate of the impacts of community college schooling, especially from courses teaching less quantitative subject matter becomes smaller for both older and younger displaced workers.

The sample that we use in this paper contains more than 65,000 individual observations.[7] Approximately, 10,400 of these displaced workers enrolled in and completed at least one community college course around the time of their job loss. At that time, about 50 percent of these workers were 35 or older. This group constitutes our sample of older trainees. The remaining 54,900 workers in our sample lost jobs during the same period, but never completed any community college courses. These individuals

---

discussion in text and in Appendix A on how we constructed our sample.

[6] See Appendix A for discussion of how we limited our samples to individuals who remained attached to the state's workforce.

[7] The number of individual observations in the sample used in this paper is smaller than the sample used in an earlier paper on the returns to community collect schooling, which had shorter period of follow-up data. Because we require every sample member to remain attached to the State's work force, we lose more

constitute the comparison group in our analysis below. In our study, we can follow some trainees' earnings for more than 10 years after they leave community college. We also have as many as eight years of pre-training earnings histories for some workers in our sample.

C. Characteristics of the Trainees and Comparisons

In this paper, we focus on the impacts of community college schooling on displaced workers who were 35 or older when they lost their jobs. We compare these impacts to their counterparts who were less than 35 when they were displaced. To estimate these impacts, we must control for differences in their underlying attributes that also influence their decisions to enroll in community college courses, their decisions complete either a few or many courses once enrolled, and their subsequent employment prospects.

Table 1 reveals that displaced workers who are retrained differ in several ways from their counterparts in the comparison group. Among both older and younger displaced workers, community college participants are better educated, more likely to be white, and to be displaced from the aerospace industry than displaced workers in the comparison group. Among the older males we see that community college participants also are more likely displaced from the state's wood products industries.

Their higher levels of educational attainment suggest that the trainees are more skilled than the comparisons. But, as shown in at the bottom of Panel A of Table 1, we find that the average pre-displacement earnings of both the older and younger trainees are similar to their respective comparison groups. This surprising result does not arise

---

observations when we move to a sample containing longer follow-up data. See Jacobson, LaLonde, and Sullivan, 2003.

because the trainees tend to be younger than the comparison group members. As shown by the first row of the table, the average age of the four groups of trainees do not differ by more than one year from their corresponding comparison group. Thus, while trainees are better educated than other displaced workers, they are not necessary representative of the population of displaced workers with similar levels of education. This evidence underscores the potential importance of controlling for individuals' skills, including the loss of skill associated with the loss of a job. An explanation for these participation patterns is that those with schooling beyond high school are more familiar with the demands of and types of courses offered by community colleges. This explanation is consistent with anecdotal evidence that workers displaced from aerospace and wood products were encouraged to participate in retraining (Jacobson and Sullivan, 1999). This explanation suggests that it might be differences in information about retraining opportunities rather than differences in skills, that influence who enrolls in community college courses.

Another factor that may influence displaced workers' participation decision is the prevailing condition of their labor market. Individuals whose job search prospects are poor may choose enroll in retraining because their opportunity costs are low. As shown towards the bottom of Panel A, our results on this point are mixed. Our two measures of local labor market conditions, the county unemployment rate and rate of employment growth, do not reveal any differences between trainees and comparisons.

By contrast, our measure of labor market conditions in displaced workers' prior (2 digit SIC) industry is different for trainees and comparisons. Trainees appear to be displaced from industries that have had slower employment growth than have their

counterparts in the comparison group. This difference suggests that the trainees may be more likely to change industries as a result of their job losses and as a result expect larger earnings losses from displacement (Jacobson, LaLonde, and Sullivan, 1993a; Neal, 1995). We explicitly account for this possibility in our empirical work below.

D. Differences Between Older and Younger Displaced Workers' Characteristics

The background characteristics of displaced workers indicate that older displaced workers are more skilled than their younger counterparts. These differences suggest that their incentives to invest in new skills also may differ. By construction, the older displaced workers have more labor market experience. As shown by the first row of the table, the difference in ages between older and younger displaced workers is about 14 years for both males and females. This difference suggests that the older displaced workers have about 14 fewer years remaining in their work lives. This difference should reduce their incentives to invest in new skills even if the per-period impact of this retraining on their earnings is that same as it is for younger workers.[8]

In addition to their greater labor market experience, older displaced workers are better educated and have accumulated more tenure with their prior employers than younger displaced workers. Comparing columns 1 and 3 for males and columns 5 and 7 for females, we see that the percentage of older trainees with at least some college education is about 12 and 4 percentage points, respectively, more than the corresponding percentages for younger trainees. More striking, the percentage of older trainees that had

[8] Using the average ages given in Table 1, and a 4 percent real discount rate, this difference of 14 years implies that, even if the per-period impact of schooling for older and younger workers is the same, the present discounted value of these impacts over the two groups remaining work lives is about 30 percent higher for the younger group.

accumulated 6 or more years of tenure with their prior employer is about double the percentage for younger trainees.

This evidence on skill is consistent with the differences in older and younger displaced workers' pre-displacement earnings. Prior to job loss, older male trainees earned about 30 percent more and older female trainees earned about 15 percent more than younger trainees. To the extent that the impact of training is larger for more skilled workers, this evidence suggests that at least for our sample the average impact of training could be higher among older workers than their younger counterparts. Therefore, we should keep in mind that in our sample the older displaced workers could be more efficient learners than the younger displace workers.

Evidence from displaced workers' baseline characteristics and quarterly earnings indicates that job loss is more costly for older displaced workers than it is for younger displaced workers we illustrate this point using average quarterly earnings for those individuals who were displaced in 1991. As shown at the bottom of Panel A of Table 1, despite earning substantially more prior to displacement, after displacement, older displaced workers earn about the same amount as their younger counterparts. This point is seen more clearly in Figures 1 and 2. In Figure 1, we see that 10 years after displacement, the earnings of younger displaced workers have returned to their pre-displacement levels. But in Figure 2, we see that the earnings of older displaced workers remain well below their pre-displacement levels. Because older workers experience larger earnings losses and workers' decisions to enroll in retraining likely depend on the size of these losses, in our empirical work below we allow the impact of displacement to vary by age.

E. Participation Patterns in Community College

As expected from the human capital framework, older displaced workers participate in retraining at lower rates than their younger counterparts.[9] As shown by Panel B, about 11 percent of older male workers enroll and complete at least one community college course around the time of their job loss, whereas the participation rate for younger male workers is nearly 17 percent. The gap between the participation rates of older and younger women is similar, although both groups of displaced women participate in retraining at higher rates than displaced males.[10]

The differences between older and the younger displaced workers' participation patterns are less striking when looking at the amount of training completed among those who completed at least one community college course. As shown by the second column of Panel B, older male displaced workers among this group completed about 27 credits. Under the Washington State quarter system each class is worth five credits and one academic year consists of 45 credits. Therefore, on average the older male community college participants completed a little less than 2/3 of an academic year of schooling. The younger males completed only 8 percent more schooling, and their female counterparts completed about 17 percent less schooling.[11] Based on the findings reported in the voluminous literature on the returns to schooling, we expect that if displaced workers

[9] This pattern of participation by age is consistent with statistics from the Current Population Survey. In the October 2000 supplement, nearly 12 percent of males and nearly 14 percent of females between 22 and 34 years reported they were enrolled in school. Nearly all of these persons were enrolled in post-secondary schooling. By contrast, only about 2 percent of males and nearly 4 percent of females between 35 and 54 reported they were enrolled in school (US Census, 2001).

[10] In other work, we find that even after controlling for the baseline characteristics shown in Table 1, including pre-displacement earnings, women are about 50 percent more likely than men to enroll in community college courses around the time they lose a job (Jacobson, LaLonde, and Sullivan, 1999). This pattern of participation in schooling, is consistent with recent trends in college attendance among teenagers and young adults (Jacob, 2001).

[11] The differences between the number of community colleges credits completed by older and younger

community college schooling has the same impact as other schooling, this level of participation would be associated with about a 5 to 7 percent increase in earnings (Card, 1999; Heckman, Lochner, and Todd, 2003).

As indicated by the sample standard deviations in completed credits, the variation in the number of completed credits is similar among all four groups of community college participants. Some of our estimates below rely on this variation in the data to identify the impact of community college schooling. But looking across Panel B, we observe that older trainees are less likely to go beyond the first course. About one-third of older displaced workers who participate in retraining around the time of their job loss complete only one course. As a result, older trainees are less likely to complete 5 or more courses (21 or more credits) than are younger trainees. For males and females the differences are 6 and 7 percentage points, respectively. This difference is consistent with diminishing returns in completed credits. Because older trainees face shorter remaining work lives, the present value of completing additional classes is less than it is for younger trainees. Below we explicitly check whether there is evidence in these data of declining impacts of community college credits.

Some researchers argue that community college has significant payoffs only if participants complete programs or receive degrees (Hollenbeck, 2002). If this is really the case, then because most participants complete only a few courses, our data indicate the community college retraining does not benefit most displaced workers. The figures in Panel B reveal that unless the returns to completing a large number of credits are exceptionally large, in order for community college retraining to be beneficial on average, it must be the case that trainees' earnings improve even if they complete only a

---

male and female participants are statistically significant at conventional levels of statistical significance.

few classes. Therefore, in our empirical work below we focus on the relationship between community college credits and earnings rather than the relationship between completion of community college programs and earnings.

Our administrative data reveal not only how much schooling displaced workers complete but also in the content of their courses. As shown by Panel B, somewhat more than one-half of the credits completed by both older and younger males are in academic and vocational courses teaching more quantitatively oriented material or in courses in health occupations or the trades. In our discussion below, we refer to these classes as Group 1 courses. All other community college courses we refer to as Group 2 courses. (See Appendix A.) Among females the pattern of completed courses is different. Only about one-third of the completed credits are in classes teaching Group 1 subject matter. This pattern is identical for both for older and younger female participants.

A final point about participation emerges from the temporal pattern of earnings of the 1991 cohort of displaced workers presented in Figures 1 and 2. Displaced workers who concentrate in Group 2 subjects are less skilled than their counterparts who concentrate their retraining in Group 1 subjects. In the pre-displacement period, Group 2 concentrators earn less than the Group 1 concentrators or the comparison group members. By contrast during this period the earnings of Group 1 concentrators and the comparisons are approximately the same. This evidence indicates that the enrollment decisions of displaced workers depend on their prior skills and that this consideration is especially important when considering separately the returns to Group 1 and to Group 2 courses.

IV. Participation in Community College Schooling by Age

As implied by the human capital framework described in Section II, our sample reveals that older displaced workers in Washington State were less likely to enroll and complete community college courses than were younger displaced workers who were under 35 years when they loss their jobs. To explore further the relation between age and participation in our sample, we decomposed the total schooling acquired by displaced workers into three measures of participation: (A) the probability of enrolling in community college, (B) the probability of completing at least one course given enrollment, and (C) the number of credits completed.[12] We consider separately the relationship between age and each of these measures of participation, using a step function for age that allows for 8 separate age intervals. We also examine these relationships after controlling for several individual and pre-displacement job characteristics using OLS. These characteristics are summarized in Table 1 and include the three measures of labor market conditions and earnings during the year prior to job loss. We report our results from this analysis in Tables 2a and 2b, showing only our estimates for age.

As shown by the first column of Table 2a, the number of community college credits completed by male and female displaced workers decline nearly monotonically with age. In the second column, we see that participation-as defined as completing one or more courses-also declines monotonically with age. These results indicate that within our broadly defined categories of older and younger displaced workers, participation as

[12] Heckman and Smith (1998) use a similar decomposition to examine the determinants of training participation in programs operated under the Job Training Partnership Act.

measured by credits completed or by attending and completing at least one credit declines with age.

The results in the last three columns of Table 2a indicate that the reason older male displaced workers complete less training than younger males is that they are less likely to enroll in courses in the first place. However once they enroll in a course, they are almost as likely to complete at least one class and given that they complete one class, except for the very youngest and oldest age groups, they on average complete nearly the same number of credits.[13]

Finally, the results in Table 2b show the relationship between age and participation after roughly holding constant foregone earnings or the opportunity cost of retraining. Among the characteristics we control for in this analysis are an individual's prior tenure and prior industry, which are likely related to the expected long-term earnings losses associated with their displacements (Jacobson, LaLonde, and Sullivan, 1993a). These variables along with schooling, prior earnings, minority status, gender, and region of the state also are likely predictors of post-displacement earnings.

As shown by Table 2b, the relationship between age and participation is not altered significantly if we control for these characteristics. If we have ruled out differences in opportunity cost of retraining by age, the age-participation relationship might then reflect (A) the shorter remaining work lives of older workers or (B) that the impact of schooling is less for older displaced workers.

[13] As shown by the bottom half of Table 2a, these patterns also hold for female displaced workers. But there are some modest differences in the results. First, among enrollees, older women are somewhat less likely to complete courses. Second, among those who complete at least one class, women 50 and over complete one to two fewer courses (or 5 to 10 credits) than women under 50.

The results in Table 2b might indicate that holding education constant, older displaced workers are less.

When older and younger workers have the same prior education and earnings, as is the case in the analysis in Table 2b, it may imply that the older displaced workers possess an unobserved attribute that makes them less productive. Otherwise why would older workers with more labor market experience earn the same as otherwise observationally similar younger workers? This finding suggests that in a sample of displaced workers, age could be correlated with this undesirable attribute. To the extent that workers with this attribute are less effective learners (i.e. a lower value of δ_i), we expect age to be associated with lower propensities to enroll in training.

V. Econometric Model

To estimate the impacts of community college schooling on the quarterly earnings of displaced workers, we use an econometric model developed in another paper (Jacobson, Sullivan, and LaLonde, 2003). Our framework takes advantage of the long longitudinal earnings histories that we have available to control for some of the standard concerns raised in the schooling and training literature about unobserved heterogeneity. It also accounts for several of the issues that we discussed above when considering the incentives for displaced workers to enroll in community college retraining. In particular, our model includes a rich specification of the temporal impact of displacement on worker's earnings (Jacobson, Sullivan, and LaLonde, 1993a). The magnitude and temporal pattern of these impacts should relate to the opportunity cost of retraining, and consequently influence workers' decisions to enroll in community colleges courses. Thus, we expect when evaluating training and schooling interventions for displaced

workers it may be important to control for the pattern of earnings losses associated with displacement.

In the next section of this paper, we report estimates based on the parameters in several statistical models of the following general form:

(1) $y_{it} = \tau_{it}(c_i, f_i, l_i, z_i) + X_{it}\beta + \delta_{it}(s_i, z_i) + \alpha_i + g_{it} + \gamma_t + \varepsilon_{it}$.

According to (1), workers' quarterly earnings, y_{it}, depend (A) on the community college schooling that they obtained, $\tau_{it}(c_i, f_i, l_i, z_i)$, which depends on the number of credits completed, c_i, the first and last quarters individuals are enrolled in school, f_i and l_i, and on personal characteristics, z_i; (B) on observed characteristics that vary with time, which in this paper are age, age squared and interactions of these variables with race and gender, and the county's unemployment rate and employment growth; (C) on the temporal pattern of the effects of displacement $\delta_{it}(s_i, z_i)$, which depends on the time elapsed between time t and the time of displacement s, on personal characteristics, and on county unemployment rates and employment growth at the time of job loss, and on changes in statewide employment during the pre-displacement year in workers' (2 digit) industry;[14] (D) on unobserved individual fixed-effects and worker-specific time trends,[15] (E) on time effects, which we specify as a vector of quarterly dummy variables

[14] The recent program evaluation literature indicates that it is important to compare trainees and comparisons from the same or similar labor markets (Heckman, Ichimura, Smith, and Todd, 1998; Heckman, LaLonde, and Smith, 1999; Smith and Todd, 2003). In this paper, we allow earnings to vary according to the quarterly unemployment rate and rate of employment growth in the county of the worker's employer. We also allow the temporal pattern of the displacement effects to vary by the unemployment rate and employment growth during the year prior to job loss, by the statewide change in employment in the worker's 2 digit industry prior to their job loss. We also allow the pattern to vary by whether the worker is from the Seattle-Tacoma SMSA, from one of the state's other smaller MSAs, or from a rural county.

[15] In Jacobson, LaLonde and Sullivan, 2003 we compare estimates that control only for fixed effects with those that also account for worker-specific time trends. We found that the estimated impact of community college schooling is smaller when we leave out worker-specific time trends. This results because our estimates of Group 2 are significantly affected by these trends. By contrast, our estimates of the impact of Group 1 courses do not depend much on whether we accounted for these trends. This evidence suggests to

for each quarter covered by our data; and (F) on other time varying unobserved characteristics characterized by an independent and identically distributed disturbance.16

The schooling effect, $\tau it\ (ci,.\ ,\ fi\ ,\ li\ ,\ zi\ )$, includes parameters that measure how schooling affects earnings when individuals are in school and after they leave school. When displaced workers enroll in community college courses, we expect that schooling may cause them to forego earnings, and that these foregone earnings losses are proportional to number of credits completed. However, we also allow for economies of scale in classes taken. Therefore, we specify the impact of schooling on earnings during the schooling period as follows:

(3) $\tau_{it}\ (c_i,\ f_i\ ,\ l_i\ ,\ z_i\ ) = \psi + \kappa\ c_i\ /(\ l_i - f_i + 1)$, if $f_i \leq t \leq l_i$,

where ci /(li - fi + 1) is the average number of credits completed per quarter while enrolled in school. In the empirical work below, we also allow the parameters in (3) to vary according to workers' age and gender.

After displaced workers leave school, we allow the impact of retraining to vary with time since leaving school. To capture the temporal pattern of these impacts of schooling, we consider four specifications. First, we include a vector of more than 40 parameters, one for each post-schooling quarter, which measures the amount that community college participation affects earnings during each quarter after leaving school. We represent this specification as follows:

(4a) $\tau it\ (ci,.,\ fi\ ,\ li\ ,\ zi\ ) = \tau 0t\ I(t - li\ ),$ if $li < t$.

In (4a), I(t - li) is a dummy variable equal to one when the current period is t - li periods after the last quarter of community college. This specification corresponds to

---

us that the participation process into Group 1 and Group 2 courses is different.

conventional dummy variable specification widely used in evaluations of government job training programs (Ashenfelter 1978; Heckman, LaLonde, and Smith, 1999). In our empirical work, we allow the vector of $\tau 1t$ parameters to take on different values for old male, old female, young male, and young female displaced workers.

Second, we capture the impact of community college through the number of completed credits. We allow for the possibility that during any given quarter the impact of community college credits on earnings is not proportional to the number of credits completed. In this alternative version of (4a), the impact of credits on earnings in any given post-schooling quarter, $t - li$ is given by $\tau 0t + \tau 1tci$. To implement this idea, we include in (1) an additional vector of variables that are the interactions between the participation dummy variable at time t and the number of completed credits:

(4b) $\tau it\ (ci,., fi, li, zi) = \tau 0t\ I(t - li) + \tau 1t\ I(t - li)ci, ,$ if $li < t$.

The difference between 4(a) and (4b) is that in 4(b) we also use variation in the number of completed credits to identify the impact of schooling. This approach is similar to that used in the literature on the returns to community college schooling (Hollenbeck, 1992; Grubb, 1993; Kane and Rouse, 1995, 1999). We allow the vector of parameters $\tau 0t$ and $\tau 1t$ to take on different values for the demographic groups of displaced workers.

Both a benefit and drawback of 4(a) and (4b) is that we estimate the impacts of Community College using up to approximately 80 parameters. On the one hand, we can report in detail how completing community college credits affects the temporal pattern of individuals' quarterly earnings over a ten-year period. On the other hand, it is hard for policy purposes to convey these results succinctly. In addition, as we examine the

[16] Note that in our empirical work, we report robust standard errors for all of our estimates of the per-

temporal pattern of these impacts for different groups, the cell sizes become smaller and the precision associated with our estimates diminishes.

Therefore we also seek to summarize the short- and long-term effects of community college retraining with just a few parameters. Some experimentation led us to the following parsimonious specification that captures the impact of community college credits with four parameters:

(5) $\tau it\ (ci,,\ fi\ ,\ li\ ,\ zi\ ) = \tau 0 + \tau 1\ ci + \tau 2\ [1/(t - li\ )] + \tau 3[1/(t - li\ )]\ ci,$ if $li < t$.

In (5), the impact of completing additional community college credits in is given by $\{\tau 1 + \tau 3[1/(t - li\ )]\}\ ci,$. During the quarter after leaving school the earnings impact of completing additional credits is given by $\tau 1 + \tau 3$. Because the term $[1/(t - li)]$ gets smaller with the passage of time, the long-term impact of completing additional credits is given by $\tau 1$. Completing an additional course, usually worth 5 credits, raises long-term earnings by $5\tau 1$ per quarter.

In (5) the parameters $\tau 0$ and $\tau 2$ measure systematic earnings differences between displaced workers who complete at least one community college credit and their counterparts who either do not enroll or enroll but do not complete any courses. One interpretation of these parameters is that they are the impact of "just showing-up" and enrolling in courses. Consistent with such an effect is the idea that exposure to the community college environment facilitates productive job search. In this case, the long-term impact of community college schooling is given by $\tau 0 + \tau 1\ ci$. In our empirical work, we show how sensitive our results are to restrictions on these parameters.

---

period impact of community college schooling.

Specifications 4(a) - (5) assume that the impact of credits on earnings is affine. We discussed above the possibility that the impact of credits might decline with the number of credits completed. This possibility is consistent with the distribution of completed credits shown in Table 1B. Therefore, our fourth specification allows for a non-linear relation between credits and earnings. To implement this idea we divide the number of credits completed into six intervals based roughly on the number of individuals in the sample within each interval.[17] We represent the impact of each credit category K on earnings as follows:

$\tau itK\ (ci, fi\ , li\ , zi\ ) = \tau 1K\ I(jK< ci < j'K) + \tau 3K\ [1/(t - li\ )]\ I(jK< ci < j'K)$ if $li < t$, and $jK< ci\ < j'K$ and $K = \{1, 2, \ldots,6\}$.

When we estimate the parameters of this semi-parametric specification, we expect that individuals who complete, for instance, 11 to 20 credits should earn more than their counterparts who complete only 6 to 10 credits, who in turn should earn more than those who complete only 1 to 5 credits.

Our analysis of the data also reveals another important extension of our model. In equation (5), we treat each credit without regard to the type of course completed. But our community college transcript data also report the subject matter taught in each class. Therefore, we can measure how the impacts of schooling depend on the subject matter of the classes. Accordingly, we also extend specification (5) and define ci as a vector denoting different types of completed credits. In the most parsimonious extension of our model, we divided the completed courses into the Group 1 and Group 2 courses described above.

[17] The intervals are 0 – 5 credits, 6 – 10 credits, 11 – 20 credits, 21 – 40 credits, 41 – 75 credits, or more than 75 credits. As shown by Panel B of Table 1, the number of trainees in the first category is larger than

VI. The Impact of Community College Schooling on Earnings

In this section, we present estimates from our four specifications of the effect of community college courses. We present our results for the first two specifications in Figures 3 and 4. The estimates that we present in Figure 3 are from the "dummy variable" specification given in 4(a). These estimates are analogous to those commonly reported in the literature on government job training programs. The estimates presented in Figure 4 are the earnings impacts of completing an additional credit, 1t, as defined in 4(b), for each quarter after leaving school.

In order to summarize the results from Figures 3 and 4 with a few parameters, we next turn to the results from our parsimonious specification given in (5). We report estimates of the schooling parameters from this model in Table 3a for males and in Table 3b for females. The top panel of each table presents estimates for displaced workers under 35; the bottom panel of each table presents estimates for displaced workers 35 and older. In the odd numbered columns, we show the results for the case in which we assume the training effects are the same during each post-schooling quarter. In the even numbered columns, the coefficients associated with the labels “Post-College” and the “Credits*Post-College” variables give the long-run impacts of schooling on earnings.

To investigate the sensitivity of our estimates to alternative specifications of the schooling effect, we present, for each of the four demographic groups, results based on 6 different versions of the schooling specification given in (5). In five of these specifications, we alternatively set one or more of the four parameters in (5) to equal zero. In columns (1) and (2), we present results for the case in which we set the parameters $\tau 1$ and $\tau 3$ to be zero. This specification corresponds to the dummy variable

---

and the number of trainees last category is smaller than the number trainees in the other credit categories.

specification commonly used in evaluations of government programs. We do not use the information on the number of credits completed, but only whether a displaced worker enrolled and completed at least one community college course. One purpose of this exercise is to highlight whether it is important to use detailed program data on how much retraining participants completed. To do this we first show what we would have concluded about the effectiveness retraining had we lacked this information.

In columns (3) and (4), we present estimates when we assume that the impact of community college schooling is proportional to the number of completed credits. In this case, we set the parameters $\tau 0$ and $\tau 2$ equal to zero. This specification corresponds to other studies that estimate the impact of community college schooling on the earnings of younger students (Kane and Rouse, 1995). We present these estimates in order to compare the results from our study to estimates from previous studies of community college schooling.

Finally, in columns (5) and (6), we present the results for the hybrid specification shown in equation (5). This hybrid specification is a parsimonious version of 4(b), which produced the estimates presented in Figure 4. We find that the impact of completing another community college course is smaller when we allow for a "just showing-up" effect than it is when we set these parameters, $\tau 0$ and $\tau 2$, equal to zero as we do in columns (3) and (4). Our estimates of the "just-showing up" effects, $\tau 0 + \tau 2(1/t - li)$, in columns (5) and (6) are never statistically significant, but as we explain below, the point estimates in column (6) are relatively large. If we ignore the "just showing-up" effects and simply attribute them to unaccounted for heterogeneity, then we assume that we capture the entire long-run effect of retraining with parameter, $\tau 1$, the estimates of which

we present in column 6. This estimate is usually the most conservative estimate of the long-run impact of community college schooling shown in Tables 3a and 3b.

After presenting results from our parsimonious specification of schooling, we turn to reconsider whether the relation between credits and earnings are linear as required by (5). In Table 4, we present estimates of the semi-parametric specification of credits as described in the text above. The semi-parametric estimates presented in the four columns of the table correspond to the model (5), whose coefficient estimates we present in columns 6 of Table 3a and 3b.

A. The Impact of Community College Schooling on Quarterly Earnings

As shown by Figure 3, point estimates based on (4a) indicate that both older and younger displaced workers who participated in community college schooling subsequently experienced increased earnings in all but the first few quarters after leaving school. The lower earnings during the immediate post-schooling period suggest a transition period after trainees leave school. This evidence indicates that evaluations of the short-term impacts of human capital interventions for this population may not very valuable for policy purposes and indeed may be misleading without also considering these interventions' long-term effects. In the long-term, impacts for the older trainees are around $900 per quarter, and are about twice as large as the impacts for the younger participants.

Another important finding in Figure 3 is that the impact of community college schooling appears to appreciate over time for both older and younger displaced workers. They do not depreciate as is sometimes assumed in studies with limited sampling

frames.[18] This result is relevant for cost-benefit analyses of training programs that usually must extrapolate impacts beyond the evaluation's sampling frame (Glazerman and McConnell, 2001). The possibility of further appreciation in per-period impacts also affects our interpretation of our own cost-benefit analyses. The long-term impacts reported here are larger than those we report below based on the more parsimonious specification of the relation between credits and earnings. Since our cost-benefit analysis uses the estimates from the parsimonious specification, the results in Figure 3 suggest we could be net-benefits understating the net-benefits of retraining in those calculations, especially for older displaced workers.

Turning to Figure 4, we observe the same pattern for the earnings impact of completing an additional community college credit. We observe that the effects of community college credits start off negative, become positive within a year after leaving school, and then rise, but at a decreasing rate over the next eight years. Again, this evidence indicates that training effects do not necessarily depreciate over time, but may appreciate significantly. The idea that the impacts from classroom training might appreciate over time is consistent with the idea that those who acquire more training subsequently acquire jobs that offer more on-the-job training (Ashenfelter and LaLonde, 1997).

B. Impacts from the Parsimonious Specification

Results from the Training Program Specification

[18] Ashenfelter's study of the 1964 MDTA cohort was for many years one of the few evaluations of government training programs that followed participants for more than a few years after completing training (Ashenfelter 1975; 1978). In his study, the impacts for the male trainees (but not the females) depreciated over time. Evaluators in their cost-benefit analysis of training programs have used the rate of depreciation observed in Ashenfelter's study when projecting the pattern of future earnings gains in their studies.

We next consider impact estimates from alternative versions of our parsimonious schooling specification (5). As explained above, each of these versions correspond to a different approach to identifying the impact of retraining. We begin with estimates based on the conventional "dummy variable" specification used in evaluations of government job training programs. These results are analogous to those that we report in Figure 3, except now we report estimates separately for males and females.

The results in column (1) and column (2) of Tables 3a and 3b indicate that (A) the long-term effects of retraining are larger than the short-term effects of retraining; (B) the long-term effects of retraining older displaced workers are at least as large as those for younger displaced workers; and (C) the long-term impact of retraining amounts to about $1,500 annually for older males and to about $1,100 annually for older females. These annual impacts compare favorably to impacts reported for government training programs targeted at disadvantaged populations (Heckman, LaLonde, and Smith, 1999).

As shown by the bottom panel of Table 3a, the impact of schooling on older males' subsequent quarterly earnings amounts to only -$141.85. But, when we allow the short-term and long-term impacts of schooling to differ, the average long-term impact of community college schooling rises to $392. This impact amounts to about 7 percent of post-displacement earnings. However, on average these men completed about two-thirds of an academic year of schooling. Therefore, if we scale-up this estimate, it suggests that in the long run, one academic year of community college schooling raises older men's annual earnings by about 11 percent. This percentage compares favorably to

conventional estimates reported in the returns to schooling literature (Card, 1999; Heckman, Lochner, and Todd, 2003).[19]

Results from Return to Community College Credits Specification

The results in columns (3) and (4) of Tables 3a and 3b focus on the impact of completing community college credits on earnings (Kane and Rouse, 1995). Here, we identify the impact of community college schooling by relying on variation in completed credits among displaced workers. These impacts indicate that (A) again the long-term effects of schooling are larger than the short-term effect; (B) the impacts generated from this specification of participation in retraining are smaller than the impacts based on the conventional "dummy variable" specification; and (C) the earnings gains from completing an additional credit are about the same for older displaced workers' as the gains experienced by younger workers.

The results in the bottom panel of Table 3a, indicate that completing community college courses raises older men's quarterly earnings by $10.83 per credit. Therefore, we expect the quarterly earnings of someone who completed two-thirds of an academic year of schooling to be $292 greater than someone who completed no retraining. If we scale up this figure, it implies that one academic year of such schooling raises older males' earnings by about 8 percent.

The earnings impact associated with the community college credits specification, although still in line with standard estimates reported in the schooling literature, is less than the percentage we reported above for the conventional "dummy variable"

[19] In the schooling literature, measures of the impact of one year of schooling usually hold constant potential experience. In our analysis we hold constant age. Because of the relation between age and potential experience, all other things equal, we expect our estimates of the impact of one year of community college schooling to be somewhat smaller than the ones we would obtain if we instead held

specification. Information on the intensity of training appears to lower affect estimates of its average impact. We reached the same conclusion for both older females and younger males. Only for younger females is the impact estimate from the community college credits specification larger than the impact estimate from the conventional dummy variable specification.

Results from Hybrid Specification

Finally, in columns (5) and (6) of Tables 3a and 3b, we present estimates of specification (5) that allows participation in community college to have its own effect on earnings that is separate from the effect of additional completed credits. For older workers, the estimated earnings gains from retraining are significant and comparable to those that we obtain for their younger counterparts. For older males, completing community colleges courses is associated with a $148.10 “just showing up" effect plus an additional $8.93 impact per completed credit. We expect, then, that on average retraining raised the earnings of older males in our sample by $393 or by about 7 percent of post-displacement earnings.[20] This amount is nearly identical to the estimate we reported above for the training program specification. If we scale this estimate up to a full year of schooling this gain amounts to about 11 percent of post-displacement earnings.

Whether we believe the foregoing estimate of the impact of community college credits for older workers is credible depends partly on how we interpret the “just-showing up” effect. Although statistically insignificant, its magnitude of $148.10 suggests that enrolling in a community college course is about as valuable to the trainee as staying

---

constant potential experience.

[20] We arrive at this figure by multiplying the per credit impact of $8.93 times 27.4 credits the number of credits completed on average by older male trainees (see Panel B, Table 1) and then adding the "just showing up" effect of $148.01.

enrolled in community college and completing nearly 3 additional courses. Although we believe it is plausible that enrolling in community college courses facilitates job search, and that this benefit could raise short-term earnings, it seems less implausible that this effect could raise individuals' long-term earnings by 3 percent.

Accordingly, we believe that our point estimates of the impact of schooling are potentially biased upward if they include the "just showing up" effect. Despite our rich controls for unobserved heterogeneity and the cost of worker displacement, our estimates may be picking up unobserved differences between the trainees and the comparisons. This conjecture is consistent with our observation above that age was a very important determinant of the enrollment process. In other work, we found more generally that many baseline characteristics appeared to be significant determinants of participation (Jacobson, LaLonde, and Sullivan, 1999). By contrast, age as well as other observed characteristics are less important predictors of how many credits displaced workers completed once they enrolled. This evidence suggests to us that if a large set of observed characteristics are not that important when predicting how many credits a trainee completes, then it is plausible that other unobserved characteristics may not be that important either. Therefore, we consider our estimates of $\tau_1 c_i$, the gains from completing additional credit, in column (6), rather than $\tau_0 + \tau_1 c_i$, to be a more plausible estimate of the long-term impact of community college schooling.

Given the foregoing interpretation of our results, we conclude that community college retraining raised older male trainees' long-term quarterly earnings by an average of $241. Therefore, we expect that one academic year of such retraining would raise their quarterly earnings by about $400 or 7 percent of post-displacement earnings. This impact

for older displaced workers is in line with conventional estimates of the impact of formal schooling on earnings, but is about 30 percent less than the impact we would have reported had we relied on estimates from the conventional dummy variable specification (shown in column 2). It also is less than the impacts from the community college credit specification (shown in column 4).

The impacts of community college schooling for two of the other three demographic groups are similar. For the third group, young females, completing an additional credit is associated with about a $12 increase in quarterly earnings. This impact amounts to about 14 percent of post-displacement earnings. But as indicated by the robust standard errors, this impact is not statistically significantly different from the $9.56 impact per credit that we report for older females. Therefore, at least among displaced workers who participate in retraining, old dogs acquire new skills as effectively as their younger counterparts.

C. The Impact of Community College Schooling While In School

Besides reporting the impact of community college credits on earnings after leaving school we also report in Tables 3a and 3b their impacts on earnings while trainees are enrolled in school. The negative coefficients associated with the "In-College*Credits per Quarter" variables in all 6 specifications and for all four demographic groups indicate that being enrolled in school is associated with significantly lower earnings. One interpretation of this finding is that trainees forego earnings by delaying their return to regular full-time work.

In column (6) of Table 3a, we see that for older males enrolling and completing community college courses during a given quarter is associated with a reduction in earnings

of $275.10 for every credit completed. Therefore, we expect that an older male who enrolled in community college and completed 1 course for 5 credits to have on average $1,376 lower earnings during the quarter. Therefore, these estimates suggest that the average opportunity cost of completing one academic year of credits completed over three calendar quarters equals about $12,350.[21] Looking across the remaining columns of the table we see that these estimates of the opportunity cost of schooling do not depend on which specification we use.

If the foregoing figures measure the opportunity costs of schooling, then because their labor market earnings are the highest, we expect older males to experience the largest earnings losses associated with participating in retraining, and the younger females to experience the smallest losses. Consistent with this reasoning, our estimates in Tables 3a and 3b imply that acquiring one academic year of community college schooling reduces the earnings of older males while in school by about 22 percent more than it does for younger males, and by about 33 percent more than it does for similarly aged women. We find that the youngest women incur the smallest opportunity costs associated with enrolling in schooling. Their costs are about 44 percent less than those of older men.

According to this interpretation of the "In-College" estimates, the opportunity costs of retraining are somewhat larger than the direct costs of retraining for older males and comparable to the direct costs of retraining for the other demographic groups. Kane and Rouse report that the cost of providing a student with an academic year of community college schooling is about $8,000, of which individuals pay about one-fifth of this amount through their tuition and fees (Kane and Rouse, 1999). If we interpret our "In-College"

[21] We arrive at this figure as follows: We assume each quarter the trainees completes 15 credits. This amounts to a loss of –$4,114 per quarter (or 12.60 plus –275.10 times 15 credits), or $12,342 over three

estimates as the opportunity cost of schooling, the private cost of one academic year of community college schooling for an older male is $14,150. The social costs of this schooling is $20,350 and higher still if we also account for the welfare cost of the taxes raised to subsidized community college schooling (Browning, 1987; Heckman, LaLonde, and Smith, 1999).

Our "In-College" estimates may not measure the opportunity cost of schooling. Instead, they could reflect individuals' unsuccessful job search. As a result, they simply tell us that those who did not find jobs right away enrolled in community college courses and the least successful job searchers among the trainees complete the most classes. Under this interpretation, our "In-College" estimates overstate the opportunity cost of completing retraining and any net-benefit or internal rate of return calculations based on them are biased downward. Consequently, later in this paper, when we estimate the internal rates of return to retraining, we consider three cases: (A) we treat our "In-College" estimates as estimates of the opportunity costs of retraining; (B) we estimate the opportunity costs of schooling to be equal to one-half of the cost estimates in (A); and (C) we assume the opportunity cost of retraining is zero.

D. Evidence of Non-linear Effects of Community College Credits

Next, we examine how sensitive our results are to our linear specification of the relation between credits and earnings. In Table 4 we present estimates of the long-run impact of the indicated amount of schooling, τ_{1K}, from the semi-parametric specification of credits described above in (6). Our results indicate that (A) displaced workers can benefit from completing just a few community college courses; (B) completing many classes usually produces greater per period impacts than completing just a few classes; and (C)

---

quarters. We use this figures with computing the net benefit and internal rates of return later in the papper.

overall, there is not much evidence here of diminishing returns to completing courses. Our earlier assumption that earnings gains rise linearly with credits appears to be a reasonable, though imprecise, approximation of the relation between credits and earnings (c.f. Kane and Rouse, 1995). As shown by column (2) of Table 4, beyond two classes, older males' earnings rise monotonically with the number of credits completed. If we compare the difference between the earnings of trainees who completed 21 to 40 credits and their counterparts who completed 6 to 10 credits, we observe more than a $500 difference in quarterly earnings. Given that on average the difference between these two groups' completed schooling is about one-half a year, this impact is quite substantial in terms of percentages. But, the relation between credits and earnings is not as uniformly monotonic during the first year and one-half of schooling for other the four demographic groups. For example, as shown by column 4, older women who completed 21 to 40 credits earn about than $450 less per quarter than their counterparts who completed only 11 to 20 credits.

The results in Table 4 reveal that trainees who completed the most schooling experienced the largest earnings gains. As shown by the last row of the table, older males who completed about 2 years of schooling experienced a nearly $1,000 gain in their quarterly earnings. This gain indicates that two years of training raises older male earnings by about 17 percent. Among the other three demographic groups, the estimated earnings gains are larger. This evidence again suggests that completing two years of community college retraining can reduce much of the long-term earnings losses associated with displacement (Ruhm, 1991; Jacobson, LaLonde, and Sullivan 1993; Farber 1993, 2003).

The impacts for trainees who completed approximately two years of community college schooling also provide evidence that our assumption in (5) requiring an affine

relation between credits and earnings is reasonable. These impacts for are roughly consistent with what we would have predicted from the results reported in columns (4) and (6) of Tables 3a and 3b. The impact of $952 reported in Table 4 for older males works out to a gain of $10.58 per credit. This amount is smaller than the $10.83 figure we reported in column (4) of Table 3a, but it is larger than the estimated impact of $8.94 reported in column (6). A similar calculation for the other three demographic groups leads to a similar conclusion.[22] Therefore, we do not find any strong evidence of diminishing returns to completed credits.

E. Impacts By Content of Courses

In this subsection, we use information on course content to show that the foregoing estimated impacts mask differences in impacts by type of course. But, within our broadly defined categories of community college credits, the per-period earnings impacts of older and younger trainees continue to be similar, especially for male trainees.

To examine these differences, we extended specification (5) in earlier work to account for the nine categories of credits listed in Appendix Table A (Jacobson, LaLonde, and Sullivan, 1997). After reviewing the results, we found it helpful for expositional purposes to aggregate these categories into two groupings. As described above in Section III, the first grouping (Group 1 courses) consists of academic courses in the sciences and mathematics as well as courses teaching more technically oriented vocational subject matter, including courses in the health occupations. The second grouping (Group 2 courses) consists of all other community college courses.

[22] For younger males, this calculation implies a $11.35 per credit effect compared with the $9.09 effect reported in Table 3a; for older females a $11.87 per credit effect compared with the $9.56 effect reported in Table 3b; and for younger females. For younger females this estimate implies an effect of $11.88 per credit, which in contrast to the other three groups is about the same as the $12.13 estimate reported in Table 3b.

As shown by Table 5, we find consistent differences between the long-term impacts of Group 1 courses and Group 2 courses. But within each of these broadly defined categories of courses, the impact of schooling is similar for older and younger displaced workers. Completing a Group 1 credit increased the long-term quarterly earnings of both older and younger males by approximately $12. Among females these courses were associated with larger earnings increases, especially for younger women.

The estimates reported in Table 5 imply that completing one academic year of Group 1 courses raises both older and younger males' long-term quarterly earnings by about $550. This increase amounts to about 10 percent of older males' post-displacement earnings and to about 12 percent of younger male's post-displacement earnings. For older females, our estimates imply that completing one academic year of Group 1 courses raises quarterly earnings by $830 or by about 21 percent of post-displacement earnings. For younger females, our point estimates imply even larger earnings impacts. For women, these earnings gains suggest that completing just one year of Group 1 schooling can eliminate much of the permanent earnings losses reported associated with displacement (Ruhm, 1991; Jacobson, LaLonde, and Sullivan, 1993a; Farber 1993, 2003).

By contrast to the foregoing results for Group 1 courses, we find that completing all other community college courses has a much smaller long-term impact on earnings. As shown by the second of the last row of Table 5, the long-term impacts of Group 2 courses are about $4 to $5 per credit for all four groups of displaced workers. Group 2 courses have about 1/5 to 1/2 the impact of the Group 1 courses.[23] The figures amount to only 3 to 5

[23] We also have found that this relation between Group 1 and Group 2 courses holds among displaced workers who tend to take a majority of their courses in Group 2 subjects. Therefore, we do not interpret our Group1 and Group 2 findings as having arisen because different types of workers concentrate in these different subject areas. We note here that our econometric specification includes both fixed effects and

percent of post-displacement earnings. Moreover, these impacts are smaller than those usually reported in studies of schooling.

F. Backcasting and Interpreting Evidence of Specification Error

Our specification of the impact of community college schooling is over identified. In particular, we have assumed that completed credits do not predict earnings prior to enrolling in school. We can explicitly test this assumption, because we observe earnings for many quarters prior to the start of training. If our econometric specification is correct retraining should not appear to affect earnings prior to completing community college credits.

We examine whether training affects earnings prior to completing community college schooling during two specific pre-training periods. The first period is after displacement, but before entering school. The second period is the year prior to displacement. We included indicator variables in (5) that were equal to one when the quarter was in one of these periods and the individual subsequently completed community college credits (the "Pre-College" variable in Table 6). In addition, we included the interaction between these indicator variables and how many credits the individual completed in Group 1 and Group 2 subject areas (the interactions with the "Pre-College" variable in Table 6). Together these variables show the relation between community college attendance and completion of credits on earnings during each of these pre-schooling periods. Each column in the Table 6 corresponds to a different specification of the cost of displacement in (5).

---

worker-specific time trends. So we have accounted for unobserved heterogeneity that corresponds to these controls.

We begin our analysis of our backcasting test with column 5 of Table 6. These figures are based on the specification that we used to produce the results that we reported in Table 5. They indicate that participating in community college schooling predicts earnings prior to enrolling in school. The first set of results reveals that during the year prior to displacement individuals who completed more Group 1 and Group 2 credits tended to have earnings that were above their own expected (trend) levels. The estimated coefficients associated with the Group 1 and Group 2 credit interactions are similar for all four demographic groups. This result indicates that individuals whose pre-displacement earnings were above expected levels subsequently completed more of both types of community college courses. This finding on earnings before job loss suggests that our results in Tables 3a and 3b as well as Table 5 might overstate the impacts of retraining.

By contrast, the next set of figures in Table 6 suggests that the bias in our results runs in the opposite direction. For all four demographic groups, these estimates indicate that during the post-displacement pre-training period individuals who subsequently completed a lot of retraining had earnings that were below their expected levels. This second set of results suggests that individuals who did worse than expected after losing a job participated in more retraining. If our specification of the cost of displacement fails to capture this variation among displaced workers, then our estimates of the impact of community college schooling are likely too low.

The findings we report in Table 6 may signal that the impact estimates we report in Tables 3a, 3b, and 5 are biased. Despite our rich econometric specification there may be important sources of selection that we have failed to take into account. The two sets of results in Table 6 suggest one explanation that we explore here. Participation is especially

high among displaced workers whose earnings were above expected levels prior to their job losses and were below expected levels just after their job losses. Therefore, workers who experienced particularly large unexplained drops in earnings between the pre- and post-displacement periods tend to enroll and complete more community college schooling. If these drops in earnings reflect the permanent cost of job loss, then the estimated impacts of community college credits reported in Tables 3a, 3b, and 5 are likely too small. If we could do a better a job controlling for these earnings drops, we might be able to reduce the magnitude of the estimates reported in Table 6 and be more confident in our non-experimental estimates.

To explore the merits of foregoing contention, we examine how sensitive our backcasting test is to the way we specify the cost of displacement. The columns in Table 6 correspond to different controls for the temporal pattern of the impact of displacement on workers' earnings. In the first column of the table, we exclude all controls for the effect of displacement on earnings. In the second column, we introduce the vector of dummy variables that account for the average temporal pattern of displacement. (See Appendix B.) In column 3, we allow this pattern to vary according to workers' gender, minority status, age, prior schooling, prior tenure, and region of the state. In column 4 we allow this pattern also to vary by a worker's prior industry. In Table 1 we observed that prior industry was related to the likelihood that a displaced worker participated in retraining, and previous studies have shown that the costs of displacement vary across industries (Jacobson, LaLonde, and Sullivan, 1993a,b). Finally, in the last column, we allow this pattern to vary according to labor market conditions at the time of an individual's job loss.

Contrary to our expectation, we find that our backcasting results change little as we refine our specification of the cost of displacement. The results in the second column indicate that controlling for the average temporal pattern of the effect of displacement may matter a good deal. The coefficients, especially the variable indicating whether a displaced worker participated in community college retraining, declines in magnitude. But as we move across the columns of the table, we observe that additional controls for how the temporal pattern of the displacement effect varies among individuals has less of an impact on the results of our backcasting test. During the year prior to displacement, the results for credits change hardly at all. During the period after displacement but before school, the magnitude of the schooling credit coefficients become smaller, but these estimates still are statistically significant at conventional levels.

The results of the foregoing exercise suggest that our estimates of the impact of community college schooling probably depend on our controls for the average temporal pattern of the cost of displacement. However our impact estimates do not depend on further refinements of this specification. To check this conjecture, we reestimated (5) using the different specifications of the displacement effect described in Table 6. We present these alternative impact estimates in Table 7.

As shown by column 1 of Table 7, if we include no controls for the displacement effect, the estimated impacts of both Group 1 and Group 2 courses are smaller than we report in Table 5 (and repeat here in column 5). When we control for the average temporal pattern of the effect of displacement, our estimates are close to those that we reported above in Table 5.[24] Allowing this pattern to vary according to other

[24] The point estimates of the "just showing up" effects vary substantially across the columns Table 7, but as indicated by the standard errors, these effects are imprecisely measured.

characteristics and to labor market conditions does not substantively alter our estimates.[25] Since our specification of the displacement effect in column 5 includes more than 130 parameters, it does not seem promising to explore whether further controls would improve the results of our backcasting test or alter our results on the impact of community college schooling.

VII. Discussion and Conclusion

A. Can We Teach Old Dogs New Tricks?

In this paper, we use administrative data to examine how community college schooling affects the short and long-term earnings prospects of older displaced workers. The question that motivated our research is whether older workers gain as much from this important source of retraining as younger workers. Our analysis indicates that older workers, those 35 or over when they lost their jobs, experienced similar per-period impacts from community college retraining as younger displaced workers. For males, we find that the per-period impacts for older and younger workers are nearly identical. Even when we consider more quantitatively oriented (Group 1) subject matter separately from other community college courses (Group 2), we still find that both older and younger male trainees experienced nearly identical earnings gains from similar types of retraining.

Our findings for females are similar to those for males. We find weak evidence of larger per-period impacts for women, especially for younger women. Our point estimates of the per-period impact of the Group 1 courses are up to two times larger than the estimates we report for males. However, the standard errors associated with these estimates indicate that we can not reject the hypotheses that (A) older and younger

[25] We also explored including both leads and lags of our three labor market condition variables in our specification of the displacement effect. Our results we unaffected by this addition to our model.

displaced females experience similar per-period impacts from broader similar types of retraining; and (B) that the per-period impacts for the female trainees are the same as those of the male trainees.

Overall, we find that community college schooling raised older displaced workers' earnings by about $9 per credit. In the short-term, we find that the impact of such retraining was negative during the first year after leaving school. But this impact grew over time and showed no sign of deteriorating after 10 years. Indeed, this impact appears to be getting larger with time since leaving school, and we have reason to believe that our estimate of $9 per credit may understate the long-term effects of retraining.

Our per-period impact estimates imply that one academic year of community college retraining raises older males' earnings by about 8 percent and older females' earnings by about 10 percent. Our point estimates also suggest that if displaced workers concentrate entirely on Group 1 subjects, these percentages are about 33 percent higher for older males and about 100 percent higher for older females. These impact estimates are consistent with the earnings gains we expect from formal schooling acquired by younger persons. As a result, we conclude "you can teach (at least some) old dogs new tricks."

In section II, we argued that is reasonable to expect the per-period impacts for older trainees to be larger than for younger trainees, even if on average the population of older displaced workers consists of less efficient learners than does the population of younger displaced workers. Instead, we find that the gains for older and younger trainees are comparable. Given that older workers have shorter remaining work lives and almost certainly higher opportunity costs, this finding suggests that the distribution of impacts

among the displaced worker population not only may have a different mean, but also a different variance for older workers. Estimating the shape of these impact distributions requires stronger assumptions that we have imposed here (Aakvik, Heckman and Vytlacil 2003). But knowing the shapes of these distributions is important for policy analysis. We leave this question for future research.

We do not have the same confidence in our findings that we would have if our estimates were generated from a social experiment. As we discussed above, our specification failed the backcasting test, and this failure may signal that our impact estimates are biased. However we have found no reason to believe that our estimates are more likely to overstate than they are to understate the impact of community college retraining. Our non-experimental estimates are based on richer a specification of unobserved heterogeneity than is used in nearly all other studies of the returns to schooling, and on a rich specification of the way displacement affects individuals' short and long-term earnings prospects. We find that further controls for these displacement effects are unlikely to alter our results. If biases do remain in our impact estimates, more work is needed to model what must be a complicated selection process into retraining that likely also requires even richer data.[26]

Finally, even if we were completely confident that our non-experimental impact estimates replicated the results that we would have reported using a social experiment, our conclusions apply only to the group of displaced workers in our sample who chose to participate in retraining. The question of the external validity of our results remains. More research is required on whether our results represent the experiences of displaced

[26] Recent findings from research on this problem in other training settings underscore the difficulty of this task. (Heckman, Ichimura, Smith, and Todd, 1998; Smith and Todd, 2003).

workers in other states and at other points in time. In addition, our results do not necessarily predict the impact of retraining for Washington State displaced workers who chose not to participate or for ones who might have been induced to participate in retraining because of expanded public subsidies.

B. Should We Teach Old Dogs New Tricks?

Even without the foregoing caveats and qualifications, our results do not necessarily imply that society should subsidize or even encourage the retraining of older displaced workers. Although older and younger workers experience similar per-period impacts from retraining, the net-benefits and rates of return (IRR) from these investments are likely different.

To examine this issue more closely, we use the information from column 6 of Table 3a and 3b to compute the private and social net-benefits and the IRR from investments in community college retraining. We assume that displaced workers complete one academic year of the same mix of Group 1 and Group 2 courses as the individuals in our Washington State sample. We also assume that individuals expect to pay one-fourth of their increased earnings in taxes and that the welfare cost of the taxes raised to subsidize community college schooling amounts to $3,250 per academic year of schooling. This amount assumes that the deadweight loss associated with raising $1 in taxes is $0.50 (Browning 1987; Heckman, LaLonde, and Smith, 1999).

In Panel A of Table 8, we present the net-benefit of retraining from the perspective of the participant and of society. Here, we assume that the opportunity cost of retraining is equal to one-half the cost implied by the "In-College" effects. In Panel B, we present alternative

IRR calculations from the perspective of society. (The private IRR calculations are in a footnote, below.) We examine how sensitive our calculations are to alternative interpretations of the "just showing up" and the "In-College" effects.

As shown by Panel A of Table 8, our calculations indicate that our sample of displaced workers likely experienced substantial net-benefits from their investments in community college schooling.[27] But the (private) net-benefits of retraining are markedly larger for younger displaced workers than for older displaced workers. The benefit to cost ratios indicate that for every dollar that younger displaced workers invested in their retraining, they got back (in present value terms) between $3.07 and $5.40.[28] By contrast, the corresponding ratios for older displaced workers are smaller ranging from $1.69 to $3.05. For both groups of displaced workers, retraining seems likely to have been a sound investment. But, the differences between older and younger trainees' benefit to cost ratios provide a reason for why we find substantially lower participation rates in retraining by older displaced workers.

The results of our cost-benefit analysis of community college retraining are less impressive from the perspective of society. The difference between results for the two perspectives occurs, because community college schooling is heavily subsidized by taxpayers, and because of the welfare cost of taxation that we incorporate in our

[27] As noted above in the text, we have standardized these calculations to one academic year of schooling. As shown in Panel B of Table 1, the trainees in our sample acquired a little less than two-thirds of a year of schooling. Recall in section VI.D we found no evidence of diminishing impacts of community college credits for any of the four demographic groups. Thus, the average net benefit of retaining for our sample of displaced workers is approximately one-third less than the figures in Table 8.

[28] The private IRR are larger for younger than for older displaced workers. Assuming the opportunity cost of retraining equals one-half the amount implied by the estimated "in-College" effects, we estimate that the private IRR for younger trainees ranges from 13.1 percent for younger men to 21.2 percent for younger women. For older trainees our private IRR estimates range from 11.4 percent for older men to 15.7 percent for older women. If we alternatively assume that our "In-College" estimates reflect the opportunity cost of retraining, then our estimates range from 5.4 percent for older males to 9.4 percent for older females.

calculations. Our more conservative calculations suggest that society approximately broke even when an older displaced male worker was retrained. For older females, our results indicate that society only received a modest net benefit: for every dollar invested, it got back about $1.27 (in present value terms).29 By contrast, the benefit to cost ratios are larger for younger displaced workers, especially for younger females.

We also examine the benefits of retraining by considering alternative IRR calculations. The figures in Panel B help to underscore the policy importance of alternative interpretations of the "just showing up" and the "In-College" effects. As shown in column 4, if we assume that the opportunity cost of schooling is zero and we include the "just schooling up" effect as part of the impact of retraining, we find that the implied (social) IRR from retraining is impressive for all four demographic groups. By contrast, if we assume, as we do in column 3, that the "In-College" effects measure the opportunity cost of retraining and we assume the "just showing up" effects are not part of the impacts of retraining, then our IRR estimates are relatively low for all groups, expect younger females. Under these assumptions, our estimates imply that the social IRR from completing one academic year of schooling is only 1.4 percent for older males. However, as shown by Panel B, our IRR estimates are very sensitive to our estimate of the opportunity cost of retraining. More research is needed on whether displaced workers really forgo job opportunities when they participate in community college schooling. Despite our cautious interpretation of the IRR figures in Panel B, the 1.4 percent IRR estimate for older males underscores the importance of accounting for labor market conditions before encouraging older workers to seek retraining. Even for our sample of

[29] The benefit to cost ratios that include the "just showing up effect" are somewhat larger: 1.34 for older males and 1.49 for older females.

older displaced workers, all who voluntarily chose to participate in retraining, it does not appear to have made sense for them to delay their return to work to acquire one academic year of community college schooling. If this decision caused them to forego what our "In-College" effects suggest are about one-half of a year of earnings, then we estimate that the social IRR from their investment was likely very low. By contrast, if they attended school while trying to generate a job offer, we estimate that the social IRR from their investment may have been quite substantial, possibly as high as 11 percent.

Finally, we observe that our conclusions about the returns to retraining also are sensitive to the type of courses completed by displaced workers. So far, we have based our net-benefit and IRR calculations on the assumption that displaced workers complete the same mix of Group 1 and Group 2 courses observed in our sample. Above, we report that the types of courses that we classify as Group 1 courses had per-period impacts that were two to five times larger than the per-period impacts of the Group 2 courses. For older male workers, this difference in per-period impacts implies that the social IRR from one academic year of Group 1 courses equals about 8 percent. This figure compares favorably with conventional estimates of the internal rates of return to schooling.[30]

By contrast, the IRR from a similar investment in Group 2 courses has a negative IRR. This finding is important for retraining policy. We observed in Table 1 that about one-half of the credits completed by male displaced workers and nearly two-thirds of the credits completed by female displaced workers were in courses teaching Group 2 subject

[30] The 8.1 percent figure assumes the "just showing up" effect is not part of the per-period impact of community college schooling. When we include it in our calculation for older males, the IRR of Group 1 courses rises to 10.3 percent. We computed these percentages under the assumption that the opportunity cost of retraining equaled one-half the cost implied by the "In-College" effects. Our social IRR figures for Group 1 courses are comparable to those reported for individuals in the population who complete between 12 and 14 years of schooling. See Heckman, Lochner, and Todd (2003), Table 4. Their calculations also include consideration of tuition and tax payments.

matter. This raises the question of whether community colleges should steer older displaced workers toward Group 1 subject areas. Similarly, would programs that operate under the Workforce Investment Act or Trade Adjustment Assistance Act, which rely on a lot of community college retaining, be more productive if participants were steered away from Group 2 courses and toward Group 1 courses?

Although our findings about the benefits of Group 2 courses suggest that program operators should steer displaced workers away from these subject areas, we are cautious about making this inference from our study. In our study older displaced workers were very unlikely to complete one academic year of especially Group 1 schooling. This fact suggests to us that incentives to concentrate on Group 1 retraining were not apparent to most trainees, the opportunity costs were indeed substantial, or possibly many displaced workers were not prepared to successfully complete such retraining. In any case, it is unclear whether our IRR estimates from Group 1 courses would have been as large as indicated here, if more displaced workers had trained intensively in these subject areas. Further research should explore whether programs designed to steer displaced workers, especially older displaced workers, toward Group 1 type courses improve the performance of government workforce development initiatives.

References

Aakvik, A. J. Heckman, and E. Vytlacil (2003). "Estimating Treatment Effects For Discrete Outcomes When Responses To Treatment Vary: An Application to Norwegian Vocational Rehabilitation Programs," forthcoming, Journal of Econometrics.

Ashenfelter, Orley (1975). "The Effect of Manpower Training on Earnings: Preliminary Results," in Proceedings of the Twenty-seventh Annual Winter Meeting of the Industrial Relations Research Association 1975: 252-260.

Ashenfelter, Orley (1978). "Estimating the Effect of Training Programs on Earnings," Review of Economics and Statistics, 60, 47-57.

Ashenfelter, Orley, and Card, David (1985). ``Using the Longitudinal Structure of Earnings to Estimate the Effect of Training Programs." Review of Economics and Statistics 67 (November): 648-60.

Ashenfelter, Orley and Robert LaLonde (1997). "The Economics of Training," Handbook of Human Resources, D. Lewin, D. Mitchell, and M. Zaidi, eds., JAI Press.

Angrist, Joshua, and Newey, Whitney (1991). ``Over-Identification Tests in Earnings Functions with Fixed Effects," Journal of Business and Economic Statistics, 9(3): 317-323 (July).

Barnett, W. Steven (1993). "The Long-term Effect of Early Childhood Programs on Cognitive and School Outcomes," The Future of Children. Volume 5(3).

Barnett, W. Steven and Leonard N. Masse (199). "A Cost-Benefit Analysis of the Abecedarian Early Childhood Intervention," National Institute for Education Research.

Browning, E., (1987). "On the Marginal Welfare Cost of Taxation," American Economic Review, 77(1): 11-23.

Card, David, (1999). "The Causal Effect of Education on Earnings," In Handbook of Labor Economics, Vol. 3A, edited by Orley Ashenfelter and David Card. (Amsterdam: North Holland), pp 1801-1863.

Carneiro, Pedro Manuel and James Heckman (2003). "Human Capital Policy," National Bureau of Economic Research Working Paper, No. 9495.

Corson, Walter; Decker, Paul; Gleason; and Nicholson, Walter (1993). International Trade and Worker Dislocation: Evaluation of the Trade Adjustment Assistance Program, Final Report DOL contract No: 99-9-0805-75-071-01, Princeton: Mathematica Policy Research Inc.

Currie, Janet (2001). "Early Childhood Education Programs," Journal of Economic Perspectives, 15(2): 213-238.

Currie, Janet and Duncan Thomas (1995). "Does Head Start Make a Difference?" The American Economic Review, 85(3): 341-364.

Currie, Janet, Eliana Garces, and Duncan Thomas (2002). "Longer Term Effects of Head Start," The American Economic Review, 92(4): 999-1012.

Farber, Henry (1993). "The Incidence and Costs of Job Loss: 1982 - 1991," Brookings Papers on Economic Activity: Microeconomics, 1993(1): 73-119.

Farber, Henry (2003). "Job Loss in the United States, 1981-2001" NBER Working Paper 9707 (May).

Freeman, Richard B. (1974). ``Occupational Training In Proprietary Schools and Technical Institutes," Review of Economics and Statistics, 63:310-318.

Grubb, Norton (1993a). ``The Long-Run Effects of Proprietary Schools on Wages and Earnings: Implications For Federal Policy," Education Evaluation and Policy Analysis, 15(1): 17 - 33 (Spring).

Grubb, Norton (1993b). ``The Varied Economic Returns to Post-secondary Education: New Evidence From the Class of 1972," Journal of Human Resources, 28(2): 365-82.

Heckman, James (2001) Policies to Foster Human Capital," Research in Economics, 54(1): 3-56.

Heckman, James, and Robb, Richard (1985). ``Alternative Methods for Evaluating the Impact of Interventions." In Longitudinal Analysis of the Labor Market Data, ed. J.J. Heckman and B. Singer. Cambridge: Cambridge University Press.

Heckman James J., and Hotz, V. Joseph (1989). ``Choosing Among Alternative Nonexperimental Methods for Estimating the Impact of Social Programs: The Case of Manpower Training." Journal of the American Statistical Association 84 (December): 862-874.

Heckman James J., H Ichimura, Jeffrey Smith, and Petra Todd (1998). "Characterizing Selection Bias Using Experimental Data," Econometrica, 66(5): 1017-1098.

Heckman, James J., Robert LaLonde, and Jeffrey Smith (1999). "The Economics and Econometrics of Active Labor Market Programs," In Handbook of Labor Economics, Vol 3A, edited by Orley Ashenfelter and David Card. (Amsterdam: North Holland), pp 1865-2097.

Heckman, James J., Lance Lochner, and Petra Todd, (2003). "Fifty Years of Mincer Earnings Regressions," Unpublished working paper, University of Chicago, March 28, 2003.

Hollenbeck, Kevin, (1992). "Post-secondary Education as Triage: Returns to Academic and Technical Programs, W.E. Upjohn Institute For Employment Research, Staff Working Paper 92-10.

Hollenbeck, Kevin, (2002). "Comments on Chapter 7," in Targeting Employment Services, R. Eberts, C. O'Leary, and S. Wandner, eds., Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Jacob, Brian (2001). "Where the Boys Aren't: Non-Cognitive Skills, Returns to School and the Gender Gap In Higher Education," National Bureau of Economic Research Working Paper, No. 8964.

Jacobson, Louis, and Daniel Sullivan (1999). " Evaluation of Timber Retraining Benefits," report conducted for Conducted for the Washington State Joint Legislative Audit and Review Committee, by Westat, Inc.

Jacobson, Louis S.; LaLonde, Robert J.; and Sullivan, Daniel G. (1993a). ``Earnings Losses of Displaced Workers," American Economic Review, 83(4):685-709.

---- (1993b). The Costs of Worker Dislocation, Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research.

---- (1997). ``The Returns from Community College Schooling for Displaced Workers," Federal Reserve Bank of Chicago Working Paper, WP-97-16 (December).

Jacobson, Louis, Robert LaLonde, and Daniel Sullivan (2000). "Participation in Community College Schooling and it Effects on Displaced Workers Earnings and Employment Prospects: A Study of Displaced Workers From Washington State," Final report to U.S. Department of Labor, Employment and Training Administration, Westat, Inc., contract number K-6307-7-00-80-30.

Jacobson, Louis S.; LaLonde, Robert J.; and Sullivan, Daniel G. (2003). ``The Returns from Community College Schooling for Displaced Workers,” Journal of Econometrics, forthcoming

Kane, Thomas; and Rouse, Cecila (1993). ``Labor Market Returns to Two- and Four- year College," American Economic Review, 85(3): 600-614.

Kane, Thomas; and Rouse, Cecila (1999). "The Community College: Educating Students at the Margin Between College and Work," Journal of Economic Perspectives, 13(1,Winter): 63-84.

Karoly, Lynn, P. Greenwood, S. Everingham, J. Hube, R. Kilborn, C. Rydell, M. Sanders, and J. Cheesa. (1998). "Investing in Our Children: What We Know and Do Not Know About the Costs and Benefits of Early Childhood Intervention Programs." The Rand Institution, ED 419 621.

Karoly, Lynn, et. al. (2001). "Assessing Costs and Benefits of Early Childhood Intervention Programs: Overview and Application to the Starting Early Starting Smart Program. Santa Monica: The Rand Institution.

Leigh, Duane E. (1990). Does Training Work for Displaced Workers: A Survey of Existing Evidence, Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research.

Leigh, Duane E. and Andrew M. Gill (1997). “Labor Market Returns to Community Colleges,” The Journal of Human Resources, 32(2): 334–353 (Spring).

LaLonde, Robert (2003) “Employment and Training Programs,” forthcoming in M. Feldstien and R. Moffitt eds. Means Tested Transfer Programs in the U.S., Chicago: Unversity of Chicago Press for the National Bureau of Economic Research, 2002.

Neal, Derek (1995). “Industry-Specific Capital: Evidence from Displaced Workers,: Journal of Labor Economics 13(October): 653-677

Olds, David, et. al. (1997). "Long-term Effects of Home Visitation on Maternal Life Course and Child Abuse and Neglect: Fifteen Year Follow-up of a Randomized Trail," Journal of the American Medical Association, 27, 278(8): 637-643.

Reynolds, Arthur J. et. al. (2001). "Long-term Effects of an Early Childhoold Intervention on Educational Achievement and Juvenile Arrest: A 15 Year Follow-up of Low Income Children in Public Schools," Journal of the American Medical Association, Volume 285, pp.

Ruhm, Christopher (1991), ``Are Workers Permanently Scarred by Job Displacements?" American Economic Review, 81:1, 319-323.

Smith, Jeffrey and Petra Todd (2003). "Does Matching Overcome LaLonde's Critique of Non-Experimental Estimators?," Journal of Econometrics, forthcoming.

U.S. Census (2001). “Table 1: Enrollment Status of the Population 3 Years and Over, By Age, Sex, Race, Hispanic Origin, Nativity, and Selected Educational Characteristics: October 2000,” June 1, 2001, U.S. Bureau of the Census, web page.

Appendix A
Notes on Administrative Earnings and Community College Records

We constructed our sample of Washington State displaced workers from three administrative data bases. We received from the state the UI claims records for every worker who filed a valid unemployment insurance claim between 1990.II and 1994.IV and who had accumulated at least six quarters job tenure. We matched these data to these workers' quarterly earnings records in UI covered jobs for the period from 1987 until 2000, and to machine-readable transcripts from 25 of the state's community colleges. The community college records begin in the fall term of 1989 and extend through 1995.

In order to focus our study on displaced workers, we restricted our sample to:

(A) Adults between 22 and 60 years old at the time of their job loss
(B) Workers who had accumulated at least 3 years job tenure with their pre-displacement employer
(C) Workers who remained continuously attached to the state's UI covered work force during the 14 year period covered by our quarterly earnings records.

We defined a displaced worker as being "continuously attached" to the state's work force if she never had more than 8 consecutive quarters without UI covered earnings, except during the period following their job loss and when she was enrolled in community college courses. This restriction of our sample meant that we excluded approximately two-thirds of the available observations from our analysis.

Our review of these excluded individuals indicated that many never had positive wage and salary earnings in Washington State following their job loss or enrollment in the state's community colleges. Although many of these individuals may have moved out of state, we also found the women and older workers were more likely in this category. These individuals are generally found to have lower mobility rates or a considered "tied movers." Interestingly the participation rates in community college schooling for the displaced workers who were not continuously attached was similar to the rates we report for our sample in Table 1 in the text (Jacobson, LaLonde, and Sullivan, 2000).

The Washington State sample used in our analysis in this paper contains 65,321 displaced workers. During the period around their displacements 10,405 completed at least one community college course. Of these participants in community college schooling, 5,180, or about 50 percent were 35 or older when they lost their jobs. This sample is smaller than the one used in an earlier paper that followed displaced workers for fewer years because here we apply the "continuously attached" criteria for a longer time period (Jacobson, LaLonde, and Sullivan, 2003).

The community college transcript database included information on the type of courses completed by students. Table A lists ten major categories of community college courses. In our empirical work in the text we found it helpful to summarize our findings by aggregating these categories into two groupings.

Table A
Classifications of Washington State Community College Classes

Group 1: Quantitative or Technically Oriented Vocational Courses:
Health related courses
Technical/professional courses
Technical trades
College level science and math academic courses

Group 2: Less Quantitative Courses:
Sales/service courses
Vocational courses (not in Group 1)
Social Science/humanities academic courses
Health/PE/consumer oriented courses
Basic skills education
Other courses.

Appendix B
Specification of the Displacement Parameters

Previous research has documented the temporal pattern of the impact of displacement on workers' earnings (Jacobson, LaLonde, and Sullivan, 1993a,b). Displaced workers' earnings tend to decline during the period prior to displacement; drop sharply following the quarter of their job loss; and then rise relatively rapidly during the next few quarters before increasing at a slower rate in subsequent periods. It may be important to account for the effects of displacement in our analysis, because this pattern may be associated with individuals' decisions to participate in community college schooling.

In Jacobson, LaLonde, and Sullivan, (2003) we found that the following specification was sufficiently rich to allow for differences in the temporal pattern of displacement among displaced workers. To control for the average pattern of displacement, we defined the impact of being displaced in period s on earnings during quarter t as follows:

$$\delta_{it}(s_i, z_i) = \delta_{t-s} = \delta_k ,$$

where $k = t - s_i$. Letting $D^k_{it} = 1$ if worker i was displaced at time t - k, we write the displacement effect as

$$\delta_{it}(s_i, z_i) = \Sigma \delta_k D^k_{it}$$

In our empirical work, we allow k to range from -12, the twelfth quarter prior to job loss, to the end of the sample period, which is more than 40 quarters after displacement for some individuals.

We allow displacement effects to vary by workers' characteristics to account for the possibility that the impact of displacement is correlated with whether a worker receives community college schooling. Instead of interacting these characteristics with the full vector of displacement indicators, D^k_{it}, we found that a more parsimonious specification adequately accounts for differences between the average pattern of displacement effects, δ_k, and the pattern for workers with characteristics, z_i.

We summarize this departure from the average patterns using four variables defined as follows:
$F^1_{it} = t - (s - 12)$, if $s - 12 \leq t \leq s$ and is equal to 0 otherwise;
$F^2_{it} = (F^1_{it})^2$;
$F^3_{it} = 1$ if $s < t$, and is equal to 0 otherwise;
$F^4_{it} = 1/(t - s)$, if $s < t$, and is equal to 0 otherwise.
This specification allows the displacement effects for workers with characteristics z_i to differ from the average effect. This occurs according to a quadratic function during the twelve quarters prior to displacement, and according to the inverse of the time since displacement during the post-displacement period. The coefficient associated with the F^3_{it} term indicates the departure from the average long-term impact of displacement for workers with characteristics z_i. Therefore, the displacement effect in our econometric model becomes:

$$(2) \quad \delta_{it}(s_i, z_i) = \Sigma \delta_k D^k_{it} + F^1_{it} z_i \phi_1 + F^2_{it} z_i \phi_2 + F^3_{it} z_i \phi_3 + F^4_{it} z_i \phi_4 .$$

The vector z_i also includes labor market conditions at the time of displacement. To control for local labor market conditions, we include in the vector, z_i, the rates of unemployment and employment growth in the county during the year prior to workers' job losses. To control for prevailing conditions in worker's former industries we include the rate of employment growth in workers' two digit (SIC) industry statewide during the year prior to job loss.

Table 1: **Characteristics and Community College Participation of Displaced Workers in Washington State**

Panel A: Characteristics of Younger and Older Workers of Washington State Displaced Workers

	Males				Females			
	Under 35		35 and Over		Under 35		35 and Over	
Worker Characteristic	T[1]	C[2]	T[1]	C[2]	T[1]	C[2]	T[1]	C[2]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age at job loss	28.7	29.6	43.0	44.0	28.9	28.8	43.6	44.5
	(3.6)	(3.5)	(5.9)	(6.3)	(3.7)	(3.4)	(5.8)	(6.2)
Minority	.12	.17	.10	.13	.11	.17	.09	.14
Greater than 6 years prior tenure	.12	.13	.25	.23	.16	.15	.28	.27
Educational Attainment:								
Less than a H.S. Degree	.09	.18	.06	.12	.06	.12	.04	.12
More than a H.S. Degree	.43	.28	.55	.43	.49	.38	.53	.41
Prior Industry:								
Aerospace	.19	.11	.18	.10	.13	.09	.11	.07
Wood Products	.09	.08	.16	.07	.02	.02	.04	.02
Other Manufacturing	.24	.24	.34	.23	.14	.14	.15	.15
Region of State:								
Seattle-Tacoma MSA	.55	.55	.51	.57	.59	.60	.53	.58
Other Counties with MSA's	.13	.12	.13	.11	.12	.11	.13	.12
Rural Counties	.32	.33	.37	.31	.29	.29	.33	.30
Labor Market Conditions at Time of Job Loss:								
County unemployment rate (%)	7.04	7.20	7.31	7.06	6.94	7.00	7.09	7.04
County employment growth (%)	1.50	1.54	1.13	1.47	1.44	1.45	1.45	1.48
2 digit Industry Employment growth (%)	0.41	1.08	-0.12	1.17	1.31	1.72	1.51	2.02

Table 1: **Characteristics and Community College Participation of Displaced Workers in Washington State (continued)**

	Males				Females			
	Under 35		35 and Over		Under 35		35 and Over	
	T[1]	C[2]	T[1]	C[2]	T[1]	C[2]	T[1]	C[2]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean Earnings Prior to Job Loss:								
1 - 4 quarters before (in 000's)	$26.5	$25.7	$34.5	$33.3	$21.1	$20.5	$24.5	$23.4
	(11.6)	(12.1)	(15.3)	(17.6)	(9.7)	(10.0)	(11.8)	(13.2)
5 - 8 quarters before (in 000's)	$26.7	$26.2	$35.8	$34.5	$21.1	$20.6	$24.7	$23.5
	(11.7)	(12.4)	(14.8)	(17.5)	(9.2)	(10.2)	(11.4)	(12.6)
Number of Observations	2,936	14,560	2,371	19,342	2,291	7,462	2,809	13,552

Panel B: Participation Rates and Community College Credits Completed by Displaced Workers

				Proportion with Number of Completed Community College Credits					
All Credits:	Rate[3]	Mean[4]	Std[5]	1-5	6-10	11-20	21-40	41-75	75+
Males Under 35	.168	29.5	33.3	.27	.16	.16	.15	.13	.13
Males 35 and Over	.109	27.4	34.0	.33	.16	.16	.12	.11	.12
Females Under 35	.235	27.3	32.3	.32	.17	.15	.14	.12	.12
Females 35 and Over	.172	23.5	30.8	.39	.16	.14	.11	.10	.10

Table 1: **Characteristics and Community College Participation of Displaced Workers in Washington State (continued)**

			Proportion with Number of Completed Group 1 Community College Credits			
Group1 Credits:	Mean[4]	Std[5]	0	1-5	6-20	21+
Males Under 35	15.2	24.3	.34	.21	.23	.22
Males 35 and Over	15.3	24.9	.29	.28	.21	.21
Females Under 35	8.8	16.8	.46	.24	.18	.12
Females 35 and Over	8.4	16.0	.41	.29	.19	.11

			Proportion with Number of Completed Group 2 Community College Credits			
Group1 Credits:	Mean[4]	Std[5]	0	1-5	6-20	21+
Males Under 35	14.3	20.9	.29	.23	.26	.22
Males 35 and Over	12.2	19.8	.33	.24	.26	.18
Females Under 35	18.5	23.5	.15	.27	.30	.28
Females 35 and Over	15.1	22.4	.21	.31	.27	.21

Notes: Panel A: <1>T denotes the training groups. We define displaced workers as trainees or community college participants if they complete at least one credit. <2> C denotes the comparison group. The comparison group consists of displaced workers who either never enrolls in community college or who enroll but dropped out before completing one course. We excluded from our sample workers who completed more than three academic years (135 credits) of community college schooling. Fractions are the proportions of indicated group with the given characteristic. The numbers in parentheses are the standard deviations. Panel B: Credits accumulated in Washington State community colleges by workers displaced between 1990 and 1995. Group 1 credits are from courses that teach more quantitatively oriented vocational material, including courses training for the health occupations and the construction trades, and that teach academic math and science courses. Group 2 credits are from all other community college courses. <3> Rate is the participation rate in community college schooling around the time of workers job loss. This fraction is the ratio of displaced workers who complete at least one credit to all displaced workers in the indicated demographic group. <4> Mean is the mean number of credits completed among those who completed at least one community college credit. <5> Std denotes the sample standard deviation.

Table 2a: Participation in Community College by Age of Displaced Workers

	Credits Completed	Probability of Completing One or More Credits	Probability of Enrolling in a Credit Course	Probability of Earning Credits Given Enrollment	Credits Earned Given At Least One Credit
Males:					
20-24	6.72 (0.53)	0.182 (0.012)	0.222 (0.013)	0.013 (0.038)	12.61 (3.63)
25-29	3.87 (0.45)	0.108 (0.010)	0.132 (0.011)	0.010 (0.037)	9.99 (3.48)
30-34	2.68 (0.45)	0.071 (0.010)	0.091 (0.011)	-0.009 (0.037)	9.19 (3.84)
35-39	2.30 (0.45)	0.053 (0.010)	0.065 (0.011)	0.008 (0.037)	10.31 (3.51)
40-44	1.51 (0.46)	0.040 (0.010)	0.051 (0.011)	-0.006 (0.038)	6.67 (3.59)
45-49	1.60 (0.48)	0.038 (0.010)	0.039 (0.011)	0.047 (0.039)	8.17 (3.69)
50-54	0.97 (0.51)	0.026 (0.011)	0.031 (0.012)	0.008 (0.041)	4.87 (3.93)
55-60	0.0	0.0	0.0	0.0	0.0
Observations	39,208	39,208	39,208	6,567	5,306

Notes: Figures in columns 1 and 5 of the table are from a regression with the indicated column heading as the dependent variable and with an intercept and indicators for the age ranges shown. The figures in columns 2 through 4 are coefficients from a linear probability model with an intercept and indicators for the age ranges shown. No other controls are included in the regressions. Information on the sample is given in the text and in Appendix A. Numbers in parentheses are standard errors.

Table 2a: Participation in Community College by Age of Displaced Workers (continued)

	Credits Completed	Probability of Completing One or More Credits	Probability of Enrolling in a Credit Course	Probability of Earning Credits Given Enrollment	Credits Earned Given At Least One Credit
Females:					
20-24	10.51	0.227	0.258	0.004	21.40
	(0.72)	(0.017)	(0.018)	(0.035)	(3.19)
25-29	4.95	0.128	0.151	0.013	12.92
	(0.60)	(0.014)	(0.015)	(0.033)	(2.98)
30-34	3.30	0.081	0.099	-0.003	10.97
	(0.58)	(0.013)	(0.014)	(0.032)	(2.97)
35-39	3.21	0.071	0.087	-0.004	11.79
	(0.58)	(0.013)	(0.014)	(0.032)	(2.97)
40-44	2.83	0.061	0.074	0.004	10.95
	(0.58)	(0.013)	(0.014)	(0.033)	(2.98)
45-49	2.30	0.047	0.057	-0.001	9.99
	(0.60)	(0.014)	(0.015)	(0.034)	(3.07)
50-54	1.05	0.028	0.031	0.009	4.55
	(0.64)	(0.015)	(0.016)	(0.036)	(3.28)
55-60	0.0	0	0.0	0.0	0.0
Observations	26,113	26,113	26,113	6,156	5,099

Notes: Figures in columns 1 and 5 of the table are from a regression with the indicated column heading as the dependent variable and with an intercept and indicators for the age ranges shown. The figures in columns 2 through 4 are coefficients from a linear probability model with an intercept and indicators for the age ranges shown. No other controls are included in the regressions. Information on the sample is given in the text and in Appendix A. Numbers in parentheses are standard errors.

Table 2b: Adjusted Participation in Community College by Age of Displaced Workers

	Credits Completed	Probability of Completing One or More Credits	Probability of Enrolling in a Credit Course	Probability of Earning Credits Given Enrollment	Credits Earned Given At Least One Credit
Males:					
20-24	6.77 (0.53)	0.191 (0.011)	0.229 (0.013)	0.023 (0.035)	10.65 (3.63)
25-29	3.61 (0.45)	0.107 (0.010)	0.130 (0.011)	0.027 (0.033)	7.90 (3.44)
30-34	2.47 (0.44)	0.070 (0.010)	0.090 (0.010)	-0.005 (0.033)	7.36 (3.42)
35-39	1.95 (0.44)	0.046 (0.010)	0.061 (0.010)	0.002 (0.033)	8.48 (3.44)
40-44	0.98 (0.42)	0.027 (0.010)	0.042 (0.010)	-0.017 (0.034)	5.07 (3.50)
45-49	1.15 (0.47)	0.024 (0.010)	0.032 (0.010)	0.006 (0.035)	5.71 (3.60)
50-54	0.79 (0.50)	0.021 (0.011)	0.030 (0.011)	-0.035 (0.037)	3.78 (3.83)
55-60	0.0	0.0	0.0	0.0	0.0
Observations	39,208	39,208	39,208	6,568	5,306

Notes: See Table 2A. Figures are coefficients for the indicators of the age ranges shown in the table. All models include controls for prior schooling, prior industry, earnings in year prior to displacement, tenure on pre-displacement job, minority status, region of state, county unemployment employment growth rates, the statewide employment growth rate in the individual's prior two digit industry and quarter and year of job loss. Numbers in parentheses are standard errors.

Table 2b: Adjusted Participation in Community College by Age of Displaced Workers (continued)

	Credits Completed	Probability of Completing One or More Credits	Probability of Enrolling in a Credit Course	Probability of Earning Credits Given Enrollment	Credits Earned Given At Least One Credit
Females:					
20-24	10.30 (0.72)	0.225 (0.017)	0.258 (0.018)	0.050 (0.032)	21.15 (3.17)
25-29	4.55 (0.59)	0.121 (0.014)	0.147 (0.015)	0.028 (0.030)	12.00 (2.95)
30-34	2.92 (0.58)	0.073 (0.013)	0.094 (0.014)	0.013 (0.030)	10.18 (2.92)
35-39	2.72 (0.57)	0.059 (0.013)	0.079 (0.014)	0.009 (0.030)	11.20 (2.92)
40-44	2.32 (0.57)	0.048 (0.013)	0.067 (0.014)	-0.004 (0.030)	9.94 (2.93)
45-49	1.72 (0.59)	0.032 (0.014)	0.483 (0.015)	-0.010 (0.031)	8.57 (3.01)
50-54	0.80 (0.62)	0.023 (0.015)	0.029 (0.016)	-0.005 (0.032)	4.50 (3.22)
55-60	0.0	0.0	0.0	0.0	0.0
Observations	26,113	26,113	26,113	6,156	5,099

Notes: See Table 2A. Figures are coefficients for the indicators of the age ranges shown in the table. All models include controls for prior schooling, prior industry, earnings in year prior to displacement, tenure on pre-displacement job, minority status, region of state, county unemployment employment growth rates, the statewide employment growth rate in the individual's prior two digit industry and quarter and year of job loss. Numbers in parentheses are standard errors.

Table 3a: Impact of Community College Schooling on Male Displaced Workers' Earnings
(Estimates from alternative specifications on quarterly earnings)

Model[a]	(1)	(2)	(3)	(4)	(5)	(6)
Under 35:						
In College	347.52	429.12	353.67	400.68	347.94	417.19
	(81.85)	(81.82)	(75.90)	(75.61)	(81.97)	(81.60)
In College*Credits/Qtr	-254.71	-253.85	-256.24	-241.30	-255.86	-242.64
	(10.72)	(10.71)	(11.17)	(10.89)	(11.32)	(11.05)
Post-College[b]	-26.72	352.09			-15.46	109.04
	(66.36)	(82.34)			(78.98)	(100.85)
Post-College*1/k[c]		-976.87				-310.05
		(91.24)				(122.26)
Post-College*Credits			-0.71	10.54	-0.52	9.09
			(1.47)	(1.81)	(1.74)	(2.23)
Post-College*Credits*1/k				-27.39		-22.92
				(2.06)		(2.80)
35 and Older:						
In College	-83.31	38.78	-43.93	-7.40	-67.61	12.60
	(109.26)	(108.09)	(101.98)	(101.77)	(110.02)	(108.84)
In College*Credits/Qtr						
Post-College[b]	-285.64	-284.30	-297.45	-273.71	-295.55	-275.10
	(12.08)	(12.07)	(13.08)	(12.74)	(13.28)	(12.93)
Post-College*1/k[c]		-1379.82				-524.29
		(120.91)				(83.77)
Post-College*Credits			-4.69	10.83	-3.89	8.94
			(1.82)	(2.13)	(2.17)	(2.63)
Post-College*Credits*1/k				-38.34		-30.98
				(2.46)		(3.28)

Notes: a. Dependent variable is quarterly earnings. All models include demographic, heterogeneous displacement, and in-college controls as well as individual and period-specific fixed effects and worker-specific time trends. Robust standard errors are in parentheses.
b. Post-College is an indicator variable for whether the current quarter is after the training participant left community college.
c. 1/k denotes the reciprocal of the number of quarters after the trainee left school.

Table 3b: Impact of Community College Schooling on Female Displaced Workers' Earnings
(Estimates from alternative specifications on quarterly earnings)

Model[a]	(1)	(2)	(3)	(4)	(5)	(6)
Under 35:						
In College	232.12	289.12	265.59	295.18	227.50	263.59
	(80.27)	(79.70)	(75.33)	(75.02)	(80.65)	(79.83)
In College*Credits/Qtr	-191.86	-191.22	-190.14	-174.17	-186.68	-171.64
	(10.45)	(10.44)	(11.26)	(11.09)	(11.45)	(11.27)
Post-College[b]	-59.62	212.38			-101.41	-76.46
	(59.25)	(74.26)			(68.68)	(88.94)
Post-College*1/k[c]		-696.94				-33.86
		(67.06)				(86.89)
Post-College*Credits			0.60	11.08	2.00	12.13
			(1.59)	(1.98)	(1.84)	(2.36)
Post-College*Credits*1/k				-25.54		-24.97
				(1.57)		(2.03)
35 and Older:						
In College	190.72	257.23	196.29	217.69	194.41	232.30
	(70.39)	(69.93)	(64.45)	(64.27)	(71.17)	(70.33)
In College*Credits/Qtr	-215.10	-214.37	-218.27	-198.64	-218.23	-200.02
	(9.58)	(9.58)	(10.81)	(10.54)	(11.07)	(10.77)
Post-College[b]	-23.01	279.26			-3.74	72.13
	(57.99)	(70.73)			(66.14)	(82.65)
Post-College*1/k[c]		-779.48				-182.55
		(81.68)				(103.09)
Post-College*Credits			-1.14	10.56	-1.11	9.56
			(1.60)	(1.91)	(1.83)	(2.23)
Post-College*Credits*1/k				-28.35		-25.60
				(2.03)		(2.61)

Notes: a. Dependent variable is quarterly earnings. All models include demographic, heterogeneous displacement, and in-college controls as well as individual and period-specific fixed effects and worker-specific time trends. Robust standard errors are in parentheses.
b. Post-College is an indicator variable for whether the current quarter is after the training participant left community college.
c. 1/k denotes the reciprocal of the number of quarters after the trainee left school.

Table 4: Impact of Community College Credits on Earnings Using a Step Function for Completed Credits

	Displaced Males		Displaced Females	
Credits	Under 35	35 and Older	Under 35	35 and Older
1 – 5	226.71 (143.82)	166.41 (171.07)	-23.03 (118.97)	42.15 (103.47)
6 – 10	180.63 (169.98)	65.72 (249.23)	78.01 (148.57)	206.89 (145.24)
11 – 20	126.29 (187.71)	403.43 (221.48)	418.33 (167.14)	598.18 (170.36)
21 – 40	459.13 (179.73)	594.14 (244.32)	-256.33 (183.54)	154.38 (179.85)
41 – 75	398.16 (193.79)	715.07 (272.17)	507.48 (217.73)	348.07 (193.69)
76+	1021.92 (209.51)	924.07 (242.89)	1281.70 (228.31)	1069.35 (224.87)

Notes: The figures in the table are estimates of the long-run impact of the indicated number of community college credits on quarterly earnings. All models allow for different long-term and short-term effects of schooling. See specification (6) in text and notes to Table 3a and 3b.

Table 5: Impact of Community College Courses by Type of Credits
(Short and Long-Run Impacts of Group 1 and Group 2 Courses)

	Males		Females	
	Under 35	35 and Older	Under 35	35 and Older
In College	488.41 (81.88)	20.45 (109.39)	262.36 (79.76)	236.57 (70.14)
In College*Group 1 Credits/Qtr	-209.68 (13.34)	-256.41 (15.43)	-165.51 (20.94)	-198.15 (19.79)
In College*Group 2 Credits/Qtr	-288.70 (15.16)	-302.33 (19.59)	-174.05 (12.80)	-202.06 (13.24)
Post-College[b]	107.89 (101.08)	151.00 (126.99)	-56.10 (88.46)	77.07 (82.64)
Post-College*1/k[c]	-275.65 (122.64)	-508.65 (157.97)	-33.59 (109.45)	-183.03 (103.08)
Post-College*Group 1 Credits	12.05 (3.14)	12.39 (3.77)	23.72 (6.29)	18.48 (5.33)
Post-College*Group 1 Credits*1/k	-15.93 (3.81)	-27.28 (4.46)	-25.84 (6.58)	-26.85 (5.46)
Post-College*Group 2 Credits	5.82 (3.74)	4.16 (4.43)	5.47 (2.99)	4.29 (3.10)
Post-College*Group 2 Credits*1/k	-32.58 (4.45)	-36.85 (5.47)	-24.61 (3.45)	-24.89 (3.56)

Notes: a. The dependent variable is quarterly earnings. All models include demographic, heterogeneous displacement, and in-college controls as well as individual and period-specific fixed effects and worker-specific time trends. Robust standard errors are in parentheses. See Appendix A for definition of Group 1 and Group 2 courses.
b. Post-College is an indicator variable for whether the current quarter is after the training participant left community college.
c. 1/k denotes the reciprocal of the number of quarters after the trainee left school.

Table 6: Does Community College Participation Predict Earnings Prior to Retraining?
(Predicted "Effect" of Community College Participation and Completed Credits on Pre-Enrollment Earnings)

	Controls for Temporal Pattern of Cost of Displacement				
	None	Just Overall Dummies [a]	Add Demo-graphics [b]	Add Prior Industry [c]	Add Labor Market [d]
Males Under 35					
One Year Prior to Displacement:					
Pre-College	-143.79 (45.65)	28.41 (42.97)	66.50 (43.23)	87.81 (43.28)	89.59 (43.30)
Pre-College*Group 1 Credits	5.21 (1.45)	4.84 (1.35)	4.77 (1.36)	5.18 (1.38)	5.15 (1.38)
Pre-College*Group 2 Credits	5.08 (1.62)	3.12 (1.54)	3.04 (1.58)	3.29 (1.60)	3.27 (1.60)
Post-Displacement/Prior to Enrollment:					
Pre-College	-1,495 (147.06)	205.99 (141.65)	-115.01 (144.23)	1.72 (143.10)	3.54 (142.14)
Pre-College*Group 1 Credits	-26.66 (5.32)	-17.11 (4.83)	-15.92 (5.11)	-12.40 (4.79)	-11.41 (4.81)
Pre-College*Group 2 Credits	-35.51 (6.22)	-21.69 (5.51)	-23.38 (5.98)	-18.29 (5.59)	-18.28 (5.54)

Table 6: Does Community College Participation Predict Earnings Prior to Retraining? (continued)
(Predicted "Effect" of Community College Participation and Completed Credits on Pre-Enrollment Earnings)

	Controls for Temporal Pattern of Cost of Displacement				
Males 35 and Older	None	Just Overall Dummies [a]	Add Demo-graphics [b]	Add Prior Industry [c]	Add Labor Market [d]
One Year Prior to Displacement:					
Pre-College	-253.97 (61.66)	-121.75 (59.37)	-66.49 (59.52)	-49.14 (59.38)	-53.98 (59.36)
Pre-College*Group 1 Credits	7.40 (1.80)	7.99 (1.69)	8.11 (1.70)	9.23 (1.70)	9.29 (1.70)
Pre-College*Group 2 Credits	8.85 (2.14)	10.07 (2.04)	10.84 (2.02)	12.70 (2.03)	12.68 (2.01)
Post-Displacement/Prior to Enrollment:					
Pre-College	-2,989 (184.71)	-1,138 (178.09)	-600.11 (178.83)	-495.78 (177.87)	-470.19 (176.28)
Pre-College*Group 1 Credits	-24.93 (6.06)	-15.67 (5.85)	-17.57 (5.88)	-12.64 (5.72)	-11.99 (5.71)
Pre-College*Group 2 Credits	-25.15 (7.49)	-13.88 (7.11)	-17.45 (7.00)	-11.70 (6.15)	-12.89 (6.02)

Table 6: Does Community College Participation Predict Earnings Prior to Retraining? (continued)
(Predicted "Effect" of Community College Participation and Completed Credits on Pre-Enrollment Earnings)

	Controls for Temporal Pattern of Cost of Displacement				
	None	Just Overall Dummies [a]	Add Demo-graphics [b]	Add Prior Industry [c]	Add Labor Market [d]
Females Under 35					
One Year Prior to Displacement:					
Pre-College	-94.97 (42.11)	56.79 (38.91)	-73.42 (39.32)	-57.11 (39.20)	-56.04 (39.22)
Pre-College*Group 1 Credits	7.19 (2.36)	5.82 (2.27)	5.98 (2.28)	6.65 (2.28)	6.72 (2.28)
Pre-College*Group 2 Credits	6.19 (1.38)	6.22 (1.23)	6.14 (1.22)	6.35 (1.21)	6.34 (1.21)
Post-Displacement/Prior to Enrollment:					
Pre-College	-1,110.9 (116.75)	634.36 (111.47)	0.97 (113.17)	38.97 (109.70)	44.22 (108.96)
Pre-College*Group 1 Credits	-35.68 (6.68)	-19.33 (6.33)	-18.24 (6.41)	-14.19 (6.02)	-13.05 (6.07)
Pre-College*Group 2 Credits	-18.80 (4.31)	-11.16 (3.95)	-14.89 (4.01)	-13.45 (3.70)	-13.01 (3.71)

Table 6: Does Community College Participation Predict Earnings Prior to Retraining? (continued)
(Predicted "Effect" of Community College Participation and Completed Credits on Pre-Enrollment Earnings)

	Controls for Temporal Pattern of Cost of Displacement				
	None	Just Overall Dummies [a]	Add Demo-graphics [b]	Add Prior Industry [c]	Add Labor Market [d]
Females 35 and Older					
One Year Prior to Displacement:					
Pre-College	17.36 (42.76)	141.45 (39.79)	48.14 (40.20)	39.14 (39.83)	39.50 (39.83)
Pre-College*Group 1 Credits	8.20 (2.59)	6.97 (2.50)	6.11 (2.51)	6.68 (2.50)	6.85 (2.50)
Pre-College*Group 2 Credits	0.41 (1.54)	1.94 (1.41)	2.71 (1.41)	4.06 (1.39)	4.01 (1.39)
Post-Displacement/Prior to Enrollment:					
Pre-College	-2,082 (115.58)	-194.99 (111.31)	-195.68 (112.33)	-224.94 (108.74)	-223.93 (107.42)
Pre-College*Group 1 Credits	-32.97 (7.21)	-20.36 (7.01)	-14.17 (6.83)	-9.70 (6.21)	-10.16 (6.15)
Pre-College*Group 2 Credits	-22.42 (4.58)	-10.77 (4.37)	-18.13 (4.18)	-14.10 (3.97)	-13.71 (3.91)

Notes: a. Dependent variable is quarterly earnings. All models include demographic, in-college controls as well as individual and worker-specific fixed effects and worker-specific time trends. Robust standard errors are in parentheses. The dummy variables that control for the temporal pattern of the cost of displacement are described in Appendix B. b. Allows for heterogeneity in the temporal pattern of displacement according to an individuals' minority status, region of the state, prior schooling, and prior tenure on the job. c. Allows in addition to b. heterogeneity according to an individual's prior industry. d. Allows in addition to c. heterogeneity according to an individual's labor market conditions at displacement. e. Pre-College is an indicator variable during the period indicated in the table for whether the individual subsequently enrolled and completed at least one community college credit.

Table 7: Sensitivity of Long-run Impacts of Community College Retraining to Specification of the Displacement Effects

	Controls for Displacement Effects				
	(1) None	(2) Dummy Variables	(3) (2) Plus Demographics	(4) (3) Plus Prior Industry	(5) (4) Plus Labor Market
Males Under 35:					
Post College	177.75	174.70	46.11	111.71	107.89
	(110.52)	(104.17)	(102.74)	(101.34)	(101.08)
Group 1*Post College	8.13	11.80	12.95	12.14	12.05
	(3.56)	(3.27)	(3.24)	(3.13)	(3.14)
Group 2*Post College	-1.72	4.82	6.23	5.69	5.82
	(4.04)	(3.86)	(3.87)	(3.74)	(3.74)
Males 35 or Older:					
Post College	-140.39	-52.19	90.26	159.24	151.00
	(135.55)	(129.04)	(127.31)	(127.17)	(126.99)
Group 1*Post College	10.70	13.56	12.84	12.29	12.39
	(4.04)	(3.84)	(3.83)	(3.77)	(3.77)
Group 2*Post College	-0.97	7.57	5.30	4.11	4.16
	(4.92)	(4.62)	(4.54)	(4.42)	(4.42)

Table 7: Sensitivity of Long-run Impacts of Community College Retraining to Specification of the Displacement Effects (continued)

	Controls for Displacement Effects				
	(1)	(2)	(3)	(4)	(5)
	None	Dummy Variables	(2) Plus Demographics	(3) Plus Prior Industry	(4) Plus Labor Market
Females Under 35:					
Post College	157.41	168.46	-98.50	-56.62	-56.10
	(96.51)	(91.79)	(89.90)	(88.74)	(88.46)
Group 1*Post College	17.24	20.47	24.57	23.89	23.72
	(6.54)	(6.51)	(6.38)	(6.29)	(6.29)
Group 2*Post College	1.09	4.28	6.15	5.47	5.47
	(3.39)	(3.19)	(3.08)	(3.00)	(2.99)
Females 35 or Older:					
Post College	-35.36	90.15	59.41	71.91	77.07
	(90.27)	(84.50)	(83.88)	(82.79)	(82.64)
Group 1*Post College	14.30	19.24	18.71	18.40	18.48
	(5.89)	(5.47)	(5.44)	(5.33)	(5.33)
Group 2*Post College	0.87	4.99	4.64	4.47	4.29
	(3.42)	(3.20)	(3.22)	(3.11)	(3.11)

Note: See Tables 3a, 3b, and 6. For discussion of specification of the effects of displacement on earnings see Appendix B. In column 3 we allow the temporal pattern of displacement effects to vary by minority status, age at displacement, prior schooling, region of the state, prior tenure on the pre-displacement job. In column 4, we add to this specification controls for prior industry. In column 5, we add controls for labor market conditions at the time of job loss. The conditions are the country unemployment rate, employment growth during the prior year in the country, and statewide employment growth during the prior year in the individuals' prior 2-digit SIC industry.

Table 8: The Net Benefit and Internal Rates of Return from an Academic Year of Community College Schooling for Displaced Workers

Panel A: Cost-Benefit Analysis of Investments in Displaced Workers' Retraining

	Exclude "Just Showing Up" Effect				Include "Just Showing Up" Effect			
	Males		Females		Males		Females	
	Young	Old	Young	Old	Young	Old	Young	Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
From Perspective of Participants:								
…Net Benefit (in 000s)	$13.1	$5.2	$21.9	9.1	$18.2	$9.9	$17.7	$11.6
…Benefit to Cost Ratio	3.07	1.69	5.40	2.61	3.88	2.30	4.56	3.05
From Perspective of Society:								
…Net Benefit (in 000s)	$9.9	-$0.3	$21.0	$4.2	$16.1	$5.9	$15.5	$7.6
…Benefit to Cost Ratio	1.61	0.98	2.43	1.27	2.04	1.34	2.05	1.49

Panel B: Alternative Social Internal Rates of Return for One Academic Year of Retraining

	Exclude "Just Showing Up" Effect			Include "Just Showing Up" Effect		
	Treatment of "In-School Effects" as Opportunity Costs					
	No	1/2	Yes	No	1/2	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Younger Men	10.4%	7.4%	5.4%	12.6%	9.2%	7.1%
Older Men	7.8%	3.9%	1.4%	10.8%	6.5%	3.9%
Younger Women	13.9%	11.1%	9.1%	12.0%	9.4%	7.6%
Older Women	9.5%	6.2%	4.0%	11.0%	7.8%	5.5%

Notes: Calculations based on estimates in column 6 of Table 3a for males and column 6 of Table 3b for females. We assume that the remaining work life is 22 years for older displaced workers and 36 years for younger workers. In panel A, we discount future per-period earnings impacts at a real rate of 4 percent. We also assume that individuals pay taxes of 25 percent on their increased incomes. We assume the total costs of a year of school equal $8,000 per year and that students pay about 20 percent or $1,500 of this direct cost through their tuition. The remaining amount is paid by taxpayers. For the calculations in Panel A, we assume the opportunity cost of schooling equal 1/2 the costs implied by the "In-College" estimates reported in Tables 3a and 3b. In Panel, B we make the indicated alternative assumptions about the opportunity cost of retraining. All figures in Panel B are the social internal rates of return. Finally, we assume that the welfare costs associated with the taxes raised to subsidized community college schooling equals 50 percent of the subsidy or $3,250.

Figure 1: Earnings of Trainees and Comparisons

Workers Under 35 Displaced In 1991

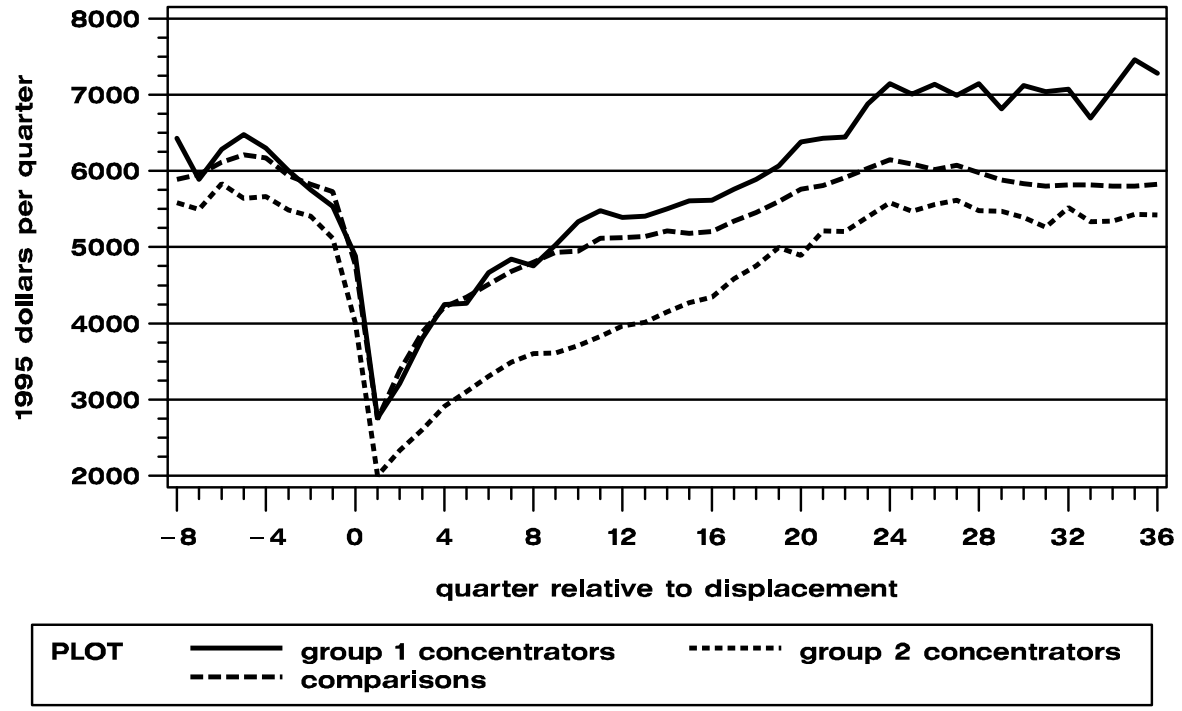

Figure 2: Earnings of Trainees and Comparisons

Workers 35 and Over Displaced in 1991

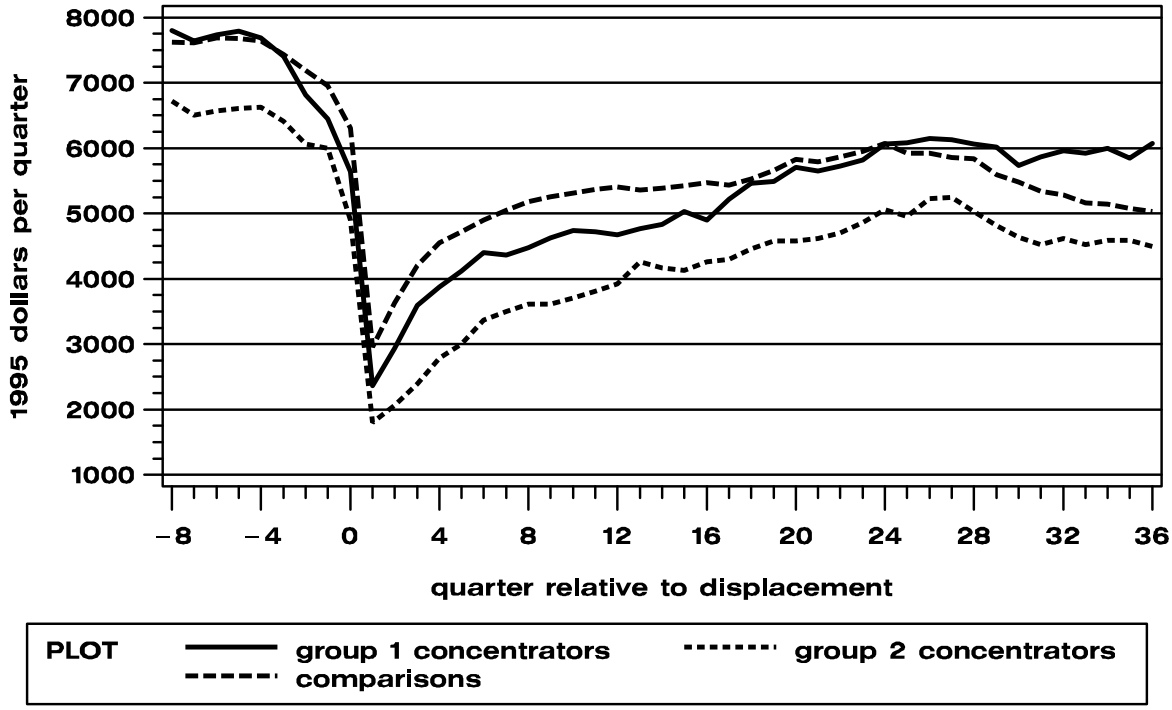

Figure 3: Time Pattern of Training Impacts

Program Evaluation Model

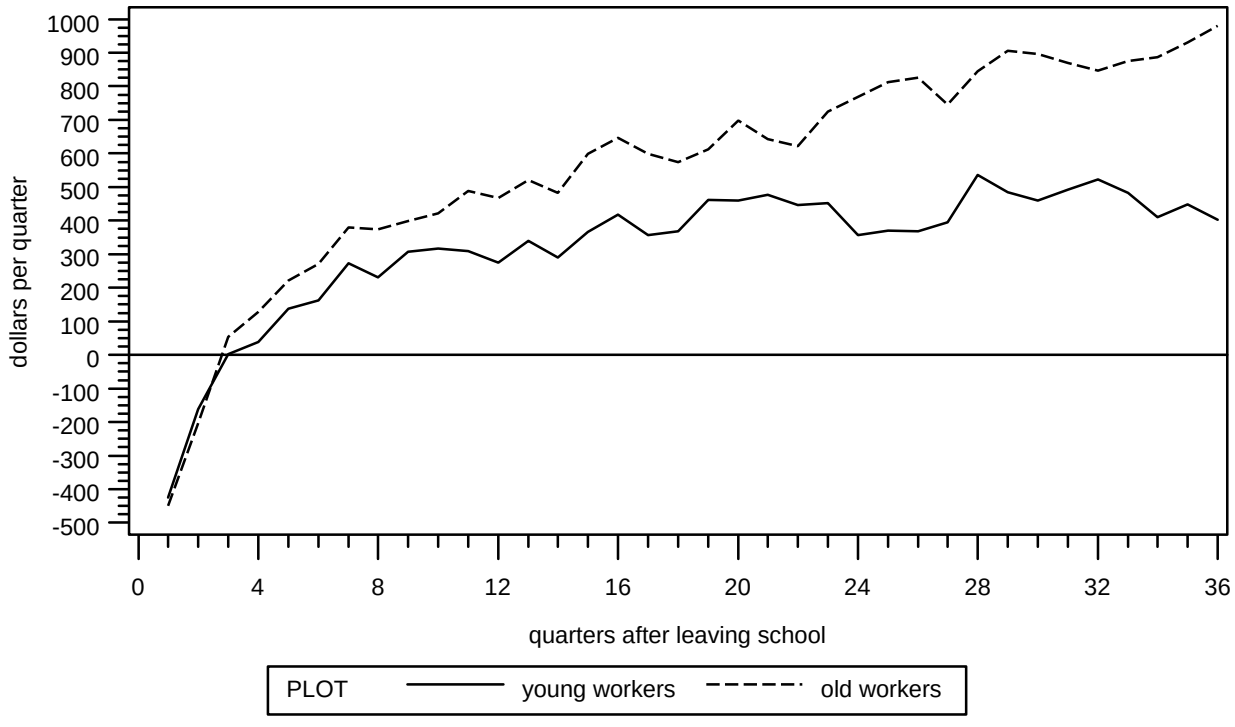

Figure 4: Time Pattern of Training Impacts

Hybrid Model

Working Paper Series

A series of research studies on regional economic issues relating to the Seventh Federal Reserve District, and on financial and economic topics.

Dynamic Monetary Equilibrium in a Random-Matching Economy **WP-00-1**
Edward J. Green and Ruilin Zhou

The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behavior **WP-00-2**
Eric French

Market Discipline in the Governance of U.S. Bank Holding Companies*:* **WP-00-3**
Monitoring vs. Influencing
Robert R. Bliss and Mark J. Flannery

Using Market Valuation to Assess the Importance and Efficiency
of Public School Spending **WP-00-4**
Lisa Barrow and Cecilia Elena Rouse

Employment Flows, Capital Mobility, and Policy Analysis **WP-00-5**
Marcelo Veracierto

Does the Community Reinvestment Act Influence Lending? An Analysis
of Changes in Bank Low-Income Mortgage Activity **WP-00-6**
Drew Dahl, Douglas D. Evanoff and Michael F. Spivey

Subordinated Debt and Bank Capital Reform **WP-00-7**
Douglas D. Evanoff and Larry D. Wall

The Labor Supply Response To (Mismeasured But) Predictable Wage Changes **WP-00-8**
Eric French

For How Long Are Newly Chartered Banks Financially Fragile? **WP-00-9**
Robert DeYoung

Bank Capital Regulation With and Without State-Contingent Penalties **WP-00-10**
David A. Marshall and Edward S. Prescott

Why Is Productivity Procyclical? Why Do We Care? **WP-00-11**
Susanto Basu and John Fernald

Oligopoly Banking and Capital Accumulation **WP-00-12**
Nicola Cetorelli and Pietro F. Peretto

Puzzles in the Chinese Stock Market **WP-00-13**
John Fernald and John H. Rogers

The Effects of Geographic Expansion on Bank Efficiency **WP-00-14**
Allen N. Berger and Robert DeYoung

Idiosyncratic Risk and Aggregate Employment Dynamics **WP-00-15**
Jeffrey R. Campbell and Jonas D.M. Fisher

Working Paper Series *(continued)*

Post-Resolution Treatment of Depositors at Failed Banks: Implications for the Severity of Banking Crises, Systemic Risk, and Too-Big-To-Fail **WP-00-16**
George G. Kaufman and Steven A. Seelig

The Double Play: Simultaneous Speculative Attacks on Currency and Equity Markets **WP-00-17**
Sujit Chakravorti and Subir Lall

Capital Requirements and Competition in the Banking Industry **WP-00-18**
Peter J.G. Vlaar

Financial-Intermediation Regime and Efficiency in a Boyd-Prescott Economy **WP-00-19**
Yeong-Yuh Chiang and Edward J. Green

How Do Retail Prices React to Minimum Wage Increases? **WP-00-20**
James M. MacDonald and Daniel Aaronson

Financial Signal Processing: A Self Calibrating Model **WP-00-21**
Robert J. Elliott, William C. Hunter and Barbara M. Jamieson

An Empirical Examination of the Price-Dividend Relation with Dividend Management **WP-00-22**
Lucy F. Ackert and William C. Hunter

Savings of Young Parents **WP-00-23**
Annamaria Lusardi, Ricardo Cossa, and Erin L. Krupka

The Pitfalls in Inferring Risk from Financial Market Data **WP-00-24**
Robert R. Bliss

What Can Account for Fluctuations in the Terms of Trade? **WP-00-25**
Marianne Baxter and Michael A. Kouparitsas

Data Revisions and the Identification of Monetary Policy Shocks **WP-00-26**
Dean Croushore and Charles L. Evans

Recent Evidence on the Relationship Between Unemployment and Wage Growth **WP-00-27**
Daniel Aaronson and Daniel Sullivan

Supplier Relationships and Small Business Use of Trade Credit **WP-00-28**
Daniel Aaronson, Raphael Bostic, Paul Huck and Robert Townsend

What are the Short-Run Effects of Increasing Labor Market Flexibility? **WP-00-29**
Marcelo Veracierto

Equilibrium Lending Mechanism and Aggregate Activity **WP-00-30**
Cheng Wang and Ruilin Zhou

Impact of Independent Directors and the Regulatory Environment on Bank Merger Prices: Evidence from Takeover Activity in the 1990s **WP-00-31**
Elijah Brewer III, William E. Jackson III, and Julapa A. Jagtiani

Does Bank Concentration Lead to Concentration in Industrial Sectors? **WP-01-01**
Nicola Cetorelli

Working Paper Series *(continued)*

On the Fiscal Implications of Twin Crises **WP-01-02**
Craig Burnside, Martin Eichenbaum and Sergio Rebelo

Sub-Debt Yield Spreads as Bank Risk Measures **WP-01-03**
Douglas D. Evanoff and Larry D. Wall

Productivity Growth in the 1990s: Technology, Utilization, or Adjustment? **WP-01-04**
Susanto Basu, John G. Fernald and Matthew D. Shapiro

Do Regulators Search for the Quiet Life? The Relationship Between Regulators and The Regulated in Banking **WP-01-05**
Richard J. Rosen

Learning-by-Doing, Scale Efficiencies, and Financial Performance at Internet-Only Banks **WP-01-06**
Robert DeYoung

The Role of Real Wages, Productivity, and Fiscal Policy in Germany's Great Depression 1928-37 **WP-01-07**
Jonas D. M. Fisher and Andreas Hornstein

Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy **WP-01-08**
Lawrence J. Christiano, Martin Eichenbaum and Charles L. Evans

Outsourcing Business Service and the Scope of Local Markets **WP-01-09**
Yukako Ono

The Effect of Market Size Structure on Competition: The Case of Small Business Lending **WP-01-10**
Allen N. Berger, Richard J. Rosen and Gregory F. Udell

Deregulation, the Internet, and the Competitive Viability of Large Banks and Community Banks **WP-01-11**
Robert DeYoung and William C. Hunter

Price Ceilings as Focal Points for Tacit Collusion: Evidence from Credit Cards **WP-01-12**
Christopher R. Knittel and Victor Stango

Gaps and Triangles **WP-01-13**
Bernardino Adão, Isabel Correia and Pedro Teles

A Real Explanation for Heterogeneous Investment Dynamics **WP-01-14**
Jonas D.M. Fisher

Recovering Risk Aversion from Options **WP-01-15**
Robert R. Bliss and Nikolaos Panigirtzoglou

Economic Determinants of the Nominal Treasury Yield Curve **WP-01-16**
Charles L. Evans and David Marshall

Price Level Uniformity in a Random Matching Model with Perfectly Patient Traders **WP-01-17**
Edward J. Green and Ruilin Zhou

Earnings Mobility in the US: A New Look at Intergenerational Inequality **WP-01-18**
Bhashkar Mazumder

Working Paper Series *(continued)*

The Effects of Health Insurance and Self-Insurance on Retirement Behavior **WP-01-19**
Eric French and John Bailey Jones

The Effect of Part-Time Work on Wages: Evidence from the Social Security Rules **WP-01-20**
Daniel Aaronson and Eric French

Antidumping Policy Under Imperfect Competition **WP-01-21**
Meredith A. Crowley

Is the United States an Optimum Currency Area?
An Empirical Analysis of Regional Business Cycles **WP-01-22**
Michael A. Kouparitsas

A Note on the Estimation of Linear Regression Models with Heteroskedastic
Measurement Errors **WP-01-23**
Daniel G. Sullivan

The Mis-Measurement of Permanent Earnings: New Evidence from Social **WP-01-24**
Security Earnings Data
Bhashkar Mazumder

Pricing IPOs of Mutual Thrift Conversions: The Joint Effect of Regulation
and Market Discipline **WP-01-25**
Elijah Brewer III, Douglas D. Evanoff and Jacky So

Opportunity Cost and Prudentiality: An Analysis of Collateral Decisions in
Bilateral and Multilateral Settings **WP-01-26**
Herbert L. Baer, Virginia G. France and James T. Moser

Outsourcing Business Services and the Role of Central Administrative Offices **WP-02-01**
Yukako Ono

Strategic Responses to Regulatory Threat in the Credit Card Market* **WP-02-02**
Victor Stango

The Optimal Mix of Taxes on Money, Consumption and Income **WP-02-03**
Fiorella De Fiore and Pedro Teles

Expectation Traps and Monetary Policy **WP-02-04**
Stefania Albanesi, V. V. Chari and Lawrence J. Christiano

Monetary Policy in a Financial Crisis **WP-02-05**
Lawrence J. Christiano, Christopher Gust and Jorge Roldos

Regulatory Incentives and Consolidation: The Case of Commercial Bank Mergers
and the Community Reinvestment Act **WP-02-06**
Raphael Bostic, Hamid Mehran, Anna Paulson and Marc Saidenberg

Technological Progress and the Geographic Expansion of the Banking Industry **WP-02-07**
Allen N. Berger and Robert DeYoung

Working Paper Series *(continued)*

Choosing the Right Parents: Changes in the Intergenerational Transmission of Inequality — Between 1980 and the Early 1990s **WP-02-08**
David I. Levine and Bhashkar Mazumder

The Immediacy Implications of Exchange Organization **WP-02-09**
James T. Moser

Maternal Employment and Overweight Children **WP-02-10**
Patricia M. Anderson, Kristin F. Butcher and Phillip B. Levine

The Costs and Benefits of Moral Suasion: Evidence from the Rescue of Long-Term Capital Management **WP-02-11**
Craig Furfine

On the Cyclical Behavior of Employment, Unemployment and Labor Force Participation **WP-02-12**
Marcelo Veracierto

Do Safeguard Tariffs and Antidumping Duties Open or Close Technology Gaps? **WP-02-13**
Meredith A. Crowley

Technology Shocks Matter **WP-02-14**
Jonas D. M. Fisher

Money as a Mechanism in a Bewley Economy **WP-02-15**
Edward J. Green and Ruilin Zhou

Optimal Fiscal and Monetary Policy: Equivalence Results **WP-02-16**
Isabel Correia, Juan Pablo Nicolini and Pedro Teles

Real Exchange Rate Fluctuations and the Dynamics of Retail Trade Industries on the U.S.-Canada Border **WP-02-17**
Jeffrey R. Campbell and Beverly Lapham

Bank Procyclicality, Credit Crunches, and Asymmetric Monetary Policy Effects: A Unifying Model **WP-02-18**
Robert R. Bliss and George G. Kaufman

Location of Headquarter Growth During the 90s **WP-02-19**
Thomas H. Klier

The Value of Banking Relationships During a Financial Crisis: Evidence from Failures of Japanese Banks **WP-02-20**
Elijah Brewer III, Hesna Genay, William Curt Hunter and George G. Kaufman

On the Distribution and Dynamics of Health Costs **WP-02-21**
Eric French and John Bailey Jones

The Effects of Progressive Taxation on Labor Supply when Hours and Wages are Jointly Determined **WP-02-22**
Daniel Aaronson and Eric French

Working Paper Series *(continued)*

Inter-industry Contagion and the Competitive Effects of Financial Distress Announcements: Evidence from Commercial Banks and Life Insurance Companies **WP-02-23**
Elijah Brewer III and William E. Jackson III

State-Contingent Bank Regulation With Unobserved Action and Unobserved Characteristics **WP-02-24**
David A. Marshall and Edward Simpson Prescott

Local Market Consolidation and Bank Productive Efficiency **WP-02-25**
Douglas D. Evanoff and Evren Örs

Life-Cycle Dynamics in Industrial Sectors. The Role of Banking Market Structure **WP-02-26**
Nicola Cetorelli

Private School Location and Neighborhood Characteristics **WP-02-27**
Lisa Barrow

Teachers and Student Achievement in the Chicago Public High Schools **WP-02-28**
Daniel Aaronson, Lisa Barrow and William Sander

The Crime of 1873: Back to the Scene **WP-02-29**
François R. Velde

Trade Structure, Industrial Structure, and International Business Cycles **WP-02-30**
Marianne Baxter and Michael A. Kouparitsas

Estimating the Returns to Community College Schooling for Displaced Workers **WP-02-31**
Louis Jacobson, Robert LaLonde and Daniel G. Sullivan

A Proposal for Efficiently Resolving Out-of-the-Money Swap Positions at Large Insolvent Banks **WP-03-01**
George G. Kaufman

Depositor Liquidity and Loss-Sharing in Bank Failure Resolutions **WP-03-02**
George G. Kaufman

Subordinated Debt and Prompt Corrective Regulatory Action **WP-03-03**
Douglas D. Evanoff and Larry D. Wall

When is Inter-Transaction Time Informative? **WP-03-04**
Craig Furfine

Tenure Choice with Location Selection: The Case of Hispanic Neighborhoods in Chicago **WP-03-05**
Maude Toussaint-Comeau and Sherrie L.W. Rhine

Distinguishing Limited Commitment from Moral Hazard in Models of Growth with Inequality* **WP-03-06**
Anna L. Paulson and Robert Townsend

Resolving Large Complex Financial Organizations **WP-03-07**
Robert R. Bliss

Working Paper Series *(continued)*

The Case of the Missing Productivity Growth: Or, Does information technology explain why productivity accelerated in the United States but not the United Kingdom? **WP-03-08**
Susanto Basu, John G. Fernald, Nicholas Oulton and Sylaja Srinivasan

Inside-Outside Money Competition **WP-03-09**
Ramon Marimon, Juan Pablo Nicolini and Pedro Teles

The Importance of Check-Cashing Businesses to the Unbanked: Racial/Ethnic Differences **WP-03-10**
William H. Greene, Sherrie L.W. Rhine and Maude Toussaint-Comeau

A Structural Empirical Model of Firm Growth, Learning, and Survival **WP-03-11**
Jaap H. Abbring and Jeffrey R. Campbell

Market Size Matters **WP-03-12**
Jeffrey R. Campbell and Hugo A. Hopenhayn

The Cost of Business Cycles under Endogenous Growth **WP-03-13**
Gadi Barlevy

The Past, Present, and Probable Future for Community Banks **WP-03-14**
Robert DeYoung, William C. Hunter and Gregory F. Udell

Measuring Productivity Growth in Asia: Do Market Imperfections Matter? **WP-03-15**
John Fernald and Brent Neiman

Revised Estimates of Intergenerational Income Mobility in the United States **WP-03-16**
Bhashkar Mazumder

Product Market Evidence on the Employment Effects of the Minimum Wage **WP-03-17**
Daniel Aaronson and Eric French

Estimating Models of On-the-Job Search using Record Statistics **WP-03-18**
Gadi Barlevy

Banking Market Conditions and Deposit Interest Rates **WP-03-19**
Richard J. Rosen

Creating a National State Rainy Day Fund: A Modest Proposal to Improve Future State Fiscal Performance **WP-03-20**
Richard Mattoon

Managerial Incentive and Financial Contagion **WP-03-21**
Sujit Chakravorti, Anna Llyina and Subir Lall

Women and the Phillips Curve: Do Women's and Men's Labor Market Outcomes Differentially Affect Real Wage Growth and Inflation? **WP-03-22**
Katharine Anderson, Lisa Barrow and Kristin F. Butcher

Evaluating the Calvo Model of Sticky Prices **WP-03-23**
Martin Eichenbaum and Jonas D.M. Fisher