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Net Impact and Benefit-Cost Estimates of the Workforce Development System in Washington State

Kevin Hollenbeck
W.E. Upjohn Institute, hollenbeck@upjohn.org

Wei-Jang Huang
W.E. Upjohn Institute

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W.E. Upjohn Institute for Employment Research
300 South Westnedge Ave.
Kalamazoo, MI 49007

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Abstract

This study estimates the net impacts and private and social benefits and costs of 11workforce development programs administered in Washington State. Six of the programs serve job-ready adults: Workforce Investment Act (WIA) Title I-B Adult programs, WIA Title I-B Dislocated Worker programs, Community and Technical College Job Preparatory Training, Community and Technical College Worker Retraining, Private Career Schools, and Apprenticeships. Three of the programs serve adults with employment barriers: Community and Technical College Adult Basic Skills Education, IBEST, and Division of Vocational Rehabilitation programs. The other two programs serve youth: WIA Title I-B Youth programs and Secondary Career and Technical Education.

The net impact analyses were conducted using a nonexperimental methodology. Individuals who had encountered the workforce development programs were statistically matched to individuals who had not. Administrative data with information from the universe of program participants and Labor Exchange registrants (who served as the comparison group pool) supported the analyses. These data included several years of pre-program and outcome information including demographics, employment and earnings information from the Unemployment Insurance wage record system, and benefits from the Unemployment Insurance system.

The empirical work undertaken for this study resulted in the estimation of *short-term* (defined as three full quarters after exit) net impacts that examined outcomes for individuals who exited from the education or training programs (or from the Labor Exchange) in the fiscal year 2007/2008 and *longer-term* (nine to 12 full quarters) impacts for individuals who exited in the fiscal year 2005/2006. Short-term employment impacts are positive for nine of the 11 programs and negative for the other two. Short-term earnings impacts are also positive for all 11 programs, although one of the estimates is not statistically significant. The longer-term impacts are similar. Employment impacts are positive for nine of the ten programs (one of the programs does not have longer-term outcomes) and negative for the other program; earnings impacts are positive and statistically significant for all ten programs. The benefit-cost analyses show that virtually all of the programs have discounted future benefits that far exceed the costs for participants, and that society also receives a positive return on investment.

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1 OVERVIEW OF THE STUDY

The Washington State Workforce Training and Education Coordinating Board (WTECB) has a commitment to accountability and data-driven performance monitoring and management. Biennial evaluations provide the public with data about the extent to which participants in the state workforce development system 1) achieve workplace competencies, 2) find employment, 3) achieve family-wage levels of earned income, 4) are productive, 5) move out of poverty, and 6) are satisfied with program services and outcomes. The performance data for these outcomes come from administrative data or surveys of program participants (or employers of participants).

The WTECB has a seventh evaluative outcome—return on investment—that is most appropriately calculated by using data from nonparticipants as well as participants. The data burden is greatly expanded as compared to what is required for the other six criteria, and so the strategy that the State follows is to examine this outcome every four years. Net impact/return on investment studies were done in 1997, 2002, and 2006.[1] This report provides the most recent net impact estimates of the Washington State employment preparation and training system and its economic value to the State.

[1]The 1997 study is documented in Washington State Workforce Training and Education Coordinating Board, *Workforce Training Results: An Evaluation of Washington State's Workforce Training System, 1997*. Second Edition. Olympia, WA: 1997. Also Battelle, "Net Impact Evaluation: Appendix A, Technical Appendix," no date. The 2002 study is documented in Washington State Workforce Training and Education Training Board, *Workforce Training Results 2002: An Evaluation of Washington State's Workforce Development System.* Olympia, WA: 2003 and K. Hollenbeck and W. Huang, *Net Impact and Benefit-Cost Estimates of the Workforce Development System in Washington State*, Upjohn Institute Technical Report No. TR03-018, July 2003. The 2006 study is documented in K. Hollenbeck and W. Huang, *Net Impact and Benefit-Cost Estimates of the Workforce Development System in Washington State*, Upjohn Institute Technical Report No. TR06-020, September 2006.

Why are Net Impact and Cost-Benefit Analyses Useful?

Washington's systematic calculation of net impacts of its workforce development programs and their costs and benefits is rare, and indeed may be unique, among states. Why does the state insist on these analyses? Presumably, the state recognizes that investment in workforce development requires considerable public resources and needs to be accountable to the public for achieving results. But the state also seems to recognize that it is important to dissect carefully the results that are achieved in order to assure the public that its return of training investments is positive and that improvements that are warranted can be implemented.

Individuals who participate in training or educational programs may experience successful outcomes such as the six outcomes listed above. However, it is not always clear that positive outcomes for individuals are the direct result of their participation in the programs. There could have been some other intervening factor(s) such as an improving economy that cause positive results. In social science evaluation, trying to tie outcomes directly to the intervention(s) is called the attribution question. Can participants' successes be *attributed* to participation in the program or might some other factor coincidental to the program have played a role?

A net impact analysis must be conducted to answer the attribution question. Such an analysis attempts to answer the question of how do outcomes compare to what would have happened to participants if there were no program and individuals were left to their next best alternatives. To find the answer, we construct a comparison group of individuals who are very similar to the participants in each of the programs but who did not receive training or enroll in education.[2] We observe both the participants and comparison group members over time. We then

[2]Experimental evaluation uses a randomly assigned control group.

attribute to the program any differences in outcomes that we observe for program participants to those of comparison group members.

The net impacts of workforce development programs are likely to be positive for participants. (The programs are delivering valuable skills to individuals who will use those skills in the labor market.) However accountability generally goes beyond positive net impacts. Of interest to the public is whether the net impacts (outcomes for program participants minus outcomes for similar individuals comprising a comparison group) aggregated over all participants will have exceeded the costs of the program. Thus to get a full picture of the return on investment, it is necessary to compare the programs' net benefits to their costs.

Programs, Outcomes, and Time Periods

The report describes analyses (net impact and benefit-cost) of 11 programs. Six of the programs serve job-ready adults: Workforce Investment Act (WIA) Title I-B Adult programs, Community and Technical College Job Preparatory Training, Private Career Schools, Apprenticeships, Title I-B Dislocated Worker programs, and Community and Technical College Worker Retraining. Three of the programs serve adults with employment barriers: Community and Technical College Adult Basic Skills Education, IBEST, and Division of Vocational Rehabilitation (DVR) programs. The other two programs serve youth: WIA Title I-B Youth programs and Secondary Career and Technical Education.

For the participants in each of these programs, we estimate the net impacts of participation on the following outcomes:

- employment rates
- hourly wages
- hours worked per quarter
- quarterly earnings
- receipt and quarterly amount of UI benefits

The first four outcomes are derived from the quarterly wage record data generated from the Unemployment Insurance (UI) system, and thus are measured over a calendar quarter.[3] Quarterly earnings and hours worked per quarter come directly from employer wage record reports filed with quarterly UI tax payments. The state supplied these administrative data for this study. A processing step that the state undertook was to add together the information from multiple employers for those individuals who had more than a single employer in a quarter. Furthermore, the state personnel had gathered quarterly wage record data from surrounding states (Idaho and Oregon), and from the federal payroll. The data from the other jurisdictions contributed to quarterly earnings, but did not have hours information as is available in Washington wage record data. Throughout this study, we define employment as having at least $100 in earnings in a quarter. Hourly wages are defined as total quarterly wages divided by hours worked in the quarter. Unemployment Insurance benefits were gathered from the Washington UI system. UI receipt in a quarter is defined as having non-zero benefits in the calendar quarter.

The next chapter of this report details the methodologies that were used to calculate net impacts. The general idea is that we constructed data bases containing longitudinal data over a lengthy period about individuals who had participated in the 11 programs of interest or who had registered for services at the Labor Exchange (ES). The latter data were used to construct the comparison groups.[4] We then statistically matched individuals who had participated in the

[3]Appendix A provides details about data editing that was performed on the wage record data. In addition to the editing that is described there, we "trimmed" earnings and hours data. Specifically, we deleted from analyses observations in the top and bottom 1% of the quarterly non-zero earnings and hours distributions of the treatment and matched comparison groups in the analyses periods: i.e., quarters 3 to 6 before registration, quarter 3 after exit, and quarters 9–12 after exit.

[4] For two of the programs, we actually used administrative data on program applicants to construct the comparison groups. The programs were secondary career and technical education and Division of Vocational Rehabilitation programs.

programs to individuals in the comparison group, and compared outcomes. Differences in outcomes were attributed to the programs.

Two time periods were used for analysis purposes. The first period was the fiscal year running from July 2005 to June 2006 (hereafter referred to in this report as 2005/2006), and the second period was July 2007 to June 2008 (2007/2008). More specifically, an individual was considered to be a member of a "treatment" group if he or she exited from an education or training program during either of the two time periods. An individual was considered to be a member of the "comparison" group pool if they exited (last received services) from the Labor Exchange during either of those years.[5]

Note that because administrative data were used, sometimes the concept of exiting from a program was ambiguous and arbitrary, especially for individuals who exited without completing the program or training. Some education or training programs result in a certificate or credential for individuals who successfully complete all of the requirements. In these cases, an individual's exit date was set at the date when they received the credential. However, individuals who stop attending a program are unlikely to report their action to program administrators, and so there may be a lag in the data that reflects how long it takes for the program's administrative information system to record the exit. Some programs use the rule that no contact over a 12-month period means that the individual exited the program; some programs use a six-month rule.

[5] In program evaluation, populations of participants are often defined by entry date or as a cross-section of current enrollees. It is well-known that current enrollees are not representative of the population of all individuals who participate in a program because individuals with longer durations are more likely to be a current participant. The alternative of selecting all individuals who entered a program at a particular period of time captures the population of all individuals who participate in the program. The problem with using entry cohorts is that if programs last a long period of time (e.g., Community and Technical College Job Preparatory programs or Apprenticeships), it will take several years to get outcome data. The approach used in this study of defining the population by exit date is also representative of all individuals participating in the program, but allows a substantial number of quarters for outcome data. The "downside" to this approach is that the "treatment" received may differ for individuals in the same program simply because they started at different times and had different durations of participation.

All in all, we note that the exit date may be subject to measurement error, which therefore implies that length of time receiving treatment and initial outcome periods after treatment are somewhat subject to error.

Summary of Results[6]

Table 1.1 provides a summary of short-term net impacts of the 11 programs on employment and earnings. The elements reported in the table show the increase (or decrease) in employment, defined as having at least $100 in earnings in the third quarter after exiting from the program, and the increase (or decrease) in quarterly earnings, on average, for that quarter.[7] Note that these results include all participants—those individuals who completed their education or training and those who left without completing. Separate net impact estimates for subgroups of participants, including completers only, are reported later in this document.

Table 1.1 Short-Term[a] Net Impacts of Washington's Workforce Development System, by Program

Program	Net Employment Impact (In percentage points)	Net Quarterly Earnings Impacts (2005 $)
WIA Title I-B Adults	12.8	1,189
WIA I-B Dislocated Workers	10.1	589
WIA I-B Youth	8.0	330
Comm. and Tech. College Job Prep	6.6	1,365
Comm. and Tech. College Worker Retraining	8.8	705
Comm. and Tech. College ABE	−2.1	131
Private Career Schools	−2.7	416
IBEST	3.9[†]	286
Apprenticeships	7.8	3,243
Secondary Career Technical Ed.	6.0	211
Vocational Rehabilitation	8.3	88[†]

NOTE: Specific estimation techniques are described in later chapters.
[a]Defined as three quarters after exit.
[†]Table entry not statistically significant.

[6] As described in the next chapter, we attempted to replicate as closely as possible the methodology used in Hollenbeck and Huang (2006). The estimated net impacts for some programs that are reported here are similar in magnitude to those reported in the earlier study. For other programs, the impacts are substantially different. This suggests that the business cycle may have a significant influence on the magnitudes of the net impacts. The inference is that one should be careful in extrapolating the results.

[7] The earnings impacts are not conditional on individuals having earnings, i.e., the means include observations with values of zero.

The employment impacts are in percentage point terms. Eight of the 11 are positive and significant, and one is positive, but not statistically significant. Two of the programs have negative short-run employment impacts—community and technical college ABE programs and private career schools. The employment rate of the comparison group is on the order of 60 to 70 percent, so the positive impacts range from about seven to 20 percent. The short-term earnings impacts are all positive, but they vary considerably in terms of magnitude. One of the impacts is not statistically significant, but the others range from a low of about $130 per quarter to over $3,200 per quarter. Note that apprenticeships, community and technical colleges Job Prep, and WIA Title I-B adults, have quite large impacts. The only program with insignificant earnings impacts is vocational rehabilitation.

Table 1.2 provides estimates of the longer-term payoffs to education and training. All but one of the employment impacts are positive, and for the community and technical college Job Prep, private career schools, apprenticeships, secondary CTE, and vocational rehabilitation programs, the longer-term employment impacts are larger than the short-term impacts. As far as earnings are concerned, all ten programs for which we estimated longer-term outcomes[8] have

Table 1.2 Longer-Term[a] Net Impacts of Washington's Workforce Development System, by Program

Program	Net Employment Impact (In percentage points)	Net Quarterly Earnings Impacts (2005 $)
WIA Title I-B Adults	10.8	766
WIA I-B Dislocated Workers	4.7	850
WIA I-B Youth	4.3	343
Comm. and Tech. College Job Prep	10.1	1,572
Comm. and Tech. College Worker Retraining	7.5	959
Comm. and Tech. College ABE	−3.9	90
Private Career Schools	3.4	394
Apprenticeships	9.8	3,511
Secondary Career Technical Ed.	10.4	574
Vocational Rehabilitation	10.2	257

NOTE: Specific estimation techniques are described in later chapters.
[a]Defined as average over quarters 9-12 after exit.

[8] As described in the text, we did not estimate longer-term net impacts for IBEST.

positive and statistically significant impacts. For many of the programs (WIA I-B Youth, community and technical college Job Prep, community and technical college ABE, private career schools, and apprenticeships), the longer-term earnings impacts are approximately the same as the short-term impacts. However, for WIA I-B Dislocated Workers, community and technical college Worker Retraining, secondary CTE, and Vocational Rehabilitation, the longer-term impacts are greater than the short-term impacts. On the other hand, the WIA I-B Adults earnings impact is smaller. Note that in percentage terms, these impacts are on the order of 20 percent.

Table 1.3 summarizes the benefit-cost estimates for the 10 programs that have longer-term net impact estimates. Due to data limitations, the benefit-cost estimates for private career schools are partial. The table presents the estimates of benefits and costs for the average participant, and it shows the benefits and costs to the public that are associated with the average participant. For participants, the benefits include net earnings changes (earnings plus fringe benefits minus taxes) and UI benefits. These changes are usually positive, indicating that the additional earnings and UI benefits accrue to the participant, but in theory they may be negative if earnings and/or UI benefits were projected to decrease. For the public, benefits include tax

Table 1.3 Benefits and Costs of Washington's Workforce Development System, by Program

	First 2.5 years				Lifetime			
	Participant		Public		Participant		Public	
Program	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
WIA Title I-B Adults	10,353	1,950	2,223	5,982	82,523	1,950	14,342	5,982
WIA I-B Dislocated Workers	5,352	11,089	2,760	10,037	64,660	11,089	19,179	10,037
WIA I-B Youth	3,512	1,006	520	5,912	67,973	1,006	9,459	5,912
Comm. and Tech. College Job Prep	13,974	6,782	3,413	8,269	200,509	6,782	36,048	8,269
Comm. and Tech. College Worker Retraining	7,399	12,343	2,078	7,995	79,253	12,343	22,296	7,995
Comm. and Tech. College ABE	766	−85	915	2,516	10,578	−85	4,397	2,516
Private Career Schools	3,421	1,655	1,427	--na--	56,216	1,655	11,150	--na--
Apprenticeships	31,751	−18,121	8,236	−2,571	412,822	−18,121	110,442	−2,571
Secondary Career Technical Ed.	3,425	599	551	899	120,188	599	18,718	899
Vocational Rehabilitation	1,090	1,597	642	8,639	30,318	1,597	5,549	8,639

NOTE: Benefits for a participant include earnings and fringe benefits less taxes plus UI benefits; for the public, benefits include tax receipts minus UI benefit payments. Costs include direct program costs (public and participant, if tuition/fees) and forgone earnings (participant) and forgone taxes (public). Program costs have not been updated since Hollenbeck and Huang (2006). Table entries in 2005 $. –na—not available; no data were available on the tuition and fees at private career schools.

receipts plus changes in UI benefits. Again, these may be positive (taxes are received and UI benefits are reduced) or, they may be negative. For participants, the costs are forgone earnings during the period of program participation and tuition/fees, if any. For the public, costs represent the budgetary expenditures necessary to provide the training/education services plus any forgone taxes because participants are in programs and have less earnings; thus paying less taxes.[9] The public costs are positive in all but one program, and participant costs are also mostly positive, although they are negative in two programs because forgone earnings are negative (participants actually earn more during their program participation than if they had not participated). All of the benefits and costs are adjusted for inflation.

The first four columns of data in the table show the average participant's benefits and costs that accrue over the first 10 quarters after exiting from the program as well as the public's benefits (revenue) and costs that are derived from or borne for the average participant. From the participant's perspective, most of the programs have real (i.e., inflation-adjusted) benefits that exceed costs over the 10-quarter time frame; however three programs do not. Dislocated workers and worker retraining participants have large forgone earnings costs that outweigh the modest net earnings impacts in the short-term, whereas vocational rehabilitation participants have small net earnings gains in the short-term.

The last four columns of the table extrapolate the benefits to the average participant's working lifetime (assumed to end at age 65). In this calculation, all of the programs are quite beneficial for participants; their benefits significantly exceed costs in all 10 cases. From the public's perspective, nine of the 10 programs have benefits that exceed costs in the long-run for the average participant; only vocational rehabilitation seems to have public costs that outweigh

[9] We thank Dave Pavelchek for pointing out these public costs. Note that they may be negative costs (i.e., savings) if the forgone earnings of participants are negative.

public benefits over the average participant's working lifetime. The benefit-cost analyses are detailed in chapter 13.

This report is organized as follows. The next chapter provides much of the technical detail underlying the net impact estimation including the statistical matching approaches and regression models used to adjust results. The following ten chapters examine the results for the 10 workforce development system programs (the short-term IBEST net impact estimate results are presented in the chapter on Adult Basic Education). The final chapter documents the cost-benefit analyses. Appendix A discusses data editing and Appendix B presents explanatory notes for the regression adjustment models and the price indices used to convert nominal dollar figures into real terms.

2 GENERAL METHODOLOGY FOR NET IMPACT ESTIMATION

Probably most evaluators would agree that the best way to estimate the net impacts of a program is to conduct a random assignment experiment. If it were feasible to do so, an experiment could sort individuals who apply and are eligible for services randomly into two groups—those who are allowed to receive services and those who aren't. As long as assignment into treatment or control is random, then the evaluator can have high levels of statistical confidence that the program was responsible for any differences in outcomes.[10]

The issue is moot in the present context, however, because the programs being evaluated were essentially entitlements for which anyone in the state could participate. Experiments were not feasible. Thus this study relied on a nonexperimental methodology. Individuals who encountered the workforce development programs were compared to individuals who didn't, and members of the latter group were not randomly chosen. In other words, there were systematic (nonrandom) differences between the participants and the individuals to whom they were compared. Thus the statistical estimators used to calculate the net impacts require strong assumptions and/or multivariate conditionality to control for those differences.

Net Impacts Problem Statement[11]

The net impact evaluation problem may be stated as follows: Individual *i*, who has characteristics X_{it}, at time *t*, will be observed to have outcome(s) $Y_{it}(1)$ if she receives a "treatment," such as participating in the workforce development system and will be observed to have outcome(s) $Y_{it}(0)$ if she doesn't participate. The net impact of the treatment for individual *i*

[10] Even with an experiment, there may be implementation problems or behavioral responses that threaten its external validity. For example, problems such as crossover, differential attrition, or Hawthorne effects may arise.

[11] Much of this discussion comes from Hollenbeck (2004).

is $Y_{it}(1) - Y_{it}(0)$. But of course, this difference is never observed because an individual cannot simultaneously receive and not receive the treatment.

The time subscript is dropped in the following discussion to simplify the notation without loss of generality. Let $W_i = 1$ if individual i receives the treatment, and $W_i = 0$ if i does not receive the treatment. Let T represent the data set with observations about individuals who receive the treatment for whom we have data, and let n_T represent the number of individuals with data in T. Let U represent the data set with observations about individuals who may be similar to individuals who received the treatment for whom we have data, and let n_U be its sample size. Some of the techniques described below identify a subset of U that contains observations that "match" those in T. This subset is C, and let n_C be its sample size. Names that may be used for these three data sets are Treatment sample (T), Comparison sample universe (U), and Matched Comparison sample (C).

Receiving the treatment is assumed to be a random event; individuals happened to be in the right place at the right time to learn about the program, or the individuals may have experienced randomly the eligibility criteria for the program. Let W_i be an indicator variable that takes on the value 1 if individual i receives the treatment and 0 otherwise. By assumption W_i is a stochastic outcome that can be represented as follows:

(1) $W_i = g(X_i, e_i)$, where

> e_i is a random variable that includes unobserved or unobservable characteristics about individual i as well as a purely random component.

An assumption made about $g(\bullet)$ is that $0 < \text{prob}(W_i = 1|X_i) < 1$. This is referred to as the "support" or "overlap" condition, and is necessary so that the outcome functions described below are defined for all X.[12]

[12] Note that Imbens (2004) shows that this condition can be slightly weakened to $\Pr(W_i = 1|X_i) < 1$.

In general, outcomes are also assumed to be stochastically generated. As individuals in the treatment group encounter the treatment, they gain certain skills and knowledge and encounter certain networks of individuals. Outcomes are assumed to be generated by the following mapping:

(2) $Y_i(1) = f_1(X_i) + e_{1i}$

Individuals not in the treatment group progress through time and also achieve certain outcomes according to another stochastic process, as follows:

(3) $Y_i(0) = f_0(X_i) + e_{0i}$

Let $f_k(X_i) = E(Y_i(k)|X_i)$, so e_{ki} are deviations from expected values that reflect unobserved or unobservable characteristics, for $k = 0,1$.

As mentioned, the problem is that $Y_i(1)$ and $Y_i(0)$ are never observed simultaneously. What is observed is the following:

(4) $Y_i = (1 - W_i)Y_i(0) + W_iY_i(1)$

The expected value for the net impact of the treatment on the sample of individuals treated:

(5) $E[Y_i(1) - Y_i(0)|X, W_i = 1] = E(\Delta Y \mid X, W = 1)$

$$= E[Y(1)|X, W = 1] - E[Y(0)|X, W = 0]$$

$$+ E[Y(0)|X, W = 0] - E[Y(0)|X, W = 1]$$

$$= \hat{f}_1(X) - \hat{f}_0(X) + \text{BIAS}, \qquad \text{where}$$

$\hat{f}_k(X)$, $k = 1, 0$, are the outcome means for the treatment and comparison group samples, respectively, and

BIAS represents the expected difference in the $Y(0)$ outcome between the comparison group (actually observed) and the treatment group (the counterfactual.)

The BIAS term may be called selection bias.

A key assumption that allows estimation of equation (5) is that $Y(0) \perp W|X$. This orthogonality assumption states that given X, the outcome (absent the treatment), $Y(0)$, is random whether or not the individual is a participant. This is equivalent to the assumption that participation in the treatment can be explained by X up to a random error term. The assumption is called "unconfoundedness," "conditional independence," or "selection on observables." If the assumption holds, then the net impact is identified because BIAS goes to 0 and

$$(6) \qquad E[\Delta Y|X, W = 1] = \hat{f}_1(X) - \hat{f}_0(X)$$

In random assignment, the X and W are uncorrelated through experimental control, so the conditional independence assumption holds by design. In any other design, the conditional independence is an empirical question. Whether or not the data come from a random assignment experiment, however, because the orthogonality assumption holds only asymptotically (or for very large samples), in practice, it makes sense to regression-adjust equation (6).

Estimation of Net Impacts

The net impacts of receiving a treatment (i.e., participating in a program) are estimated by comparing the outcomes of the individuals who received the treatment to the outcomes of a set of individuals who did not receive the treatment. In the above exposition, T represents the data set(s) with treatment observations, and U represents the data set from which the comparison set of observations may be chosen. The chosen observations comprise C. Note that T and U may come from the same source of data, or may be entirely different data sets. In the former situation, U has been purged of all observations that are also in T.

Various techniques have been suggested in the literature for deriving C, but they may be boiled down to two possibilities: 1) use all of the U set or 2) try to find observations in U that closely match observations in T. Note that identification of the treatment effect requires that none

of the covariates X in the data sets are perfectly correlated with being in T or U. That is, given any observation X_i, the probability of being in T or in U is between 0 and 1. Techniques that use all of U are called full sample techniques.[13] Techniques that attempt to find matching observations will be called matching techniques. Each will be described in turn.

Full sample estimators. Assuming that T and U have some resemblance to each other, the evaluator should calculate the simple difference in means of the outcome variables as a baseline estimator. This estimator essentially assumes away selection bias. It may be represented as follows:

$$\tau = \frac{1}{n_T} \sum_{i \in T} Y_1(1) - \frac{1}{n_U} \sum_{i \in U} Y_j(0) \tag{7}$$

This estimator can be regression-adjusted. If it is assumed that the same functional form holds for both $Y(1)$ and $Y(0)$, then the treatment effect can be estimated from a linear equation such as the following using the observations in the union of T and U:

$$Y_i = a + B'X_i + \tau W_i + e_i. \tag{8}$$

More generally, τ can be estimated by using two separate regression functions for the two regimes ($Y(1)$ regressed on X in T and $Y(0)$ regressed on X in U), using both models to predict a "treated" and "non-treated" outcome for all observations in both T and U.[14] The following average treatment effect can then be calculated:

$$\tau = \frac{1}{N} \sum_{i \in T,U} \left[\hat{f}_1(X_i) - \hat{f}_0(X_i) \right], \text{ where} \tag{9}$$

$N = n_T + n_U$ and $\hat{f}_k(X_i)$ is predicted value for $k = 1, 0$.

[13] Some of these techniques trim or delete a few outlier observations from U but will still be referred to as full sample techniques.

[14] Imbens (2004) points out this generalization. The intuition is similar to that of the basic Roy (1952) model with two regimes and individuals pursuing the regime for which they have a comparative advantage. However, Imbens (2004) notes, "These simple regression estimators may be very sensitive to differences in the covariate distributions for treated and control units." (p. 12)

Equation (8) and the more general regressions in the first stage of (9) require strong parameterization assumptions. Heckman, Ichimura, Smith, and Todd (1998) relax those assumptions in a nonparametric kernel method. This method amounts to weighting the observations in U such that the observations closest to the treatment observations receive the highest weights. This estimator may be written as follows (following Imbens 2004):

$$(10) \qquad \hat{f}_k\left(X_1\right) = \frac{\sum_j Y_j K\left(\frac{X_j - X_i}{h}\right)}{\sum_j K\left(\frac{X_j - X_i}{h}\right)} \text{ for } k = 1, 0$$

where $j \in T$ if $k = 1$ and $j \in U$ if $k = 0$ and $K(\bullet)$ is a kernel function with bandwidth h.

$$(11) \qquad \tau = \frac{1}{N}\sum_i \left[\hat{f}_1\left(X_i\right) - \hat{f}_0\left(X_i\right)\right]$$

Several of the full sample estimators rely on the observations' propensity scores, which are the estimated probabilities of being in the treatment group. Rosenbaum and Rubin (1983) showed that the conditional independence assumption, $Y(0) \perp W|X$ implies that $Y(0) \perp W|p(X)$, where $p(X)$ is the conditional probability of receiving the treatment (= Prob($W = 1|X$)).

This result implies that the regression approaches in equations (8) through (10) can be re-estimated, at reduced dimensionality, with the X_i replaced by $p(X_i)$. That is, estimates can be generated as follows:

$$(8') \qquad Y_i = a + B'p(X_i) + \tau W_i + e_i.$$

$$(9') \qquad \tau = \frac{1}{N}\sum_{i \in T,U} \left[\left(\hat{f}_1\left(p\left(X_i\right)\right) - \hat{f}_0\left(p\left(X_i\right)\right)\right)\right]$$

(10') $$\hat{f}_k\left(X_i\right) = \frac{\sum_j Y_j K\left(\frac{p\left(X_j\right) - p\left(X_i\right)}{h}\right)}{\sum_j K\left(\frac{p\left(X_j\right) - p\left(X_i\right)}{h}\right)} \text{ for } k = 1, 0.$$

The final type of full sample estimator is computed by a technique known as blocking on the propensity score (see Dehejia and Wahba 1998). The intuition here is to partition the union of the treatment and full sample into "blocks" or strata by propensity score, such that there is no statistical difference between the covariates, *X*, in each block. This essentially achieves the conditional independence assumption locally in each block. Then the average treatment effect is a weighted average of the treatment effects in each block.

Assume there are *K* blocks. Let the *k*th block be defined as all treatment or full comparison sample cases with values of *X* such that $p(X) \in [p_{1k}, p_{2k}]$. Let NT_k be the number of treatment cases in the *k*th block and NU_k be the number of comparison cases from the full sample. The treatment effect with each block *k* is as follows:

(12) $$\tau_k = \sum_{\substack{i=1 \\ i \in T}}^{NT_k} \frac{1}{NT_k} Y_i(1) - \sum_{\substack{j=1 \\ j \in U}}^{NU_k} \frac{1}{NU_k} Y_j(0)$$

and the overall estimated average treatment effect is given as follows:

(13) $$\tau = \sum_{k=1}^{K} \frac{NT_k}{N} \tau_k$$

Matching estimators. As above, *U* denotes the set of observations from which a subset *C* (for matched comparison group) is chosen that will be used in the net impact analyses. The idea is to have *C* be comprised of the observations where individuals are most 'like' the individuals comprising *T*. Matching adds a whole new layer of complexity to the net impact estimation problem. The estimator becomes a function of how the match is done in addition to

the characteristics of the sample. Since the matching process is a structured algorithm specified by the analyst, the statistical error associated with the net impact estimator now includes a component that may be identified as matching error in addition to the sampling error and model specification error.[15]

There is a substantial and growing literature on how to sample individuals to construct the comparison sample.[16] The first candidate approach is *cell-matching algorithms*. Variables that are common to both data sets would be used to partition (cross-tabulate) the data into cells. Then for each treatment observation, the cell would be randomly sampled (with or without replacement) to select a comparison group observation. A substantial drawback to cell-matching is that the cross-tabulation of data, if there are many common variables, may result in small or empty cells.[17]

More sophisticated comparison group construction can be accomplished with *nearest-neighbor algorithms*. These algorithms minimize a distance metric between observations in T and U. Letting X represent the vector of variables that are common to both T and U, and letting X_j, X_k be the values of X taken on by the jth observation in T and kth observation in U, then C will be comprised of the k observations in U that minimize the distance metric $|(X_j - X_k)|$ for all j. This approach is very mechanistic, but it does allow use of all of the X variables.

The literature usually suggests that the distance metric be a weighted least squares distance, $(X_j - X_k)' \Sigma^{-1} (X_j - X_k)$, where Σ^{-1} is the inverse of the covariance matrix of X in the comparison sample. This is called the Mahalanobis metric. If we assume that the X_j are uncorrelated, then this metric simply becomes least squared error. Imbens (2004) has a

[15] This forces the analyst to use bootstrapping techniques to calculate standard errors.
[16] See Heckman, Lalonde, and Smith (1999) and references cited there.
[17] King et al. (1994) used a variation of this approach.

discussion of the effect of using different metrics, although in practice the Mahalanobis metric is used most often.[18]

In his work on training program evaluation, Ashenfelter (1978) demonstrated that participants' pre-program earnings usually decrease just prior to enrollment in a program. This implies that a potential problem with the nearest-neighbor approach is that individuals whose earnings have 'dipped' might be matched with individuals whose earnings have not. Thus, even though their earnings *levels* would be close, these individuals would not be good comparison group matches.

An alternative matching algorithm involves use of propensity scores (see Dehejia and Wahba 1995). Essentially, observations in T and U are pooled, and the probability of being in T is estimated, often using logistic regression. The predicted probability for each observation is called its propensity score. Propensity score matching reduces the distance metric to a single dimension, and it is appropriate because of the Rosenbaum and Rubin (1983) result that $Y(0) \perp W|X$ implies that $Y(0) \perp W|\mathrm{p}(X)$, where p(X) is the propensity score. Treatment observations are matched to observations in the comparison sample with the closest propensity scores.

A key assumption in matching procedures is the "unconfoundedness" or "conditional independence" of the outcome variable, Y, with the covariates, X. The assumption implies that the (co)variability of the X variables can be used to generate an estimate of the expected value of Y in the treatment and comparison samples. This requires two conditions. First, the distribution of the X variables should be statistically equivalent in the samples, and second, there is no variable in either the treatment or comparison sample that is related to the outcome variable Y that is not in X. If the first condition is violated, then any difference in outcomes between the

[18] Note that Zhao (2004) uses a metric that weights distances by the coefficients in the propensity score logit. This is similar to the technique that Schroeder implemented in Hollenbeck, King, and Schroeder (2003).

treatment and comparison groups might result from different covariability in *X* and not due to the treatment. If the second condition is violated, then any difference in outcomes between the treatment and comparison groups might be due to the unobserved or uncontrolled variable and not due to the treatment.

Thus, in practice, analysts conducting the estimation need to show that the *X* variables in the treatment sample are *balanced* with the X variables in the comparison sample. If the distributions differ significantly, then the propensity score model is misspecified, and additional interactions or polynomial terms may be added to the propensity score model. Matching should be redone, and balancing tests should be redone.

Also, in practice, analysts need to justify the assumption that there are no unobserved variables that are related to the outcomes of interest. In this study, we have access to many variables that are related to labor market outcomes[19] and use them in the matching algorithm. Arguably an important unobserved variable is individual motivation/initiative. We assume that there is little difference in the distribution of this characteristic between the treatment and comparison groups because the latter come from individuals who apply for services from the public employment service, and it requires some degree of motivation to apply for those services.

Genetic matching (Diamond and Sekhon, 2012) is a new approach that actually generalizes to both the distance-minimizing and propensity score matching techniques. It combines the distance metric to be minimized, along with a loss function to be minimized. The loss function measures the balance between the covariates in the treatment and matched comparison sets. By simultaneously minimizing the distance metric and the loss function, this

[19] The primary purpose of workforce development programs is to achieve favorable labor market outcomes. Thus it makes sense that programs collect the variables that are most likely to be related to those outcomes. If it were discovered that there were important variables that were left out, programs would quickly start collecting those variables.

approach is much more practical because it avoids the iterative re-balancing that often accompanies propensity score matching.

An important consideration in implementing the matching approach is whether to sample from *U* with or without replacement. Sampling with replacement reduces the "distance" between the treatment and comparison group cases, but it may result in the use of multiple repetitions of observations, which may artificially dampen the standard error of the net impact estimator. Another consideration is the number of cases to use from *U* in constructing *C*. Commonly, matching is done on a 1-to-1 basis, where the nearest neighbor is chosen. However, it is also possible to take multiple nearest neighbors.

The whole reason for matching is to find similar observations in the comparison group to those in the treatment group when the 'overlap' or statistical support is weak. Consequently, the nearest-neighbor approach may be adjusted to require that the distance between the observations that are paired be less than some criterion distance. This is called *caliper or radii matching*.

Once the matched sample *C* has been constructed, the net impact estimation can be done using the estimators analogous to those in equations (8) through (11). The outcome variable can be in terms of levels or difference-in-differences if the underlying data are longitudinal.

Estimation Procedures Used in This Study

With a wide variety of techniques available, the choice of estimation procedures is almost arbitrary. The literature does not single out any technique to be preferred. One factor that was taken into account, however, is that much of the analyses in this study examines programs that were analyzed in an earlier study, so it made sense to keep techniques consistent over time to minimize the number of factors that might cause results to differ. Net impacts were thus estimated using caliper matching on propensity scores with replacement as they were in the prior

study. Two regression-adjusted estimates were produced with the propensity score matched comparison groups: regression-adjusted levels and regression-adjusted difference-in-differences. The tables of results that are presented in this report show both estimates as well as simple differences in means.

Having all three estimates helps to indicate the stability of the results. In general, they are reasonably similar in magnitude, which arguably provides confidence about their reasonableness. However, to present the results to the Workforce Board, to summarize the results, and to have an estimate to be used in the cost-benefit calculations, it was necessary to select a preferred estimator. Table 2.1 summarizes the decisions that were made about this. In general, the preferred estimator came from the matched propensity score approach (to remain consistent with the 2006 study) and used regression-adjusted difference-in-differences (adjusts for individual-

Table 2.1 Preferred Estimation Technique

Workforce Program	Comparison Sample	Preferred Estimator
WIA Title I-B Adults	Labor Exchange (age = [22,60])	Regression-adjusted difference-in-differences
WIA Title I-B Dislocated Workers	Labor Exchange (age = [18,60])	Regression-adjusted levels
WIA Title I-B Youth	Labor Exchange (age = [14,21])	Regression-adjusted levels
CTC Job Prep	Labor Exchange (age = [16,60])	Regression-adjusted difference-in-differences
CTC Worker Retraining	Labor Exchange (age = [16,60])	Regression-adjusted levels
CTC Adult Basic Education	Labor Exchange (age = [16,60])	Regression-adjusted difference-in-differences
IBEST	Labor Exchange (age = [18,60])	Regression-adjusted difference-in-differences
Private Career Schools	Labor Exchange (age = [16,60])	Regression-adjusted difference-in-differences
Apprenticeships	Labor Exchange (age = [16,60])	Regression-adjusted difference-in-differences
Secondary Career and Technical Education	OSPI High School graduate data (not vocational completers)	Regression-adjusted levels
Vocational Rehabilitation	DVR administrative data (closure status = 30)	Regression-adjusted difference-in-differences

level *fixed* unobservables), unless the participants were likely to have structurally different pre-program labor market experiences from their post-program experiences. In this case, the preferred choice was the regression-adjusted levels estimator.

Choice of Outcome and Base Periods

As mentioned in the first chapter, net impacts were calculated for each program using two different fiscal years. *Short-term* impacts were calculated by specifying the treatment group as all individuals who exited from a program in fiscal 2007/2008. *Longer-term* impacts were calculated by using individuals who exited in fiscal 2005/2006 as the treatment group. The comparison groups were drawn from administrative data for individuals who last received services from the Labor Exchange during those two fiscal years. (In other words, the counterfactual situation for the net impact analysis was that without the workforce development system programs, the next best alternative for participants would have been registering for services with the Labor Exchange.)

The outcomes that we used in equations (1) through (8), i.e., the Y_i, included the following:

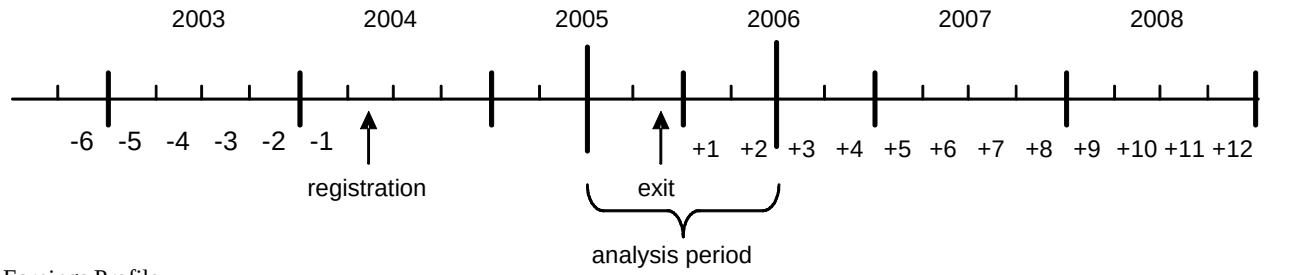
- employment rates
- hourly wages
- hours worked per quarter
- quarterly earnings
- receipt of UI benefits

All of these were measured on a quarterly basis. Employment was defined as having at least $100 in earnings in a quarter; hourly wage rate was defined as quarterly earnings divided by hours worked in the quarter; and receipt of a transfer or UI benefit was defined as nonzero benefits received during the calendar quarter.

We used two different approaches for identifying the specific periods over which to measure the short-term and longer-term outcomes. The first approach was to use the outcomes three quarters after exiting from the program, and the second was the quarterly average during quarters 9–12 after exiting from the program. The latest quarter for which we had data was Quarter 1 of 2010 (2010:Q1), so we were only able to use the first approach for the 2007/2008 program exiters. For difference-in-differences estimators, we specified the pre-program base period to be the average of quarters 3–6 prior to registration.

The timeline in Figure 2.1 is intended to help explain the analyses periods. The timeline shows the registration and exit dates for a hypothetical individual of adult age who registered for WIA Title I-B in April, 2004 (Quarter 2 of 2004) and exited from services in November, 2005(Quarter 4 of 2005). The earnings profile shows that this person had average quarterly earnings of $2,500 (real) in the base period (2002:Q4 to 2003:Q3), $2,700 in the 3rd quarter after exit (2006:Q3); and $3,100 average quarterly earnings in the 9th–12th post-exit quarters, which

Figure 2.1 Timeline and Earnings Profile for a Hypothetical WIA Title I-B Adult Client



Earnings Profile

Calendar Quarter	02:Q1	02:Q2	02:Q3	02:Q4	03:Q1	03:Q2	03:Q3	03:Q4	04:Q1	04:Q2	04:Q3	04:Q4
Analysis Quarter	–9	–8	–7	–6	–5	–4	–3	–2	–1	Treatment →		
Real Earnings	$2,300	$1,500	$0	$1,000	$2,800	$3,000	$3,200	$3,200	$1,600	$0	$0	$1,200
Calendar Quarter	05:Q1	05:Q2	05:Q3	05:Q4	06:Q1	06:Q2	06:Q3	06:Q4	07:Q1	07:Q2	07:Q3	07:Q4
Analysis Quarter	Treatment →				+1	+2	+3	+4	+5	+6	+7	+8
Real Earnings	$2,000	$0	$0	$1,500	$2,500	$2,700	$2,700	$2,700	$2,900	$0	$1,600	$2,900
Calendar Quarter	08:Q1	08:Q2	08:Q3	08:Q4								
Analysis Quarter	+9	+10	+11	+12								
Real Earnings	$3,000	$3,100	$3,100	$3,200								

Outcome Variables	
Earnings (+3)	$2,700
Ave. Earnings (9–12)	$3,100
Base Period Earnings (–6 through –3)	$2,500

were 2008:Q1 to 2008:Q4. So in the regression adjustment of earnings levels, the dependent variables would have been $2,700 and $3,100 for the short-term and longer-term outcomes. In the regression adjustment of difference-in-differences, the dependent variables would have been $200 and $600, respectively.

Subgroups

One of the advantages of relying on linked administrative data in an evaluation such as this project is that there are usually adequate sample sizes to examine the net impacts of the program interventions on subgroups of the population. Over the course of this project, we examined different subgroups for many of the programs. For example, the treatment groups usually comprised all individuals who had participated in a program and last received services during a particular fiscal year. This included individuals who "completed" the program and those who left without completing. Consequently in subgroup analyses, we examined "completers" versus "non-completers." As would be expected, "completers" generally had more favorable outcomes.

The subgroup analyses that we performed are described in each of the chapters of this report. We limited the subgroup analyses to programmatic feature variables—such as particular types of interventions or completion status. Differences in outcomes by client characteristics—such as age, sex, or minority status—could be identified by the coefficients in the regression adjustments.

3 WORKFORCE INVESTMENT ACT (WIA) TITLE I-B ADULTS

The Workforce Investment Act (WIA) programs have replaced the Job Training Partnership Act (JTPA) programs as the primary federally-funded job development activities for individuals entering the workforce. Title I-B services include core services—skill assessment, labor market information, consumer reports on training programs, and job search and placement assistance—and intensive services. The latter services are individualized and tend to be sequential in nature—intensive assessment, individual counseling, employment planning, and prevocational and vocational training. There are no eligibility criteria for core services; they are available to all adults. The intensive services are provided to adults who are unable to obtain jobs through the core services. Highest priority is given to welfare and low-income clients.

Participant Characteristics

Table 3.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool (exiters from the Labor Exchange (LE) who were at least 22 but no more than 60 at the time of exit). The first two columns of numbers compare the WIA clients who exited in 2005/2006 to individuals who exited from the Labor Exchange in the same year (except that individuals who were served by Washington's education and training programs were removed from the data). The final two columns compare the WIA exiters in 2007/2008 to LE exiters in the same year.

Note that there are two types of variables displayed in the table. The top panel of the table shows demographic and educational characteristics. The bottom panel presents variables that are intended to gauge the labor market history of individuals. The latter variables summarize the individuals' employment and earnings histories prior to registration with WIA (or with the Labor

Table 3.1 Descriptive Statistics for WIA Adult Treatment Group and Comparison Group Universe

Characteristics	2005/2006 WIA Adult	2005/2006 Labor Exchange	2007/2008 WIA Adult	2007/2008 Labor Exchange
Demographics and Education				
Female	60.5%	44.3%	61.0%	43.4%
Minority	36.0%	33.6%	35.9%	31.2%
Mean, age at registration	36.5	38.2	37.2	38.1
Disability	10.9%	16.5%	11.5%††	12.4%††
Mean, years of education at registration	12.4	12.3	12.5	12.4
Veteran	7.8%	13.9%	7.1%	9.4%
Single parent	29.4%	5.9%	31.2%	4.3%
On TANF at registration	10.7%	1.1%	10.7%	0.5%
On other public assistance at registration	--[d]	--[d]	39.0%	14.3%
West WA	68.4%	45.6%	71.2%	53.4%
Urban county	47.0%	43.1%	36.9%	48.4%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	56.5%	66.8%	57.3%	66.8%
Average quarterly earnings[a, b]	$2,423	$4,222	$2,337	$4,799
Mean, earnings trend[c]	−$5.9	$39.3	$11.5	$90.1
Mean, earnings variance[c] (in 10^6 $)	$5.6	$11.7	$5.0	$14.7
Percentage of quarters with multiple jobs	14.5%	15.5%	14.6%	13.9%
Had earnings dip	51.4%	42.8%	50.2%	36.1%
Mean, number of quarters since dip at registration[b]	1.7	1.5	1.7	1.1
Average earnings dip size in percentage[b]	41.4%	29.9%	39.4%	23.8%
Sample Size	3,874	184,525	2,864	90,609

NOTE: All differences in means are statistically significant at the 0.05 level (t-test). Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[d]Data not available.
††Differences in means are not statistically significant at 0.05 level (t-test).

Exchange). Percent of quarters with employment measures the percentage of calendar quarters prior to registration for which we had historical data (back to approximately 2003) that the individual had earnings of over $100.[20] The average quarterly earnings variable is the average for quarters in which the individual had any earnings. Earnings trend is the slope coefficient on a straight line time trend of earnings prior to registration (including 0s). Earnings variance is the statistical variance of the quarterly earnings time series prior to registration. Larger variances suggest more instability in earnings. Number of quarters with a job change is a measure of

[20]The numerator is the number of quarters with earnings that exceed $100 (‘05 $) prior to registration; the denominator is potential number of quarters prior to registration that the individual could have had earnings. We started the “clock” for potential quarters in the earliest quarter in our data for which the individual had non-zero earnings.

turnover. It is the number of quarters during the earnings histories prior to registration that the individual had a different employer from the previous quarter (the wage record data supplied by the state had a flag indicating different employer).

The last three variables refer to an earnings "dip" that may have occurred during the individual's pre-registration earnings history. A "dip" is defined as a decrease in earnings of at least 20 percent from one quarter to the next. In addition to a dummy variable indicating the existence of such a dip, two other variables were entered in the model: number of quarters prior to registration at which the dip occurred and the percentage size of the dip.[21]

The table shows that the populations are quite dissimilar both in terms of demographic characteristics and labor market histories. All but one of the variables have differences in the mean values that are statistically significant at the 0.05 level. Some differences are particularly large. In 2005/2006, over 60 percent of the WIA clients who had exited were females as compared to just over 44 percent of the Labor Exchange clients. In the earlier year, about 11 percent of the WIA adult participants reported themselves to be disabled and about 8 percent were veterans. These percentages compare to over 16 percent and about 14 percent in the Labor Exchange registrants. The differences for these two characteristics were much smaller in 2007/2008.

About 30 percent of the WIA Adult clients were single parents, whereas only about 6 percent of the Labor Exchange registrants were single parents. Concomitantly, the WIA Adult clients had a larger percentage of individuals on TANF at the time of registration—approximately 10 percent compared to 1 percent. In the last two columns of data, it can be seen that in the 2007/2008 cohort of exiters from the WIA adult program, almost 40 percent were on a

[21] In the previous study, the participation models included several variables that described the pre-registration public assistance experience of the individuals. In this study, no pre-registration public assistance data were provided to us, so those variables had to be dropped from the models.

public assistance program other than TANF; whereas only about 14 percent of the Labor Exchange registrants reported that same status. (Note that this variable was not available for the 2005/2006 cohort.) Approximately 70 percent of the WIA participants resided in western WA, whereas only about half of the Labor Exchange registrants lived there.

The average quarterly earnings for all WIA clients who had any earnings prior to registration was $2,300 to $2,400 (’05 $). The average quarterly earnings prior to registration for the Labor Exchange was over $4,200. Over 50 percent of the WIA clients had an earnings dip (defined as a quarter-to-quarter decrease in earnings of 20 percent or more), whereas only about 40 percent of the Labor Exchange clients had one.

Participation Model

Table 3.2 provides the results from the logit estimation of participation in the WIA Title I-B adult program. More precisely, the adults (aged 22–60) who had exited from the Labor Exchange (but who had not received employment and training services in Washington) were pooled with the WIA adult clients who had exited. A “treatment” dependent variable was created; it was a dummy variable equal to 1 for the WIA participants (and 0 for the LE group). The “model” is not theoretically derived, and so inferences about causality should be cautiously formulated. The independent variables include the pre-registration employment and earnings variables, for which causality may be appropriate because they precede the participation outcome. The demographic variables, however, are control variables that likely have little causal influence.

The table provides the logit coefficient estimates and standard errors. The magnitude of the coefficients is not easily interpreted, but the sign and statistical significance are. If the coefficient is positive, then a change in the variable will increase the likelihood of participation.

If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a WIA exiter.

Table 3.2 Coefficient Estimates from a Logit Model of Participation in WIA Title I-B Adult Programs

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.043	0.039	0.054	0.046
Minority	0.055	0.036	0.253***	0.044
Age at registration	0.005**	0.002	0.017***	0.002
Disability	−0.691***	0.054	−0.347***	0.063
Years of education, at registration	0.043***	0.009	0.068***	0.009
Veteran	−0.286***	0.065	0.091	0.080
Single parent	1.352***	0.044	1.579***	0.055
On TANF at registration	1.079***	0.066	1.432***	0.092
On other public assistance at registration	--[a]	--[a]	0.345***	0.051
West WA	0.939***	0.036	0.957***	0.045
Urban county	0.160***	0.035	−0.386***	0.043
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.007***	0.001	0.012***	0.001
Average quarterly earnings	−0.016***	0.001	−0.024***	0.001
Mean, earnings trend	−0.007	0.004	−0.009	0.005
Mean, earnings variance (in 10^8 $)	0.098	0.130	−0.072	0.238
Percentage of quarters with multiple jobs	−0.001	0.001	0.001	0.001
Had earnings dip	−0.355***	0.103	−0.324**	0.114
Mean, number of quarters since dip at registration	−0.015	0.010	0.043***	0.013
Average earnings dip size in percentage	1.067***	0.103	1.014***	0.117
Observations	188,399		93,473	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
[a]Data not available.

The coefficient estimates seem quite reasonable. The following variables are positively associated with being in the treatment group at a statistically significant level (i.e., a WIA adult exiter) in both years of data: minority status (not significant in 2005/2006), age, years of education, being a single parent, being on TANF or other public assistance at time of registration, employment rate prior to registration, magnitude of earnings dip, and being from western Washington. The following variables are significantly correlated with being in the Labor Exchange group (i.e., not being an individual who is served by the WIA Title I-B adult program): having a self-reported disability, average level of quarterly earnings prior to enrollment, having an earnings dip, and average quarterly earnings prior to registration. The

other variables in the table either have insignificant coefficients or "flip" signs between the two cohorts.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated logit coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. A measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group pool at the propensity score that is at the 20th percentile for the treatment group; a value of approximately 80 is "optimum." Table 3.3 provides these data for the WIA Title I-B Adult analyses. Note that there is a sizeable difference in the means between the WIA Adult and Labor Exchange samples, and the 20th percentile indicators have a relatively high value, although they do not reach 80 percent. The mean propensity scores for the treatment groups are roughly 0.06 and 0.12, whereas they are about 0.02 and 0.03 for the comparison pool, for 2005/2006 and 2007/2008, respectively. The 20th percentile indicators are approximately 60 percent for the earlier cohort and 67 percent for the later cohort. These values suggest that the participation model discriminated between the treatment and comparison observations at a level that was not especially noteworthy.

Table 3.3 Indicators of Propensity Score Model Quality for WIA Adult Analyses

Statistic	2005/2006	2007/2008
Mean p-score, WIA Adult	0.059	0.120
Mean p-score, Labor Exchange	0.020	0.028
Percentile Labor Exchange, at 20th percentile WIA Adult	59.8%	67.1%

Statistical Match

As described in the last chapter, the statistical matching that was done used a "nearest neighbor" approach with the propensity score. For every observation *j* in *T*, we found the observation *k* in *U* that minimized the absolute value of the difference between the propensity score for *j* and *k*. We then added observation *k* to the comparison group sample, *C*. The statistical match was done with replacement, so some observations in *U* were the "matches" for more than one observation in the treatment group. Furthermore it was done with a caliper of 0.005.

Table 3.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for WIA Adults

	2005/2006		2007/2008	
Statistic/Characteristic	WIA Adult	Labor Exchange	WIA Adult	Labor Exchange
Sample size	3,954	206,315	2,864	98,261
Sample size used in match	3,874	184,525	2,864	90,609
Matched sample size	3,872	3,872	2,851	2,851
Number of observations used once	--[c]	3,485	--[c]	2,344
Number of observations used multiple times	--[c]	177	--[c]	223
Maximum number of repeats	--[c]	6	--[c]	5
Demographics and Education				
Mean, age at registration	36.5	36.6	37.2	37.5
Female	60.5%	60.8%	60.8%	61.6%
Minority	36.0%	36.4%	35.9%	36.4%
Mean, years of education at registration	12.4	12.5	12.5	12.5
Single parent	29.4%	29.2%	30.9%	30.3%
Disability	11.0%	10.8%	11.5%	12.9%
Veteran	7.8%	7.6%	7.1%	7.4%
On TANF at registration	10.7%**	8.1%**	10.2%	8.7%
Urban county	47.0%	46.4%	37.1%	38.1%
West WA	68.4%	69.0%	71.1%	72.9%
On public assistance at registration other	--[c]	--[c]	38.7%	38.9%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	56.5%	57.0%	57.2%	57.0%
Average quarterly earnings[a]	$2,423	$2,371	$2,342	$2,280
Mean, earnings trend[b]	−$5.7	−$8.5	$11.9	$3.1
Mean, earnings variance[b] (in 10^6 $)	$5.6	$5.2	$5.0	$4.7
Percentage of quarters with multiple jobs	14.4%	13.9%	14.6%	14.8%
Had earnings dip	51.3%	52.9%	50.0%	50.0%
Mean, number of quarters since dip at registration[a]	1.7	1.8	1.7	1.6
Average earnings dip size in percentage[a]	41.4%	42.4%	39.2%	39.0%
Sample Size of matched sample	3,872	3,872	2,851	2,851

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
[c]Variable not available.
** Difference in means is statistically significant at the 0.05 level (t-test).

Table 3.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment group and constructed comparison group for the statistical match. In matching with replacement, we are artificially reducing the variation in the matched comparison sample whenever the same observation is used multiple times. (This is the tradeoff that is made in order to get "better matches.") Consequently, other things equal, matches would be preferred with a smaller number of observations that are used multiple times, and a smaller number of maximum matches. The table indicates that approximately five to ten percent of the matched comparison group records are matched multiple times, and the maximum number of times for a record is six times.

It is also the case that there should be little non-random differences in characteristics between the treatment and matched comparison set. Table 3.4 presents the means of a number of covariates in the treatment and matched comparison samples. Sample exclusions that account for the differences between the first two rows of the table were for observations that had missing data for any of the variables used in the match. The difference in counts between the second and third row represents the number of observations that were deleted because they were not within the caliper radius. Notice that the resulting distributions are well-balanced. There is only one variable for which the difference in means is statistically significant.

Net Impacts

The major purpose of the study was, of course, to estimate the net impacts of the workforce development system programs on clients. In particular, net impacts were estimated for the following five outcomes:

- employment
- hourly wage
- quarterly hours of employment

- quarterly earnings
- receipt and amount of Unemployment Compensation benefits per quarter

Tables 3.5 and 3.6 provide the estimated net impacts for WIA Title I-B adult programs. The first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group.

Table 3.5 Net Impact Estimates for WIA Adult Program for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	11.1***	12.0***	62.9	--	56.5	--
Ever-employed, longer term (%)	3.0***	3.0***	67.4	--	64.3	--
Percent of quarters, longer term	5.5***	5.6***	57.1	--	52.3	--
Percent of quarters, longer term, diff-in-diff	11.1***	10.8***	−6.9	--	−0.8	--
Average hourly wage						
Short term ($)	1.78***	1.76***	9.62	15.10	7.37	12.73
Short term, diff-in-diff ($)	2.15***	2.17***	−0.46	−0.43	−0.09	−0.46
Longer term ($)	0.90***	0.88***	9.51	16.03	7.51	13.75
Longer term, diff-in-diff ($)	1.42***	1.44***	−1.84	0.40	−0.66	0.54
Average quarterly hours						
Short term	75.2***	74.9***	247.4	388.4	201.7	348.5
Short term, diff-in-diff	68.6***	68.7***	0.3	11.4	8.2	25.9
Longer term	41.5***	41.7***	237.9	383.6	202.3	347.3
Longer term, diff-in-diff	40.7***	41.1***	−35.3	11.6	−4.7	35.1
Average quarterly earnings						
Short term ($)	1,028***	1,007***	3,847	6,041	2,612	4,513
Short term, diff-in-diff ($)	1,062***	1,086***	−245	−35	48	280
Longer term ($)	651***	638***	4,001	6,368	2,858	4,855
Longer term, diff-in-diff ($)	733***	766***	−620	318	67	729
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−1.2**	−1.0**	9.7	--	6.3	--
Benefits, short term ($)	−16*	−17*	129	1,323	78	1,238
Percent receiving, longer term	−2.0**	−1.9**	18.6	–	15.5	–
Benefits, longer term ($)	−9	−10	174	1,611	133	1,474

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 3.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, although for some programs we use the levels of the outcome variables as the dependent variable and, for others, we use difference-in-differences. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

Table 3.5 shows the results for the analyses of the 2005/2006 cohort and table 3.6 provides the results for the 2007/2008 cohort. Our general strategy is to rely on the earlier cohort of exiters to provide the longer-term net impacts, and on the more recent cohort of exiters to

Table 3.6 Net Impact Estimates for WIA Adult Program for 2007/2008 Cohort

	Matched Sample Estimator		Comparison Group Means			
	Diff. in	Regr.	Full Sample		Matched Sample	
Outcome	Means	Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	12.1***	12.8***	60.2	--	52.7	--
Average hourly wage						
Short term ($)	1.79***	1.70***	10.05	16.46	7.03	13.09
Short term, diff-in-diff ($)	2.00***	1.99***	−0.92	−0.88	0.38	0.39
Average quarterly hours						
Short term	66.8***	64.9***	243.6	399.2	192.1	357.5
Short term, diff-in-diff	67.6***	66.4***	−22.1	−23.7	1.8	1.9
Average quarterly earnings						
Short term ($)	1,006***	957***	4,087	6,696	2,520	4,689
Short term, diff-in-diff ($)	1,196***	1,189***	−801	−919	6	40
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−1.8**	−1.7**	13.9	--	9.8	--
Benefits, short term ($)	−56***	−59***	303	2,183	169	1,732

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 3.4.

*significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

provide the short-term impacts. However, as exhibited in the first table, we have also generated short-term impacts for the earlier cohort.

Note on unconditional versus conditional means. For many of the outcome variables, the issue of whether or not to use observations with values of 0 in the calculations of mean results arose. Means that are calculated without 0s are referred to as *conditional means*; means that included 0s are referred to as *unconditional means*. The reason to use conditional means is that many outcomes depend on whether or not an individual is in a particular status and on what occurs in that status. For example, to have quarterly earnings, an individual must be employed. If employed, the individual's earnings depend on hours worked and wage rates. If a program has impacts on the likelihood of employment and on wage rates, then the unconditional level of earnings will confound both an employment and a wage rate effect. The conditional mean will not be influenced by the share of the treatment or comparison group that is employed. The reason to rely solely on unconditional means is that we are interested in the effect of a program on the population that it serves. Furthermore, we are using the average or mean to measure that effect. Therefore the correct statistic is the unconditional mean. Both sets of impacts were estimated. In all of the tables and in the cost-benefit analysis, we use unconditional means. However, the conditional mean impacts are available from the authors on request.

The longer-term employment and earnings impacts that are shown in Table 3.5 are positive and relatively large. The program results in more employment, a higher average hourly wage, and more hours of work per quarter. Thus the overall earnings impact is positive and significant. The longer-term earnings impact is approximately 25 percent (the estimated net impact is $766 per quarter and the unconditional mean level of earnings for the match comparison group is $2,858). The longer-term estimates in the table suggest a decrease in the

percent of individuals receiving UI benefits, and a decrease in those benefits. The reduction in percent of individuals receiving UI is significant, but the reduction in benefits is not. These point estimates suggest that not only do treatment cases improve their labor market outcomes, but they also are less at risk of being laid off and receiving unemployment compensation.

The short-term impacts on employment and earnings displayed in Table 3.6 are also positive, and in fact, are larger than the longer-term impacts. The earnings impact of $1,189 per quarter is approximately 40 percent of average earnings for the matched comparison group. The table also shows a short-term decrease in UI take-up that is statistically significant, although somewhat smaller than the longer-term estimates. However, the short-term impacts on UI benefits is about −$60—much larger in magnitude than the longer-term reduction in benefits—and is also significant.

The results in these two tables suggest that in the short term, the WIA Title I-B Adult programs have large and significant positive effects on employment and earnings that are somewhat attenuated in the longer-term.

Subgroup Analyses

To test the effect of providing training to WIA Title I-B adult program participants, we estimated the net impact outcomes for the subgroup of individuals who received training. On the one hand, we might hypothesize that training will result in more positive outcomes. But on the other hand, one reason why participants don't get training is because they have been successful in finding employment. Tables 3.7 and 3.8 display the estimated net impacts for the preferred estimated outcomes (those highlighted in Tables 3.5 and 3.6) for individuals who did and did not receive "training services," as opposed to job search assistance or other "non-training" services only.

A clear pattern is displayed in the results: both the short-term and longer-term net impacts for individuals who received training are substantially better than the impacts for those individuals who did not receive training services. Employment rates are a little over four percentage points higher. Both the longer-term and short-term hourly wage net impacts are approximately $2.50 per hour for participants who received training whereas they were about half of that for the short-term impact and only about $0.50 per hour for the longer-term impact for individuals who did not receive training. The average quarterly hours of employment are also considerably higher for trainees than for the non-trainees. And of course given the sanguine net impacts for employment, hourly wage rates, and quarterly hours, the average quarterly earnings for participants with training far exceeded the average quarterly earnings for participants who did not receive training. The short-term net earnings impact for individuals who had been trained is over $1,600 and is about half of that for individuals who had not been trained. In the longer-term, the net quarterly earnings impact estimates are approximately $1,250 and $335 for individuals who received training and who didn't receive training, respectively. Interestingly, the magnitudes of the net impacts get smaller between the short-term and longer-term, but the difference between the trained and non-trained individuals get larger. These results can be interpreted as a positive result for training as an intervention because differentials for individuals who received training become larger. Training seems to have a value that grows with time.

Table 3.7 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Adult Participants: 2005/2006 Cohort

Outcome	Subgroup: Participants who did not receive training	Subgroup: Participants with training	Matched Comparison Group Mean
Employment	8.9%**	13.2%**	52.3%
Hourly Wage	$0.48**	$2.52**	$7.51
Hours Worked	27.5**	56.7**	202.3
Earnings	$335**	$1,241**	$2,858
UI Receipt	−0.2%	−4.2%**	15.5%
Subgroup Sample Size	2,086	1,786	—

NOTE: Monetary data in '05 $.
**Significant at 0.05 level (two-tailed test).

Table 3.8 Selected Short-Term Net Impact Estimates for Subgroups of WIA Adult Participants: 2007/2008 Cohort

Outcome	Subgroup: Participants who did not receive training	Subgroup: Participants with training	Matched Comparison Group Mean
Employment	11.0%**	15.4%**	52.7%
Hourly Wage	$1.36**	$2.62**	$7.03
Hours Worked	56.5**	80.4**	192.1
Earnings	$796**	$1,635**	$2,520
UI Receipt	−0.7%	−3.0%**	9.8%
Subgroup Sample Size	1,560	1,291	—

NOTE: Monetary data in '05 $.
**Significant at 0.05 level (two-tailed test).

4 WIA TITLE I-B DISLOCATED WORKERS

Over the period of analysis in this study, the Workforce Investment Act (WIA) Title I-B had a funding stream to serve dislocated workers, defined as individuals who lost jobs due to plant closures, company downsizing, or other significant change in the market such that they are unlikely to return to their occupation. The services that were provided to clients were identical to those provided to the Title I-B adult services described in the previous section. That is, they included, "core services:" skill assessment, labor market information, training program consumer reports, and job search and placement assistance. Dislocated workers unable to get jobs with core services are eligible for individualized attention through intensive and training services. In addition to the services for dislocated workers, this funding mechanism also established early intervention programs for workers and firms facing substantial layoffs. Although the services were similar, the clients who participated in this program were quite different from those who participated in the adult programs. Dislocated workers tended to have had substantial labor market attachment and much higher earnings levels and skill levels prior to their participation.

Participant Characteristics

Table 4.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The first two columns of numbers in the table compare the WIA dislocated worker clients who exited in 2005/2006 to individuals who exited from the Labor Exchange in the same year (except that individuals who were served by Washington's education and training programs were removed from the data). The final two columns compare the WIA dislocated worker exiters in 2007/2008 to LE exiters in the same year. The comparison group pool for the WIA dislocated workers is not quite identical to the pool for the WIA Title I-

Table 4.1 Descriptive Statistics for WIA Dislocated Worker Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	WIA Dislocated Workers	Labor Exchange	WIA Dislocated Workers	Labor Exchange
Demographics and Education				
Female	48.7%	44.7%	49.8%	43.5%
Minority	23.0%	34.5%	21.3%	32.0%
Mean, age at registration	43.5	36.5	44.1	36.3
Disability	4.8%	18.1%	5.9%	12.6%
Mean, years of education at registration	13.1	12.3	13.2	12.3
Veteran	15.0%	12.9%	14.1%	8.7%
Single parent	11.8%	6.0%	13.5%	4.4%
West WA	67.2%	44.8%	68.9%	52.1%
Urban county	52.7%	41.9%	46.1%††	47.0%††
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	82.7%	65.2%	80.8%	65.4%
Average quarterly earnings[a, b]	$7,460	$3,937	$7,034	$4,463
Mean, earnings trend[c]	$20.3	$42.8	$34.0	$91.4
Mean, earnings variance[c] (in 10^6 $)	$19.0	$10.8	$18.4	$13.5
Percentage of quarters with multiple jobs	10.4%	15.3%	11.2%	13.9%
Had earnings dip	51.6%	42.5%	48.5%	36.4%
Mean, number of quarters since dip at registration[b]	1.5††	1.5††	1.3	1.1
Average earnings dip size in percentage[b]	37.4%	30.0%	34.7%	24.4%
Sample Size	4,296	203,377	2,817	99,792

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
††Differences in means are not statistically significant at 0.05 level (t-test).

B adults because we included individuals aged 18–21 at the time of exit in addition the observations over the age of 21.[22]

The populations had a few differences in their demographic and educational characteristics. Not surprisingly, the dislocated workers were older than the labor exchange participants, averaging about 44 years old compared to about 36. They were less likely to be a minority, less likely to have a (self-reported) disability, and had higher average education levels, were more likely to be a veteran, more likely a single parent, and more likely to reside in West Washington. In terms of their labor market histories, the dislocated workers had higher levels of prior employment and average quarterly earnings. They were much likely to have experienced a

[22]We included individuals aged 18–20 because dislocated workers can be in this age range.

dip in earnings, and the size of their earnings dip was significantly greater. On the other hand, they had less turnover (average number of quarters with multiple jobs) and their earnings trends were lower.

Participation Model

Table 4.2 provides the results from the logit estimation of participation. More precisely, the individuals who had exited from the Labor Exchange (but who had not received employment and training services in the Washington workforce development system) were pooled with the WIA Title I-B dislocated worker clients who had exited, and participation was a dummy variable equal to 1 for the latter group (and 0 for the former). The independent variables used in the model were identical to those used in the model of WIA Title I-B adult program participation as described in the preceding chapter. The table provides the logit coefficient estimates and standard errors.

Table 4.2 Coefficient Estimates from a Logit Model of Participation in WIA Dislocated Worker Analyses

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.239***	0.036	0.241***	0.045
Minority	−0.223***	0.039	−0.178***	0.049
Age at registration	0.035***	0.002	0.049***	0.002
Disability	−1.168***	0.073	−0.721***	0.082
Years of education, at registration	0.097***	0.009	0.094***	0.010
Veteran	−0.013	0.048	0.376***	0.062
Single parent	1.175***	0.053	1.478***	0.063
West WA	0.697***	0.034	0.564***	0.044
Urban county	0.070*	0.033	−0.333***	0.042
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.018***	0.001	0.014***	0.001
Average quarterly earnings	0.003***	0.000	−0.000	0.001
Mean, earnings trend	−0.005	0.003	−0.007**	0.003
Mean, earnings variance (in 10^8 $)	−0.228***	0.042	−0.120*	0.048
Percentage of quarters with multiple jobs	−0.011***	0.001	−0.003*	0.001
Had earnings dip	0.023	0.080	−0.195*	0.098
Mean, number of quarters since dip at registration	−0.078***	0.010	−0.031*	0.014
Average earnings dip size in percentage	0.908***	0.085	1.220***	0.106
Observations	207,673		102,609	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As we noted in chapter 3, the model is not really a formal model of participation, and the magnitudes of the coefficients are not particularly meaningful, but their signs and statistical significance are. If the coefficient is positive, then a change in that independent variable will increase the likelihood of being a WIA Title I-B dislocated worker. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a WIA dislocated worker participant.

The coefficient estimates seem quite reasonable. The following variables are significantly correlated with being in the treatment group (i.e., a dislocated worker) in both years of data: Female, age at registration, years of education, being a single parent, residing in western Washington, percent employed, and the magnitude of the earnings dip. The following variables are significantly correlated with being in the Labor Exchange group: being a minority, having a disability, earnings trend (not significant in 2005/2006), earnings variance, turnover, and number of quarters between the earnings dip and registration. The other variables in the analysis either have insignificant coefficients or "flip" signs between the two cohorts.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile; a value of approximately 80 indicates a "good model." Table 4.3 provides these indicators for the WIA Title I-B dislocated worker analyses. There is a large difference in the

means, although these differences are not as great as expected. The mean propensity scores for the treatment groups are between 0.065 and 0.08, whereas they are 0.020 and 0.026 for the comparison pool in 2005/2006 and 2007/2008, respectively. The 20th percentile indicators are reasonably large, although they do not achieve the 80 percent threshold—only about 65 percent in both cohorts. These statistics suggest that the participation model does not discriminate quite as well as the model for WIA Title I-B adults.

Table 4.3 Indicators of Propensity Score Model Quality for WIA Dislocated Worker Analyses

Statistic	2005/2006	2007/2008
Mean p-score, WIA Dislocated Worker	0.065	0.079
Mean p-score, Labor Exchange	0.020	0.026
Percentile Labor Exchange, at 20th percentile WIA Dislocated Worker	64.9%	64.7%

Statistical Match

The statistical matching that was done used a "nearest neighbor" approach with the propensity score. For every observation *j* in *T*, we found the observation *k* in *U* that minimized the absolute value of the difference between the propensity score for *j* and *k*. We then added *k* to the comparison group sample. The statistical match was done with a caliper, but also with replacement, so some observations in *U* were the "matches" for more than one observation in the treatment group and were duplicated in the match comparison set. Table 4.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment group and constructed comparison group. As with the analysis of the adult title of WIA, we had less than 10 percent of the matches with multiple copies of the comparison group record—just under 220 in the 2005/2006 analysis and about 150 in the 2007/2008 analysis, which had a smaller treatment group. Notice that means for the

comparison group are quite close to the treatment group as would be expected indicating that the treatment and comparison group populations are well-balanced. Only a single variable had a difference in means that is significant. Sample exclusions that account for the differences between the first two rows of the table were for observations that had missing data for any of the variables used in the participation logit estimation.

Table 4.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for WIA Dislocated Worker Analyses

	2005/2006		2007/2008	
Statistic/Characteristic	WIA Dislocated Workers	Labor Exchange	WIA Dislocated Workers	Labor Exchange
Sample size	4,471	227,714	2,898	107,731
Sample size used in match	4,296	203,377	2,817	99,792
Matched sample size	4,292	4,292	2,810	2,810
Number of observations used once	--	3,837	--	2,485
Number of observations used multiple times	--	217	--	154
Maximum number of repeats	--	5	--	4
Demographics and Education				
Mean, age at registration	43.5	43.5	44.1	44.5
Female	48.7%	48.4%	49.7%	48.4%
Minority	23.0%**	21.2%**	21.4%	21.7%
Mean, years of education at registration	13.1	13.1	13.2	13.2
Single parent	11.7%	11.7%	13.3%	12.3%
Disability	4.8%	4.8%	5.9%	5.8%
Veteran	15.1%	15.3%	14.1%	14.4%
Urban county	52.7%	51.4%	46.2%	45.1%
West WA	67.2%	66.2%	68.8%	69.7%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	82.6%	82.6%	80.8%	80.4%
Average quarterly earnings[a]	$7,454	$7,481	$7,031	$7,026
Mean, earnings variance[b] (in 10^6 $)	$19.0	$18.2	$18.5	$19.7
Mean, earnings trend[b]	$20.5	$5.8	$33.9	$28.0
Percentage of quarters with multiple jobs	10.4%	10.2%	11.3%	11.4%
Had earnings dip	51.6%	52.1%	48.5%	48.2%
Mean, number of quarters since dip at registration[a]	1.5	1.5	1.3	1.3
Average earnings dip size in percentage[a]	37.3%	37.5%	34.7%	35.0%
Sample Size of matched sample	4,292	4,292	2,810	2,810

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
** Difference in means is statistically significant at the 0.05 level (t-test).

Net Impacts

One of the major purposes of the study was to estimate the net impacts of the education and training programs on clients. Tables 4.5 and 4.6 provide the estimated net impacts for the WIA Title I-B dislocated workers. The first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, and note for this program we use the levels of the outcome variables as the dependent variable because the base for the difference-in-difference estimators would involve a period of time when these workers were likely to have lost their jobs. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

The results in Table 4.6 show that in the short term, the WIA dislocated worker clients increase their employment rates, average hourly wages, and hours of work. The significant increases in employment, wage rates, and hours worked combine to yield a substantial increase in quarterly earnings of about $600, which represents an impact of about 12 percent. Note that the short-term net impact estimators suggest a decrease in the take-up of unemployment insurance benefits.

Table 4.5 Net Impact Estimates for WIA Title I-B Dislocated Worker Program for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	6.3***	6.5***	62.5	--	66.8	--
Ever-employed, longer term (%)	1.7*	1.6*	67.5	--	72.1	--
Percent of quarters, longer term	4.8***	4.7***	56.9	--	62.7	--
Percent of quarters, longer term, diff-in-diff	2.6**	2.7***	−5.1	--	−16.8	--
Average hourly wage						
Short term ($)	1.04***	1.04***	9.31	14.68	12.32	18.27
Short term, diff-in-diff ($)	0.96***	0.95***	−0.35	−0.32	−2.74	−1.72
Longer term ($)	1.66***	1.65***	9.24	15.59	12.22	18.80
Longer term, diff-in-diff ($)	1.58***	1.55***	−1.60	0.56	−5.24	−1.32
Average quarterly hours						
Short term	54.8***	54.5***	242.2	381.8	275.6	408.8
Short term, diff-in-diff	37.1***	37.5***	4.4	17.3	−40.3	−9.7
Longer term	36.2***	35.6***	234.6	378.3	272.8	406.5
Longer term, diff-in-diff	10.7*	10.8**	−27.7	19.6	−84.8	−8.9
Average quarterly earnings						
Short term ($)	836***	826***	3,679	5,799	5,182	7,689
Short term, diff-in-diff ($)	776***	768***	−168	58	−1,491	−953
Longer term ($)	858***	850***	3,854	6,128	5,395	7,948
Longer term, diff-in-diff ($)	770***	760***	−486	441	−2,345	−682
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−3.8***	−3.6***	9.1	--	11.1	--
Benefits, short term ($)	−69***	−69***	120	1,310	178	1,605
Percent receiving, longer term	−3.3***	−3.2***	17.8	--	19.7	--
Benefits, longer term ($)	−20	−21	164	1,591	206	1,759

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 4.4. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The longer-term impacts displayed in Table 4.5 are similar to the short-term net impacts, although the employment and quarterly hours impacts are smaller in size. However, the hourly age impact is quite a bit larger. The short-term employment impact is 10.1 percentage points, whereas the longer-term net impact is only 4.7 percentage points. The short-term net impacts for the average hourly wage and average quarterly hours of employment are $0.76 and 66.4 hours, whereas the longer-term impacts are $1.65 and 35.6 hours. The longer-term net impact for

Table 4.6 Net Impact Estimates for WIA Title I-B Dislocated Worker Program for 2007/2008 Cohort

Outcome	Matched Sample Estimator: Diff. in Means	Matched Sample Estimator: Regr. Adj.	Comparison Group Means: Full Sample With 0	Comparison Group Means: Full Sample W/O 0	Comparison Group Means: Matched Sample With 0	Comparison Group Means: Matched Sample W/O 0
Employment						
Short term (%)	10.0***	10.1***	59.8	--	62.0	--
Average hourly wage						
Short term ($)	0.79**	0.76**	9.67	15.95	11.45	18.20
Short term, diff-in-diff ($)	0.87***	0.90***	−0.78	−0.72	−2.82	−2.30
Average quarterly hours						
Short term	67.5***	66.4***	237.9	392.3	253.9	403.5
Short term, diff-in-diff	31.0***	32.2***	−17.1	−15.9	−53.7	−39.6
Average quarterly earnings						
Short term ($)	602***	589***	3,885	6,407	4,775	7,588
Short term, diff-in-diff ($)	554***	561***	−685	−765	−1,805	−1,827
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−3.2***	−3.1***	13.0	--	17.2	--
Benefits, short term ($)	−141***	−140***	279	2,154	438	2,546

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 4.4. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

average quarterly earnings turns out to be $850, a little more than 15 percent. Finally, as with the short-term net impacts, the longer-term estimates show reductions in unemployment insurance benefit recipiency and benefit levels.

Subgroup Analyses

About 60 percent of the WIA dislocated worker participants were coded in the administrative data as having received training. Tables 4.7 and 4.8 display the net impact estimates for that subgroup along with the estimates for the subgroup that did not receive training. In the subgroup analyses for WIA Title I-B adults presented in chapter 3, we showed (1) that the short-term and longer-term net impacts for individuals with training were more positive than the net impacts for participants who did not get training, (2) that the longer-term net impacts for individuals who had been trained were smaller in magnitude than the short-term impacts, and (3) that the differentials between trained and non-trained individuals were much larger in the

longer-term than in the short term. This suggested a substantial payoff to training take grew over time.

A somewhat similar picture is painted in the tables for dislocated workers. Unlike WIA adults, the short-term net impacts are very similar for participants who did and who did not receive training services. However, just like WIA adults, the labor market impacts were smaller in the longer-term than in the short-term, the longer-term net impacts were larger in magnitude for the participants that received training services, and obviously then, the differentials between trained and non-trained dislocated workers were larger in the longer-term than in the short-term. The bottom line is that, as with WIA adults, training seems to result in positive outcomes for dislocated worker participants, although the advantage doesn't appear until the longer-term.

Table 4.7 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Dislocated Worker Participants: 2005/2006 Cohort

	Subgroup		
Outcome	Participants who did not receive training	Participants with training	Matched Comparison Group Mean
Employment	4.4%**	4.6%**	62.7%
Hourly Wage	$0.65	$2.11**	$12.22
Hours Worked	32.7**	35.6**	272.8
Earnings	$314	$1.095**	$5,395
UI Receipt	−2.1%	−4.2%**	19.7%
Subgroup Sample Size	1,648	2,644	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

Table 4.8 Selected Short-Term Net Impact Estimates for Subgroups of WIA Dislocated Worker Participants: 2007/2008 Cohort

	Subgroup		
Outcome	Participants who did not receive training	Participants with training	Matched Comparison Group Mean
Employment	10.4%**	10.1%**	62.0%
Hourly Wage	$0.44	$1.02**	$11.45
Hours Worked	70.4**	62.9**	253.9
Earnings	$612**	$590**	$4,775
UI Receipt	−1.6%	−3.8%**	17.2%
Subgroup Sample Size	1,246	1,564	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

5 WIA TITLE I-B YOUTH PROGRAMS

The Workforce Investment Act (WIA) Title I-B youth programs prepare low-income youth ages 14 to 21 for academic and employment success. Youth are assessed to determine academic, skill level, and support service needs. Staff members work with each young person to develop a plan that may encompass counseling, tutoring, job training, mentoring, or work experience. Other strategies include summer employment, study skills training, or basic skills instruction in preparation for obtaining a GED. Youth ages 18 to 21 may be co-enrolled in WIA Title I-B adult programs. At least 30 percent of the funding must be used to provide activities for out-of-school youth.

To participate, youth must be low income (TANF or Food Stamp recipient, homeless, or family income below 70 percent of the lower living standard income level) and must have an educational deficiency.

Participant Characteristics

Table 5.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The first two columns of numbers compare the WIA youth clients who exited in 2005/2006 to individuals under 22 who exited from the Labor Exchange in the same year (except that individuals who were served by Washington's education and training programs were removed from the data). The final two columns compare the WIA youth program exiters in 2007/2008 to LE exiters in the same year.

The populations are dissimilar. In particular, the WIA youth are younger (by about a year on average), are more likely to be female, and are more likely to be from an urban county and from western Washington than the LE exiters. The WIA youth have less employment and earnings prior to registration: lower prior employment rates, lower average quarterly earnings,

and a lower trend in prior earnings. In short, compared to the entire Labor Exchange group of individuals, the WIA youth seem to have much less human capital in the form of education and prior employment.

Table 5.1 Descriptive Statistics for WIA Youth Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	WIA Youth	Labor Exchange	WIA Youth	Labor Exchange
Demographics and Education				
Female	54.2%	49.5%	55.4%	45.5%
Minority	45.3%[††]	45.4%[††]	46.0%	43.0%
Mean, age at registration	17.8	18.9	17.9	18.9
Disability	16.8%	35.3%	18.3%[††]	17.5%[††]
Mean, years of education at registration	10.0	11.5	10.3	11.2
Veteran	--[d]	--[d]	0.1%	1.5%
Single parent	9.3%	6.3%	9.8%	4.1%
On TANF at registration	9.4%	0.6%	7.1%	0.3%
On other public assistance at registration	--[d]	--[d]	32.2%	14.4%
West WA	56.6%	36.4%	61.8%	36.6%
Urban county	48.4%	31.1%	53.4%	34.0%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	22.7%	43.4%	29.2%	45.3%
Average quarterly earnings[a, b]	$301	$1,014	$343	$1,001
Mean, earnings trend[c]	−$8.4	$59.7	−$2.9	$78.6
Mean, earnings variance[c] (in 10^6 $)	$0.4	$1.6	$0.3	$1.7
Percentage of quarters with multiple jobs	4.5%	10.9%	5.6%	11.4%
Had earnings dip	28.1%	34.9%	30.0%	34.6%
Mean, number of quarters since dip at registration[b]	0.9	1.2	0.9	1.1
Average earnings dip size in percentage[b]	24.0%	27.6%	25.2%[††]	27.0%[††]
Sample Size	3,045	25,176	2,250	12,423

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[d]Data not available.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

Participation Model

Table 5.2 provides the results from the logit estimation of program participation. Again, the estimation occurs for populations of individuals who had exited from the Labor Exchange (but who had not received employment and training services in Washington) and the WIA Title I-B youth clients who had exited. The latter have a dummy variable equal to 1 (as opposed to 0 for the former). The table provides the logit coefficient estimates and standard errors. The

magnitudes of the coefficients are not particularly meaningful, but the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a WIA participant.

Table 5.2 Coefficient Estimates from a Logit Model of Participation in WIA Youth

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.007	0.045	0.081	0.054
Minority	−0.147***	0.044	0.067	0.053
Age at registration	−0.313***	0.017	−0.350***	0.022
Disability	−1.079***	0.055	−0.194**	0.067
Years of education, at registration	-0.256***	0.010	−0.135***	0.012
Veteran	--[a]	--[a]	−1.357*	0.592
Single parent	−0.002	0.084	0.464***	0.105
On TANF at registration	2.522***	0.124	2.641***	0.218
On other public assistance at registration	--[a]	--[a]	0.655***	0.066
West WA	0.753***	0.044	1.165***	0.054
Urban county	0.756***	0.046	0.718***	0.053
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	−0.001	0.001	0.005**	0.002
Average quarterly earnings	−0.034***	0.006	−0.052***	0.008
Mean, earnings trend	−0.014	0.008	−0.012	0.011
Mean, earnings variance (in 10^8 $)	−0.245	1.517	−11.724**	3.838
Percentage of quarters with multiple jobs	−0.005**	0.002	−0.004*	0.002
Had earnings dip	0.254	0.191	−0.328	0.221
Mean, number of quarters since dip at registration	−0.011	0.019	−0.002	0.024
Average earnings dip size in percentage	0.125	0.192	0.497*	0.226
Observations	28,221		14,673	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]Data not available.

The following variables are significantly correlated with being in the treatment group (i.e., a WIA participant) in both years of data: being on public assistance (TANF) at the time of registration, residing in an urban county, and being from western Washington. The following variables are significantly correlated with being in the Labor Exchange group: age at registration, disability status, years of education, average earnings prior to registration, and turnover.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. The mean p-score for the treatment group is 0.289 in 2005/2006, which is over three times larger than the mean for the comparison pool—0.086. For the 2007/2008 data, the difference is also substantial, 0.332 to 0.121. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile. Table 5.3 provides these data for the WIA I-B youth analyses. These indicators are do not exceed 80 percent suggesting that the model does not discriminate as well as we might wish.

Table 5.3 Indicators of Propensity Score Model Quality for WIA Youth Analyses

Statistic	2005/2006	2007/2008
Mean p-score, WIA Youth	0.289	0.332
Mean p-score, Labor Exchange	0.086	0.121
Percentile Labor Exchange, at 20th percentile WIA Youth	69.7%	62.5%

Statistical Match

The statistical matching algorithm uses a nearest neighbor approach with the propensity score. For every observation *j* in *T*, we find the observation *k* in *U* that minimizes the absolute value of the difference between the propensity score for *j* and *k*. We then add *k* to the comparison group sample as long as it is within the length of the caliper. The statistical match is done with replacement, so some observations in *U* are the "matches" for more than one observation in the treatment group and are duplicated. Table 5.4 provides data about the sample sizes, number of

matched observations that are duplicates, and a comparison of descriptive statistics between the treatment group and constructed comparison group. Duplication occurred quite a bit in the statistical matches for this program. In 2005/2006, about 15 percent of the records used in the match had multiple observations, and in the 2007/2008 match, just under 20 percent of the matched comparison group records had multiple observations.

Table 5.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for WIA Youth

	2005/2006		2007/2008	
Statistic/Characteristic	WIA Youth	Labor Exchange	WIA Youth	Labor Exchange
Sample size	3,097	30,059	2,264	13,975
Sample size used in match	3,045	25,176	2,250	12,423
Matched sample size	3,010	3,010	2,186	2,186
Number of observations used once	--	1,812	--	1,200
Number of observations used multiple times	--	465	--	368
Maximum number of repeats	--	11	--	8
Demographics and Education				
Mean, age at registration	17.9**	18.0**	18.0**	18.0**
Female	54.2%	54.5%	54.9%	53.8%
Minority	45.1%	43.4%	45.3%	43.9%
Mean, years of education at registration	10.0**	9.7**	10.3**	10.1**
Single parent	9.4%	10.5%	9.6%	11.3%
Disability	16.9%	16.1%	18.7%	18.9%
On TANF at registration	8.3%**	5.7%**	4.6%	4.2%
Urban county	47.9%	49.9%	52.5%	50.8%
West WA	56.1%	55.3%	61.1%	61.5%
Veteran	--[c]	--[c]	0.1%	0.1%
On public assistance at registration other	--[c]	--[c]	30.3%	32.8%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	22.9%	24.5%	29.4%	31.2%
Average quarterly earnings[a]	$305	$315	$349	$372
Mean, earnings variance[b] (in 10^6 $)	$0.4	$0.4	$0.3	$0.4
Mean, earnings trend[b]	−$8.4	−$11.2	−$3.9	−$4.5
Percentage of quarters with multiple jobs	4.6%	4.4%	5.7%	6.0%
Had earnings dip	28.3%	29.6%	30.3%**	34.1%**
Mean, number of quarters since dip at registration[a]	0.9	1.0	0.9	1.0
Average earnings dip size in percentage[a]	24.2%	25.2%	25.5%**	29.0%**
Sample Size of matched sample	3,010	3,010	2,186	2,186

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
[c]Variable not available.
** Difference in means is statistically significant at the 0.05 level (t-test).

In general, the statistical matches for this program were not as close in terms of characteristics as most of the other matches and thus the distributions are not as well balanced. In the 2005/2006 analysis, three characteristics displayed in the data have means that are statistically different from each other, and in the 2007/2008 match, there are four. It is likely that restricting the comparison group to individuals under the age of 22 limited the sample size of the comparison group pool substantially, and thus made it more difficult to find close matches. In fact, comparing the third row of the table to the second row shows that one to three percent of the matches were deleted because they were not within a caliper width.

Net Impacts

Tables 5.5 and 5.6 provide the estimated net impacts of the WIA Title I-B youth programs on clients. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, and for this program, we use the levels of the outcome variables as the dependent variable. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final four columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

Table 5.5 Net Impact Estimates for WIA Youth Program for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	10.0***	11.2***	55.4	--	42.7	--
Ever-employed, longer term (%)	3.4***	3.3***	68.2	--	64.4	--
Percent of quarters, longer term	4.4***	4.3***	53.7	--	47.3	--
Percent of quarters, longer term, diff-in-diff	5.7***	4.8***	18.5	--	30.2	--
Average hourly wage						
Short term ($)	1.15***	1.18***	5.82	10.22	3.99	8.98
Short term, diff-in-diff ($)	0.44***	0.45***	0.65	0.92	0.50	1.17
Longer term ($)	0.41***	0.41***	6.33	11.19	5.04	9.98
Longer term, diff-in-diff ($)	0.10	0.13	0.64	2.21	0.70	2.07
Average quarterly hours						
Short term	45.3***	46.3***	171.7	301.3	102.8	231.2
Short term, diff-in-diff	16.4***	17.2***	39.0	87.7	29.1	107.4
Longer term	27.7***	27.8***	192.4	316.7	143.5	259.9
Longer term, diff-in-diff	6.1*	6.9**	42.0	114.1	39.3	135.0
Average quarterly earnings						
Short term ($)	491***	502***	1,832	3,214	956	2,150
Short term, diff-in-diff ($)	209***	225***	485	1,124	320	1,240
Longer term ($)	337***	343***	2,269	3,666	1,465	2,601
Longer term, diff-in-diff ($)	109**	131***	707	1,819	508	1,771
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	0.6**	0.3**	2.4	--	0.7	--
Benefits, short term ($)	5*	6*	22	928	6	854
Percent receiving, longer term	2.3***	2.2***	8.7	--	5.2	--
Benefits, longer term ($)	13**	14***	54	1,215	30	967

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 5.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

In our prior studies, we have usually found negative results for WIA youth, but the results presented in these two tables are positive and significantly different from zero. The magnitudes of the estimated net impacts are quite close to each other for the short-term and longer-term time periods. In the short term, employment is estimated to increase by 8.0 percentage points, hourly wages increase by $0.41, and average quarterly hours rise by almost 40. These combine to provide an average quarterly earnings increase of $330. In the longer term, the employment

Table 5.6 Net Impact Estimates for WIA Youth Program for 2007/2008 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
	Diff. in Means	Regr. Adj.	Full Sample		Matched Sample	
			With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	7.5***	8.0***	51.0	--	39.6	--
Average hourly wage						
Short term ($)	0.41**	0.41**	5.50	10.45	4.04	9.72
Short term, diff-in-diff ($)	0.26**	0.25**	0.46	1.16	0.20	1.20
Average quarterly hours						
Short term	38.3***	39.5***	159.5	303.1	98.7	237.3
Short term, diff-in-diff	17.6***	18.8***	27.3	78.4	19.5	91.6
Average quarterly earnings						
Short term ($)	319***	330***	1,686	3,205	933	2,244
Short term, diff-in-diff ($)	165***	175***	378	1,044	225	1,035
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	0.3	0.3*	3.0		1.2	
Benefits, short term ($)	1	2	34	1,134	10	794

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 5.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

effect is 4.3 percentage points, the hourly wage increase is estimated to be $0.41, and the average quarterly hours rise by about 30. The net impact on average quarterly earnings is estimated to be a little over $340. For this population, the earnings impacts are about 25 to 33 percent. The net impact estimates presented in the two tables do suggest a slight increase in the take-up of unemployment insurance benefits.

Subgroup Analyses

According to the administrative data, training is not as prevalent for WIA youth as it is for adults or dislocated workers, but we still find that around 20 to 25 percent of exiters are reported to have received training services. Tables 5.7 and 5.8 display the net impact estimates for that subgroup along with the estimates for the subgroup that did not receive training. The tables show that the short-term and longer-term net impacts for individuals with training are more positive than the net impacts for participants who did not get training and that the longer-

term net impacts for individuals who had been trained are smaller in magnitude than the short-term impacts. The outcomes for the participants who did not receive training are approximately the same in the short-term and longer-term time frames. However, the estimated short-term net impacts for those that did receive training are much larger than the longer-term net impacts. All in all, the results suggest that there is a substantial payoff to training for WIA youth; however the differential between those participants that received training and those that didn't attenuates over time.

Table 5.7 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Youth Participants: 2005/2006 Cohort

	Subgroup		
Outcome	Participants who did not receive training	Participants with training	Matched Comparison Group Mean
Employment	4.0%**	4.4%	47.3%
Hourly Wage	$0.24	$0.85**	$5.04
Hours Worked	24.7**	34.7**	143.5
Earnings	$256	$563**	$1,465
UI Receipt	2.0%**	3.0%**	5.2%
Subgroup Sample Size	2,314	696	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

Table 5.8 Selected Short-Term Net Impact Estimates for Subgroups of WIA Youth Participants: 2007/2008 Cohort

	Subgroup		
Outcome	Participants who did not receive training	Participants with training	Matched Comparison Group Mean
Employment	6.6%**	13.7%**	39.6%
Hourly Wage	$0.22	$1.38**	$4.04
Hours Worked	33.1**	68.9**	98.7
Earnings	$245**	$730**	$933
UI Receipt	0.3%	0.4%	1.2%
Subgroup Sample Size	1,824	362	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

6 COMMUNITY AND TECHNICAL COLLEGE JOB PREPARATORY TRAINING

Job preparation programs represent the applied (non-transfer) training mission of community and technical colleges. For the most part, these institutions provide training for individuals to enter a variety of technical occupations that don't require a baccalaureate degree. These programs are open to all high school graduates or persons over the age of 18. (Persons under 18 who have not completed high school may be admitted with the permission of their local school district.) Training is offered in every county of the state. In fact, the public community and technical college system offers training at over 600 sites operated by the 34 primary campuses and multiple extension sites.

Participant Characteristics

Table 6.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The comparison group consists of Labor Exchange clients who were 16 to 60 at the time of registration. The individuals who had participated in the workforce development programs were removed from the data. The first two columns of numbers compare the community college job preparatory training students who exited in 2005/2006 to individuals in the comparison group. The final two columns compare the community college job preparation students in 2007/2008 to LE exiters in the same year.

The populations are dissimilar. The job prep students tend to be younger. The average age of the job prep students when they entered the community and technical college system is about 32, whereas the average age of the LE exiters when they registered is about 36. Also, there

Table 6.1 Descriptive Statistics for Job Prep Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	Job Prep	Labor Exchange	Job Prep	Labor Exchange
Demographics and Education				
Female	58.3%	44.9%	59.0%	43.7%
Minority	25.9%	35.0%	27.8%	32.6%
Mean, age at registration	31.9	35.9	32.9	35.8
Disability	7.2%	18.7%	6.8%	13.0%
West WA	78.6%	44.5%	76.4%	51.4%
Urban county	59.0%	41.7%	58.3%	46.7%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	62.7%	64.1%	63.6%	64.3%
Average quarterly earnings[a, b]	$2,875	$3,846	$3,141	$4,349
Mean, earnings trend[c]	$45.8[††]	$41.8[††]	$64.8	$89.0
Mean, earnings variance[c] (in 10^6 $)	$6.1	$10.5	$6.8	$13.2
Percentage of quarters with multiple jobs	13.6%	15.0%	13.9%	13.6%
Had earnings dip	40.1%	41.9%	41.5%	36.0%
Mean, number of quarters since dip at registration[b]	1.4	1.5	1.4	1.1
Average earnings dip size in percentage[b]	30.0%[††]	29.7%[††]	31.2%	24.2%
Sample Size	26,529	209,170	31,037	102,842

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

is a much larger percentage of females and much lower percentage of minorities in the job prep population than in the Labor Exchange registrants. Geographically, the table shows that job prep students are disproportionately from western Washington and from urban counties.

The bottom panel of the table shows that the prior employment and earnings experiences of the two populations are not too different, with the exception of earnings levels. The pre-registration average quarterly earnings levels of Labor Exchange registrants are close to or over $1,000 greater than the job prep earnings levels prior to their registration in community colleges.

Participation Model

Table 6.2 provides the results from the logit estimation of participation in job preparatory training. The dependent variable in this econometric model, which was estimated with a sample that pooled the individuals who had exited from the Labor Exchange (but who had not received employment and training services in Washington) with the community and technical college job

preparation students who had exited, is a dummy variable equal to 1 for the students (and 0 for the LE clients). The table provides the logit coefficient estimates and standard errors. While the magnitude of the coefficients is not particularly meaningful, the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a community college job preparation student.

Table 6.2 Coefficient Estimates from a Logit Model of Participation in Job Prep

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.309***	0.015	0.438***	0.015
Minority	−0.456***	0.016	−0.294***	0.016
Age at registration	−0.029***	0.001	−0.016***	0.001
Disability	−1.329***	0.025	−0.899***	0.026
West WA	1.500***	0.016	1.158***	0.016
Urban county	0.630***	0.015	0.357***	0.015
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.007***	0.000	0.006***	0.000
Average quarterly earnings	−0.010***	0.000	−0.009***	0.000
Mean, earnings trend	−0.007***	0.002	−0.005**	0.002
Mean, earnings variance (in 10^8 $)	−0.045	0.046	−0.108**	0.040
Percentage of quarters with multiple jobs	−0.004***	0.000	−0.000	0.000
Had earnings dip	−0.597***	0.042	−0.772***	0.040
Mean, number of quarters since dip at registration	0.032***	0.005	0.066***	0.005
Average earnings dip size in percentage	0.483***	0.044	1.107***	0.043
Observations	235,699		133,879	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The coefficient estimates seem quite reasonable. The following variables are significantly correlated with being in the treatment group (i.e., a community and technical college job preparation participant) in both years of data: Female, being from Western Washington, residing in an urban county, percent of quarters in the labor market prior to enrollment with employment, length of time since any earnings dip, and size of the earnings dip. The following variables are significantly correlated with being in the Labor Exchange group: age at registration, minority status, having a disability, average earnings prior to registration, trend in earnings prior to registration, turnover, and having experienced an earnings dip. The results are consistent with the

story that the community college job prep programs seem to be attractive to women, urban county residents, and individuals with relatively weak earnings histories.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile. Table 6.3 provides these data for the community college job preparation analyses. The mean propensity scores for the treatment groups are roughly 0.22 and 0.33 for the 2005/2006 and 2007/2008 cohorts of exiters, respectively, whereas they are just under 0.10 and just over 0.20 for the comparison groups. The 20th percentile indicators are under 60 percent, which suggests that the participation model does not discriminate well between students and non-students.

Table 6.3 Indicators of Propensity Score Model Quality for Job Prep Analyses

Statistic	2001/2002	2003/2004
Mean p-score, Job Prep	0.222	0.328
Mean p-score, Labor Exchange	0.099	0.203
Percentile Labor Exchange, at 20th percentile Job Prep	59.3%	50.9%

Statistical Match

The statistical matching used a nearest neighbor approach with the propensity score. For every observation *j* in *T*, we found the observation *k* in *U* that minimized the absolute value of

the difference between the propensity score for *j* and *k*. We then added k to the comparison group sample as long as the difference between the propensity scores did not exceed the caliper. The statistical match was done with replacement, so some observations in *U* were the "matches" for more than one observation in the treatment group. Table 6.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment and comparison group observations.

Table 6.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Job Prep

	2005/2006		2007/2008	
Statistic/Characteristic	Job Prep	Labor Exchange	Job Prep	Labor Exchange
Sample size	29,917	235,827	33,579	112,039
Sample size used in match	26,529	209,170	31,037	102,842
Matched sample size	26,526	26,526	31,033	31,033
Number of observations used once	--	17,494	--	16,149
Number of observations used multiple times	--	3,748	--	5,828
Maximum number of repeats	--	17	--	19
Demographics and Education				
Mean, age at registration	31.9	31.9	32.9	33.0
Female	58.3%**	60.2%**	59.0%	59.6%
Minority	25.9%	25.5%	27.8%**	26.7%**
Disability	7.2%	7.5%	6.8%	6.7%
Urban county	59.0%	58.9%	58.3%**	57.1%**
West WA	78.6%	78.3%	76.4%	76.2%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	62.7%	62.6%	63.6%	63.6%
Average quarterly earnings[a]	$2,875	$2,863	$3,141**	$3,204**
Mean, earnings variance[b] (in 10^6 $)	$6.1	$6.6	$6.8**	$7.4**
Mean, earnings trend[b]	$45.9**	$37.2**	$64.8	$62.8
Percentage of quarters with multiple jobs	13.6%**	13.9%**	13.9%	14.1%
Had earnings dip	40.1%	40.6%	41.5%**	42.8%**
Mean, number of quarters since dip at registration[a]	1.4	1.4	1.4**	1.4**
Average earnings dip size in percentage[a]	30.0%**	30.8%**	31.2%**	32.5%**
Sample Size of matched sample	26,526	26,526	31,033	31,033

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
** Difference in means is statistically significant at the 0.05 level (t-test).

As would be expected, the differences between the treatment group and the match comparison group means are much smaller than in Table 6.1. However, because the logit model has relatively low discriminatory power, a number of the mean differences are significant. For

example, three of the employment and earnings variables (prior to registration) still have significantly different averages in the 2005/2006 match as does one of the demographic and education variables—female. The match for 2007/2008 is worse as would be expected by the relative closeness of the mean propensity scores shown in Table 6.3. In this case, the means of five of the prior employment and earnings variables and two of the demographics and education variables remained significantly different. In all likelihood, it would have made sense to add interaction terms or higher order polynomial terms to the participation equation.

Net Impacts

The major purpose of the study is to estimate the net impacts of the education and training programs on clients. Tables 6.5 and 6.6 provide the estimated net impacts for community college job preparatory training. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, although for some programs we use the levels of the outcome variables as the dependent variable and, for others, we use difference-in differences. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

Table 6.5 Net Impact Estimates for CTC Job Prep Programs for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	6.4***	7.2***	62.1	--	61.5	--
Ever-employed, longer term (%)	3.2***	3.1***	67.5	--	68.4	--
Percent of quarters, longer term	6.9***	6.7***	56.7	--	56.9	--
Percent of quarters, longer term, diff-in-diff	10.0***	10.1***	−4.0	--	−1.1	--
Average hourly wage						
Short term ($)	2.32***	2.29***	9.18	14.58	8.25	13.19
Short term, diff-in-diff ($)	2.37***	2.38***	−0.33	−0.32	0.00	−0.08
Longer term ($)	2.69***	2.65***	9.14	15.46	8.52	14.29
Longer term, diff-in-diff ($)	2.86***	2.87***	−1.54	0.57	−0.67	1.23
Average quarterly hours						
Short term	53.7***	52.3***	238.8	379.1	225.0	359.5
Short term, diff-in-diff)	55.9***	56.5***	4.9	17.9	12.6	29.9
Longer term	49.4***	48.2***	232.8	375.9	224.4	358.9
Longer term, diff-in-diff	57.5***	58.5***	−26.1	20.8	−11.1	34.6
Average quarterly earnings						
Short term ($)	1,376***	1,349***	3,614	5,737	3,073	4,910
Short term, diff-in-diff ($	1,347***	1,350***	−158	64	89	336
Longer term ($)	1,507***	1,478***	3,800	6,048	3,373	5,310
Longer term, diff-in-diff ($)	1,568***	1,572***	−462	454	8	870
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−3.9***	−3.3***	8.9	--	6.1	--
Benefits, short term ($)	−51***	−51***	116	1,310	79	1,292
Percent receiving, longer term	−5.9***	−5.7***	17.5	--	14.1	--
Benefits, longer term ($)	−51***	−52***	160	1,587	125	1,574

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 6.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

Short-term and longer-term impacts for the job preparatory training students are quite positive. In the short term, average quarterly earnings increase by almost $1,400, or about 40 percent. These earnings gains come from increased employment impacts of 6.6 percentage points, average hourly wage increases of $2.42, and increased average hours per quarter of about 55 hours. In addition to the positive short-term employment outcome estimates, job prep students are also estimated to significantly reduce their take-up and levels of unemployment compensation.

Table 6.6 Net Impact Estimates for Job Prep Programs for 2007/2008 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	6.0***	6.6***	59.2	--	59.5	--
Average hourly wage						
Short term ($)	2.15***	2.18***	9.51	15.83	8.69	14.35
Short term, diff-in-diff ($)	2.45***	2.42***	−0.75	−0.70	−0.04	0.04
Average quarterly hours						
Short term	40.2***	39.5***	233.9	389.2	227.4	375.3
Short term, diff-in-diff	54.4***	54.5***	−16.1	−15.0	−2.4	4.5
Average quarterly earnings						
Short term ($)	1,198***	1,216***	3,804	6,331	3,332	5,500
Short term, diff-in-diff ($)	1,382***	1,365***	−660	−752	−136	−21
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−5.5***	−4.7***	12.6	--	10.1	--
Benefits, short term ($)	−116***	−115***	271	2,153	200	1,987

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 6.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The longer-term earnings impacts for job prep are even larger than the short-term estimated net impacts. The students earn, on average, almost $1,600 per quarter more than their comparison group counterparts. This arises because of an employment net impact of 10.1 percentage points, an average hourly wage impact of $2.87, and an average hours of employment impact of almost 60 hours. Also, the reduction in recipiency and benefits for UI are estimated in the longer-term outcomes.

Subgroup Analyses

For community and technical college job preparatory training students, we examined completers versus all students. That is, all of the treatment groups are defined by individuals who "exited" during the fiscal year. Some of the exits may have occurred because the individuals completed their participation in the program, and some of the exits may have occurred because

the individuals decided to leave without completing the program. As seen in tables 6.7 and 6.8, a little more than 60 percent of the job prep treatment group actually completed their schooling, defined as receiving a certificate or degree.[23] As would be expected, the results show that completers have far better net impacts than the average. Employment rates, average hourly wages, average quarterly hours worked, and average quarterly earnings are all much higher for the completers than for the noncompleters. For example, the estimated long-term net impact for quarterly earnings is just under $2,000 for completers and under $1,000 for noncompleters. Note that for both subgroups, the longer-term estimates exceed the short-term estimates. That is, there is no indication of depreciation of labor market outcomes for completers or noncompleters; in fact, just the opposite—the positive outcomes grow larger during the first three years after exit.

Table 6.7 Selected Longer-Term Net Impact Estimates for Job Prep Completers and Noncompleters: 2005/2006 Cohort

	Subgroup		Matched Comparison
Outcome	Noncompleters	Completers	Group Mean
Employment (%)	5.8**	13.0**	56.9
Hourly Wage ($)	1.64**	3.72**	8.52
Hours Worked	39.2**	71.7**	224.4
Earnings ($)	991**	1,965**	3,373
UI Receipt (%)	−5.7**	−5.6**	14.1
Subgroup Sample Size	10,903	15,623	—

NOTE: Monetary data in 2005 $.
**Significant at the 0.05 level (two-tailed test).

Table 6.8 Selected Short-Term Net Impact Estimates for Job Prep Completers and Noncompleters: 2007/2008 Cohort

	Subgroup		Matched Comparison
Outcome	Noncompleters	Completers	Group Mean
Employment	1.2%	10.4%**	59.5%
Hourly Wage	$1.26**	$3.28**	$8.69
Hours Worked	37.4**	67.1**	227.4
Earnings	$801	$1,779**	$3,332
UI Receipt	−4.5%**	−4.8%**	10.1%
Subgroup Sample Size	13,349	17,684	—

NOTE: Monetary data in ’05 $.
**Significant at the 0.05 level (two-tailed test).

[23] The definition is slightly broader. The exact specification was GradDrop>0, which in addition to certificate or degree includes 1) individuals who completed 45 quarter credits or more with at least a 2.0 gpa but didn’t receive a degree, and 2) all other completers (high school or GED completer, apprentice completer, or completer of a non-credit vocational program that results in certification, e.g. A+, CISCO, etc.).

7 COMMUNITY AND TECHNICAL COLLEGE WORKER RETRAINING PROGRAM

The Worker Retraining (WR) program provides long-term unemployed and dislocated workers with skill training at community and technical colleges.[24] Workers must be unemployed or on notice that they are about to be laid off and must be eligible for or have exhausted their unemployment compensation benefits within the last 24 months. The training programs are similar to community and technical college job preparation, i.e., technical training geared to sub-baccalaureate occupations, although funds may also be used for training in basic skills and literacy and related or supplemental instruction for apprentices. Students receive financial assistance to help with tuition and may receive assistance to offset costs of child care and transportation. The trainees are similar in economic circumstances to individuals served by the WIA Title I-B dislocated worker program. In fact, dislocated workers and the long-term unemployed have priority access to the program's training and supportive services.

Participant Characteristics

Table 7.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The comparison group consists of Labor Exchange clients who were 16 to 60 at the time of registration and last received services in 2005/2006 or 2007/2008. The individuals who were served by Washington's workforce development programs were removed from the comparison group pool data. The first two columns of numbers compare the community and technical college worker retraining clients who exited in 2005/2006 to

[24]A small percentage of Worker Retraining participants attended private career schools, but this project excluded those individuals from the analyses and focused on community and technical college students only.

individuals in the comparison group. The final two columns compare the community and technical college worker retraining exiters in 2007/2008 to LE exiters in the same year.

Table 7.1 Descriptive Statistics for Worker Retraining Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	Worker Retraining	Labor Exchange	Worker Retraining	Labor Exchange
Demographics and Education				
Female	55.8%	44.9%	58.4%	43.7%
Minority	27.7%	35.0%	30.6%	32.6%
Mean, age at registration	41.4	35.9	41.8	35.8
Disability	9.2%	18.7%	9.5%	13.0%
Mean, years of education at registration	13.9	12.2	13.9	12.2
West WA	79.5%	44.5%	79.7%	51.4%
Urban county	59.4%	41.7%	58.4%	46.7%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	73.8%	64.1%	69.9%	64.3%
Average quarterly earnings[a, b]	$5,524	$3,846	$4,826	$4,349
Mean, earnings trend[c]	-$36.1	$41.8	$2.5	$89.0
Mean, earnings variance[c] (in 10^6 $)	$12.9	$10.5	$11.9	$13.2
Percentage of quarters with multiple jobs	12.5%	15.0%	13.4%[††]	13.6%[††]
Had earnings dip	65.7%	41.9%	63.3%	36.0%
Mean, number of quarters since dip at registration[b]	1.7	1.5	1.7	1.1
Average earnings dip size in percentage[b]	52.2%	29.7%	50.6%	24.2%
Sample Size	5,679	209,170	4,154	102,842

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

As with the other programs analyzed in this study, the populations differ. On average, the worker retraining participants are 5–6 years older than the LE exiters. On average, they have acquired more years of education (prior to participation), and as in the job preparatory programs, have larger shares of females and residents of urban counties and western Washington, and have smaller shares of minorities and disabled individuals than the Labor Exchange.

The worker retraining exiters' work histories show more employment and higher average quarterly earnings (percentage of quarters worked are about 70 to 74 percent versus about 64 percent for the worker retraining and Labor Exchange clients, respectively). The average

quarterly earnings difference was about $1,700 in the 2005/2006 data, and about $500 in the 2007/2008 data.

Participation Model

Table 7.2 provides the results from the logit estimation of participation. The individuals who had exited from the Labor Exchange were pooled with the community and technical college worker retraining clients, and the dependent variable, participation, was a dummy variable equal to 1 for the latter group (and 0 for the former). The independent variables in the participation model were identical to those used in the job prep participation model documented in Chapter 6. The table provides the logit coefficient estimates and standard errors. While the magnitude of the coefficients is not particularly meaningful, the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a community and technical college worker retraining client.

Table 7.2 Coefficient Estimates from a Logit Model of Participation in Worker Retraining Program

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.451***	0.030	0.498***	0.036
Minority	−0.035	0.032	0.155***	0.037
Age at registration	0.025***	0.001	0.039***	0.002
Disability	−0.732***	0.048	−0.453***	0.056
Years of education, at registration	0.307***	0.008	0.263***	0.009
West WA	1.310***	0.035	1.157***	0.041
Urban county	0.281***	0.030	0.121***	0.036
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.010***	0.001	0.009***	0.001
Average quarterly earnings	−0.001**	0.000	−0.006***	0.001
Mean, earnings trend	−0.009***	0.003	0.000	0.003
Mean, earnings variance (in 10^8 $)	−0.491***	0.070	−0.277***	0.079
Percentage of quarters with multiple jobs	−0.002	0.001	0.003**	0.001
Had earnings dip	0.260***	0.073	−0.152	0.088
Mean, number of quarters since dip at registration	−0.112***	0.009	−0.020*	0.010
Average earnings dip size in percentage	1.576***	0.074	2.129***	0.089
Observations	214,849		106,996	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimation results show that the following variables are significantly correlated with being in the treatment group (i.e., a community and technical college worker retraining client) in both years of data: Female, age at registration, years of education, being from Western Washington, residing in an urban county, and magnitude of the earnings dip. The following variables are significantly correlated with being in the comparison group pool: having a disability, average quarterly earnings prior to registration, variance in earnings prior to registration, and length of time since experiencing an earnings dip.

Propensity Score Statistics

If the participation model had substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile. Table 7.3 provides these data for the community college worker retraining analyses. The mean propensity scores for the treatment groups are roughly 0.25 and 0.13, whereas they are approximately 0.10 and 0.04 for the comparison group for 2005/2006 and 2007/2008 respectively. The 20th percentile indicator is approximately 70 percent. The relatively large difference in p-score means is good, but the 20th percentile indicators did not reach the 80th percentile standard.

Table 7.3 Indicators of Propensity Score Model Quality for Worker Retraining Analyses

Statistic	2001/2002	2003/2004
Mean p-score, Worker Retraining	0.245	0.128
Mean p-score, Labor Exchange	0.099	0.035
Percentile Labor Exchange, at 20th percentile Worker Retraining	70.2%	65.4%

Statistical Match

Table 7.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment and comparison group observations. The quality of the match seems relatively high. Less than 10 percent of the matched comparison group records have multiple copies, and all of the demographic and education as well as employment and earnings means are not significantly different from each other. Relative to the community and technical college job preparatory training, the statistical match for worker retraining does much better on the previous earnings and employment variables and approximately as well on the educational attainment variables.

Table 7.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Worker Retraining

	2005/2006		2007/2008	
Statistic/Characteristic	Worker Retraining	Labor Exchange	Worker Retraining	Labor Exchange
Sample size	6,151	235,827	4,448	112,039
Sample size used in match	5,679	209,170	4,154	102,842
Matched sample size	5,663	5,663	4,141	4,141
Number of observations used once	--	4,841	--	3,354
Number of observations used multiple times	--	377	--	352
Maximum number of repeats	--	6	--	6
Demographics and Education				
Mean, age at registration	41.5	41.6	41.8	42.0
Female	55.7%	55.4%	58.3%	59.3%
Minority	27.7%	27.3%	30.5%	30.6%
Mean, years of education at registration	13.7	13.7	13.7	13.7
Disability	9.2%	9.5%	9.5%	9.1%
Urban county	59.5%	58.3%	58.4%	56.9%
West WA	79.5%	79.6%	79.6%	79.1%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	73.8%	73.4%	69.8%	69.3%
Average quarterly earnings[a]	$5,529	$5,445	$4,832	$4,794
Mean, earnings variance[b] (in 10^6 $)	$12.9	$13.0	$12.0	$12.2
Mean, earnings trend[b]	−$36.5	−$48.0	$2.5	−$6.1
Percentage of quarters with multiple jobs	12.5%	12.6%	13.4%	13.4%
Had earnings dip	65.7%	66.0%	63.3%	62.1%
Mean, number of quarters since dip at registration[a]	1.7	1.8	1.7	1.7
Average earnings dip size in percentage[a]	52.2%	52.1%	50.6%	49.7%
Sample Size of matched sample	5,663	5,663	4,141	4,141

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
** Difference in means is statistically significant at the 0.05 level (t-test).

Net Impacts

Tables 7.5 and 7.6 provide the estimated net impacts for Worker Retraining. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9–12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate

Table 7.5 Net Impact Estimates for Worker Retraining Programs for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
	Diff. in	Regr.	Full Sample		Matched Sample	
Outcome	Means	Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	7.5***	7.8***	62.1	--	61.6	--
Ever-employed, longer term (%)	5.5***	5.3***	67.5	--	67.4	--
Percent of quarters, longer term	7.7***	7.5***	56.7	--	57.9	--
Percent of quarters, longer term, diff-in-diff	7.5***	7.7***	−4.0	--	−13.0	--
Average hourly wage						
Short term ($)	1.49***	1.43***	9.18	14.58	10.27	16.34
Short term, diff-in-diff ($)	1.13***	1.20***	−0.33	−0.32	−2.20	−2.04
Longer term ($)	2.08***	2.01***	9.14	15.46	10.66	17.79
Longer term, diff-in-diff ($)	2.09***	2.16***	−1.54	0.57	−3.81	−0.62
Average quarterly hours						
Short term	51.0***	49.8***	238.8	379.1	240.4	382.5
Short term, diff-in-diff	29.6***	30.5***	4.9	17.9	−26.3	1.0
Longer term	45.2***	44.0***	232.8	375.9	242.9	387.9
Longer term, diff-in-diff	29.2***	30.4***	−26.1	20.8	−62.5	9.7
Average quarterly earnings						
Short term ($)	850***	810***	3,614	5,737	4,123	6,561
Short term, diff-in-diff ($)	542***	576***	−158	64	−899	−607
Longer term ($)	1,000***	959***	3,800	6,048	4,523	7,157
Longer term, diff-in-diff ($)	833***	882***	−462	454	−1,304	63
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−3.0***	−2.6***	8.9	--	7.7	--
Benefits, short term ($)	−49***	−49***	116	1,310	110	1,434
Percent receiving, longer term	−1.0	−0.9	17.5	--	16.4	--
Benefits, longer term ($)	−9	−8	160	1,587	175	1,811

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 7.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

from a regression adjustment of that mean. This column represents the preferred specification. For this program we use the levels of the outcome variables as the dependent variable. The coefficient estimates that are in "boxes" represent the final, "official" preferred specifications as chosen by the WTECB staff. The final columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

Table 7.6 Net Impact Estimates for Worker Retraining Program for 2007/2008 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	8.3***	8.8***	59.2	--	57.6	--
Average hourly wage						
Short term ($)	1.20***	1.17***	9.51	15.83	9.93	16.94
Short term, diff-in-diff ($)	0.89***	0.94***	−0.75	−0.70	−1.07	−1.19
Average quarterly hours						
Short term	47.1***	47.1***	233.9	389.2	224.2	382.1
Short term, diff-in-diff	19.9***	21.8***	−16.1	−15.0	−19.8	−15.0
Average quarterly earnings						
Short term ($)	711***	705***	3,804	6,331	3,811	6,496
Short term, diff-in-diff ($)	412***	443***	−660	−752	−702	−740
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	0.0	−0.1	12.6	--	14.1	--
Benefits, short term ($)	3	−0	271	2,153	318	2,258

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 7.4.
* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

Short-term impacts for the worker retraining participants, shown in Table 7.6, reflect a very strong positive, employment rate gain of 8.8 percentage points and positive net impacts in average hourly wages and quarterly hours; $1.17 per hour and 47.1 hours, respectively. All together, the estimate of the average change in quarterly earnings is $705. In the short term, the

Worker Retraining participants had no significant change in the incidence of unemployment compensation.

The longer-term earnings impact is larger than the short-term estimated impact—about $950 to $700. The employment rate, average hourly wage rate, and average quarterly hours of employment all increase at levels that are statistically significant (7.5 percentage points, $2.01, and 44 hours, respectively). Neither the short-term or longer-term estimates of the net impact on receipt of or levels of Unemployment Insurance benefits is significantly different from 0.

Subgroup Analyses

About 60 percent of the Worker Retraining treatment groups actually completed their community and technical college course of study. Selected net impact estimates for these subgroups are provided in Tables 7.7 and 7.8. As with the job prep students analyzed in the previous chapter, in both the short term and longer term, the completers have much more positive outcomes. All of the short-term and longer-term employment and earnings impacts for completers are positive, significant, and larger than the impacts for noncompleters. The average quarterly earnings net impacts are over $1,000 larger for completers than noncompleters. The average hourly wage rates are at or exceed $2.00 per hour more for completers than noncompleters. In fact, Table 7.8 shows that the hourly wage impact for noncompleters is virtually zero and in Table 7.7, it is not significantly from zero. The UI impacts tend to be negative (i.e., reductions in take-up) for completers as compared to positive (although not statistically significant) impacts for the noncompleters.

Table 7.7 Selected Longer Term Net Impact Estimates for Subgroups of Worker Retraining Participants: 2005/2006 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	1.9%	11.0%**	57.9%
Hourly Wage	$0.46	$2.93**	$10.66
Hours Worked	14.6**	61.9**	242.9
Earnings	$240	$1,378**	$4,523
UI Receipt	1.3%	-2.0%**	16.4%
Subgroup Sample Size	2,170	3,493	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

Table 7.8 Selected Short-Term Net Impact Estimates for Subgroups of Worker Retraining Participants: 2007/2008 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	4.3%**	12.2%**	57.6%
Hourly Wage	$0.04	$2.00**	$9.93
Hours Worked	17.7**	70.9**	224.2
Earnings	$53	$1,202**	$3,811
UI Receipt	2.1%	−1.9%**	14.1%
Subgroup Sample Size	1,824	2,317	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

8 ADULT BASIC EDUCATION PROGRAMS ON COMMUNITY AND TECHNICAL COLLEGE CAMPUSES

Adults with deficits in basic academic skills are supported in adult basic education (ABE) across the state. The purposes of the instruction that is provided are to:

- assist adults to become literate and obtain the knowledge and skills necessary for employment and self-sufficiency,
- assist adults who are parents to obtain the educational skills necessary to become full partners in the educational development of their children, or
- assist adults in the completion of a secondary school (high school) education.

The types of programs include adult literacy, family learning, workplace skills enhancement, English language instruction, citizenship classes, basic skills education, high school equivalency preparation, or alternative high school diploma program. A substantial share of the instruction is for individuals with limited English proficiency who participate in English language instruction. Programs are offered at community and technical colleges or at community-based organizations. The analyses in this study were limited to programs delivered at community and technical colleges because of the availability of administrative data.

Participant Characteristics

Table 8.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. As with the other community and technical college programs, the comparison group consists of Labor Exchange clients who were 16 to 60 at the time of LE registration, and as with all other programs in this study, individuals who were served by Washington's education and training programs were removed from the data. The first two columns of numbers compare the community college ABE participants who exited in 2005/2006

to individuals in the comparison group. The final two columns compare the exiters in 2007/2008 to LE exiters in the same year.

Table 8.1 Descriptive Statistics for ABE Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	ABE	Labor Exchange	ABE	Labor Exchange
Demographics and Education				
Female	60.0%	44.9%	59.8%	43.7%
Minority	55.8%	35.0%	58.9%	32.6%
Mean, age at registration	31.2	35.9	30.9	35.8
Disability	1.6%	18.7%	1.9%	13.0%
Mean, years of education at registration	--[d]	--[d]	12.1	12.2
Veteran	--[d]	--[d]	0.4%	8.5%
Single parent	--[d]	--[d]	22.1%	4.3%
West WA	78.3%	44.5%	73.5%	51.4%
Urban county	59.9%	41.7%	60.6%	46.7%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	40.5%	64.1%	50.1%	64.3%
Average quarterly earnings[a, b]	$1,545	$3,846	$1,858	$4,349
Mean, earnings trend[c]	$54.4	$41.8	$73.6	$89.0
Mean, earnings variance[c] (in 10^6 $)	$2.2	$10.5	$2.9	$13.2
Percentage of quarters with multiple jobs	10.0%	15.0%	13.7%[††]	13.6%[††]
Had earnings dip	27.5%	41.9%	35.4%[††]	36.0%[††]
Mean, number of quarters since dip at registration[b]	1.0	1.5	1.3	1.1
Average earnings dip size in percentage[b]	20.8%	29.7%	26.9%	24.2%
Sample Size	11,129	209,170	12,540	102,841

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[d]Data not available.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

The populations are quite different. The ABE participants are younger—averaging about 31 as compared to 36 for the Labor Exchange population—and are more likely to be female and to be a minority. In both cohorts, about 60 percent of the treatment group members are female, whereas about 45 percent of the Labor Exchange exiters are female. Similarly, in both cohorts, about 60 percent of the community and technical college ABE clients are minorities as compared to just about 35 percent of the Labor Exchange leavers. As with many of the programs analyzed in this study, the ABE participants are much more likely to reside in an urban county and in

western Washington than were LE exiters. The 2005/2006 treatment sample is missing some demographic data, but in 2007/2008, the ABE participants are much more likely to be single parents and less likely to be veterans.

The pre-program labor market experiences of the ABE students are also quite different from the LE exiters. Their percentage of quarters with employment is 40 percent in the earlier cohort and 50 percent in the later cohort, whereas the comparison group pool was over 64 percent. The average quarterly earnings are significantly lower. The average quarterly earnings for the ABE population is only about $1,550 to $1,850; whereas it is over $3,800 in 2005/2006 and almost $4,350 in 2007/2008 for the LE exiters.

Participation Model

Table 8.2 provides the results from the logit estimation of participation in ABE. The independent variables in the participation model are exactly the same as those used in the other community and technical college programs as documented in the two previous chapters. The table provides the logit coefficient estimates and standard errors. While the magnitude of the coefficients is not particularly meaningful, the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a community and technical college ABE exiter.

The following variables are significantly correlated with being in the treatment group (i.e., ABE participant) in both years of data: female, minority, being from western Washington, residing in an urban county, earnings trend, and size and length of time since an earnings dip. The following variables are significantly correlated with being in the comparison group (LE registrants): age at registration, having a disability, average quarterly earnings, variance in earnings, and having experienced an earnings dip.

Table 8.2 Coefficient Estimates from a Logit Model of Participation in ABE

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.339***	0.022	0.200***	0.023
Minority	0.742***	0.022	0.976***	0.022
Age at registration	-0.018***	0.001	−0.016***	0.001
Disability	-3.373***	0.077	−2.542***	0.068
Years of education, at registration	--[a]	--[a]	0.030***	0.004
Veteran	--[a]	--[a]	−2.340***	0.142
Single parent	--[a]	--[a]	1.664***	0.032
West WA	1.670***	0.026	1.246***	0.025
Urban county	0.745***	0.023	0.681***	0.023
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.001	0.001	0.002***	0.001
Average quarterly earnings	−0.009***	0.001	−0.014***	0.001
Mean, earnings trend	0.035***	0.003	0.017***	0.003
Mean, earnings variance (in 10^8 $)	−7.176***	0.338	−4.419***	0.265
Percentage of quarters with multiple jobs	−0.004***	0.001	0.001	0.001
Had earnings dip	−0.559***	0.075	−0.766***	0.068
Mean, number of quarters since dip at registration	0.062***	0.008	0.102***	0.008
Average earnings dip size in percentage	0.325***	0.078	0.744***	0.071
Observations	220,299		115,381	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]Data not available.

Propensity Score Statistics

Table 8.3 provides the mean propensity scores and 20th percentile indicator for the community and technical college ABE analyses. The mean propensity scores for the treatment groups are roughly 0.21 and 0.30 whereas they are 0.04 and 0.09 for the comparison group for the 2005/2006 and 2007/2008 cohorts, respectively. The 20th percentile indicator is approximately 79 percent for 2005/2006 and 72 percent for 2007/2008.

Table 8.3 Indicators of Propensity Score Model Quality for ABE Analyses

Statistic	2001/2002	2003/2004
Mean p-score, ABE	0.211	0.300
Mean p-score, Labor Exchange	0.042	0.085
Percentile Labor Exchange, at 20th percentile ABE	79.1%	72.2%

Statistical Match

Table 8.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment and comparison group observations. Only a few of the differences in means are still significant suggesting that the populations are relatively balanced. The top panel of statistics in the table shows that less than 10 percent of the observations from the 2005/2006 comparison group pool were used multiple times; however about 16 percent of the comparison group pool observations were used in the 2007/2008 match. Furthermore, the maximum number of repeats is 53 and 41 in the two

Table 8.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for ABE

	2005/2006		2007/2008	
Statistic/Characteristic	ABE	Labor Exchange	ABE	Labor Exchange
Sample size	11,722	235,827	12,540	112,039
Sample size used in match	11,129	209,170	12,540	102,841
Matched sample size	11,129	11,129	12,539	12,539
Number of observations used once	—	5,842	—	6,555
Number of observations used multiple times	—	926	—	1,955
Maximum number of repeats	—	53	—	41
Demographics and Education				
Mean, age at registration	31.2	31.2	30.9**	30.5**
Female	60.0%	59.7%	59.8%	59.2%
Minority	55.8%	56.0%	58.9%**	60.6%**
Disability	1.6%	1.7%	1.9%	2.0%
Urban county	59.9%**	58.3%**	60.6%	59.7%
West WA	78.3%	79.1%	73.5%	74.2%
Mean, years of education at registration	--[c]	--[c]	12.1**	12.0**
Veteran	--[c]	--[c]	0.4%	0.5%
Single parent	--[c]	--[c]	22.1%	22.2%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	40.5%	39.8%	50.1%	49.7%
Average quarterly earnings[a]	$1,545	$1,506	$1,858	$1,847
Mean, earnings variance[b] (in 10^6 $)	$2.2	$2.2	$2.9**	$3.3**
Mean, earnings trend[b]	$54.4**	$44.1**	$73.6	$70.6
Percentage of quarters with multiple jobs	10.0%	9.9%	13.7%	14.1%
Had earnings dip	27.5%	28.2%	35.4%	36.1%
Mean, number of quarters since dip at registration[a]	1.0	1.1	1.3	1.3
Average earnings dip size in percentage[a]	20.8%	21.7%	26.9%	27.2%
Sample Size of matched sample	11,129	11,129	12,539	12,539

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
[c]Data not available.
** Difference in means is statistically significant at the 0.05 level (t-test).

matches which is far greater than what occurred in any of the other program analyses. This is likely a result of the fact that the LE file is much smaller in 2007/2008 and because most of the matching variables are discrete.

Net Impacts

The major purpose of the study is to estimate the net impacts of the education and training programs on clients, and Tables 8.5 and 8.6 provide the estimated net impacts for ABE programs. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, although for some programs we use the levels of the outcome variables as the dependent variable and, for others, we use difference-in differences. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final four columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

The short-term net impacts for the community and technical college Adult Basic Education participants are shown in Table 8.6. The employment rate dropped by 2.1 percentage points, but the hourly wage and average hours of work per quarter exhibited statistically significant increases. Combined, these impacts result in a small, but statistically significant,

increase in average quarterly earnings of about $131. Furthermore, providing ABE is estimated to reduce the participants' reliance on unemployment insurance benefits.

Table 8.5 Net Impact Estimates for ABE Program for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	−8.3***	−10.6***	62.1	—	54.1	—
Ever-employed, longer term (%)	−10.4***	−10.7***	67.5	—	60.6	—
Percent of quarters, longer term	−6.5***	−6.9***	56.7	—	48.5	—
Percent of quarters, longer term, diff-in-diff	−4.2***	−3.9***	−4.0	—	13.4	—
Average hourly wage						
Short term ($)	−1.31***	−1.38***	9.18	14.58	6.74	12.18
Short term, diff-in-diff ($)	0.27***	0.30***	−0.33	−0.32	0.41	0.71
Longer term ($)	−1.27***	−1.34***	9.14	15.46	6.60	12.87
Longer term, diff-in-diff ($)	−0.01	0.02	−1.54	0.57	0.12	1.47
Average quarterly hours						
Short term	−9.6***	−12.4***	238.8	379.1	190.9	345.2
Short term, diff-in-diff	11.7***	13.0***	4.9	17.9	13.9	38.4
Longer term	−11.7***	−14.1***	232.8	375.9	187.7	341.9
Longer term, diff-in-diff	2.6	4.4*	−26.1	20.8	5.5	44.0
Average quarterly earnings						
Short term ($)	−148***	−187***	3,614	5,737	2,341	4,233
Short term, diff-in-diff ($	234***	246***	−158	64	168	571
Longer term ($)	−296***	−332***	3,800	6,048	2,543	4,557
Longer term, diff-in-diff ($)	72**	90***	−462	454	211	1,013
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−2.2***	−1.7***	8.9	—	4.0	—
Benefits, short term ($)	−31***	−32***	116	1,310	52	1,287
Percent receiving, longer term	−5.9***	−5.6***	17.5	—	11.5	—
Benefits, longer term ($)	−56***	−57***	160	1,587	98	1,475

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 8.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The longer-term net impacts, shown in Table 8.5, are similar to the short-term impacts, but slightly less positive. The employment rate goes down by almost 4 percentage points. However, the average hourly wage goes up slightly by $0.02 (not statistically significant) and average quarterly hours rise by about 4 hours. The combined effect is that the longer-term

average quarterly earnings impacts are positive, $90, less than a four percent increase. The reduced usage of unemployment insurance benefits estimated in the short-term continues in the longer-term, and is larger in magnitude.

Table 8.6 Net Impact Estimates for ABE Program for 2007/2008 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	−1.9***	−2.1***	59.2	—	54.1	—
Average hourly wage						
Short term ($)	−0.83***	−0.85***	9.51	15.83	6.93	12.55
Short term, diff-in-diff ($)	0.24***	0.26***	−0.75	−0.70	0.39	0.62
Average quarterly hours						
Short term	2.6	1.7	233.9	389.2	196.3	355.3
Short term, diff-in-diff	8.6***	9.4***	−16.1	−15.0	11.4	23.1
Average quarterly earnings						
Short term ($)	−153***	−154***	3,804	6,332	2,510	4,543
Short term, diff-in-diff ($)	121***	131***	−660	−752	171	436
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−3.0***	−2.5***	12.6	—	7.5	—
Benefits, short term ($)	−70***	−72***	271	2,153	131	1,752

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 8.4.
* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

IBEST

No separate subgroup analysis has been conducted with this treatment group. However, we are able to estimate the short-term net impact of the Integrated Basic Education and Skills Training (IBEST) program. This program is an approach that integrates the instruction of basic academic skills with technical content in order to facilitate the completion of an occupational community college program of study by students with basic skills deficiencies. The courses comprising a career pathway for a student are jointly taught by a career and technical education (CTE) instructor and a basic skills instructor. Courses are supplemented by support classes or

learning labs where students can receive additional help. IBEST was developed by the Washington State Board of Community and Technical Colleges (SBCTC) and was first offered to students in the 2004/2005 year at five pilot institutions. It was expanded to five additional campuses the next academic year and was implemented system-wide to all 34 public community colleges in the state in the 2007/2008 academic year. The analysis reported here examines short-term outcomes for IBEST students who completed (or left) their participation in 2007/2008.

Table 8.7 provides the estimated short-term net impacts for IBEST and non-IBEST participants. The small sample size for the former precluded statistical significance. However, the point estimates suggest more positive employment, average quarterly hours of employment, and average quarterly earnings net impacts for the IBEST subgroup. Note that these impacts were all on the order of 10 percent or more. The non-IBEST subgroup (essentially all of the ABE treatment cases) were estimated to have a higher average hourly wage net impact and a larger reduction in take-up of unemployment insurance benefits.

Table 8.7 Selected Short Term Net Impact Estimates for the IBEST and non-IBEST Subgroups of ABE Exiters: 2007/2008 Cohort

	Subgroup		Matched Comparison
Outcome	IBEST	Non-IBEST	Group Mean
Employment	4.2%	−2.3%**	54.1%
Hourly Wage	$0.12	$0.26**	$6.93
Hours Worked	22.2	8.9**	196.3
Earnings	$268	$124**	$2,510
UI Receipt	−1.8%	−2.5%**	7.5%
Subgroup Sample Size	450[a]	12,089	—

NOTE: Monetary data in '05 $.

[a]The state supplied us with identifiers for 590 IBEST exiters. Of these, 450 were in the ABE exiter administrative data. The other 140 were in Job Prep administrative data. Note that 352 were in both ABE and Job Prep.

**Significant at the 0.05 level (two-tailed test).

9 PRIVATE CAREER SCHOOL PROGRAMS

Private career (proprietary) school programs train individuals who have completed high school or its equivalency for specific occupations. The institutions are privately operated, but they are monitored by the WTECB. The occupations that are being trained run the gamut from cosmetology to truck driving to computer programming and many others. The administrative data come from a voluntary data collection effort administered by the WTECB. Because of its voluntary nature, the representativeness or generalizability of the data is uncertain, but thought to be reasonable.

Participant Characteristics

Table 9.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. As with many of the other programs including those at community colleges, the comparison group consists of Labor Exchange clients who were 16 to 60 at the time of registration with individuals who were served by Washington's education and training programs removed from the data who exited from the LE in 2005/2006 or 2007/2008. The first two columns of numbers compare the private career school students who exited in 2005/2006 to individuals in the comparison group. The final two columns compare the exiters in 2007/2008 to LE exiters in the same year.

The populations are somewhat different. About 60 percent of the private career school participants are females compared to about 45 percent of the LE registrants. The private career school students are also about six years younger than the LE comparison group, on average, although they have about one year more of education at the time of registration. A smaller share of the private career school participants are minorities than of the Labor Exchange registrants. A

stark difference arises with disability status. Only about 0.5 percent of the private career school students identify themselves as disabled, whereas almost 19 percent of the 2005/2006 LE registrants and 13 percent of the 2007/2008 LE registrants are self-identified as disabled. Private career school students are disproportionately from urban counties and from western Washington.

Table 9.1 Descriptive Statistics for Private Career School Treatment Group and Comparison Group Universe

	2005/2006		2007/2008	
Characteristics	Private Career School	Labor Exchange	Private Career School	Labor Exchange
Demographics and Education				
Female	59.5%	44.9%	59.8%	43.7%
Minority	28.0%	35.0%	29.5%	32.6%
Mean, age at registration	30.1	35.9	30.3	35.8
Disability	0.6%	18.7%	0.4%	13.0%
Mean, years of education at registration	13.2	12.2	13.3	12.2
West WA	74.3%	44.5%	71.2%	51.4%
Urban county	64.9%	41.7%	59.4%	46.7%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	56.5%	64.1%	53.9%	64.3%
Average quarterly earnings[a, b]	$2,669	$3,846	$2,487	$4,349
Mean, earnings trend[c]	$59.7	$41.8	$77.7	$89.0
Mean, earnings variance[c] (in 10^6 $)	$6.2	$10.5	$6.1	$13.2
Percentage of quarters with multiple jobs	12.7%	15.0%	13.0%	13.6%
Had earnings dip	36.7%	41.9%	35.5%[††]	36.0%[††]
Mean, number of quarters since dip at registration[b]	1.3	1.5	1.2	1.1
Average earnings dip size in percentage[b]	26.9%	29.7%	26.0%	24.2%
Sample Size	12,691	209,170	11,269	102,842

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

In terms of labor market experience prior to schooling, the private career school students had lower levels of average quarterly earnings—about $2,500 to $2,700 compared to $3,850 and $4,350—and had lower prior employment rates. The lower earnings may be explained by the younger ages of the private career school students.

Participation Model

Table 9.2 provides the results from the logit estimation of participation in private career schools. The table provides the logit coefficient estimates and standard errors. While the

magnitude of the coefficients is not particularly meaningful, the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being an exiter from a private career school.

Table 9.2 Coefficient Estimates from a Logit Model of being a Private Career School Student

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	0.303***	0.021	0.419***	0.022
Minority	−0.369***	0.022	−0.208***	0.024
Age at registration	−0.053***	0.001	−0.039***	0.001
Disability	−4.108***	0.119	−4.050***	0.161
Years of education, at registration	0.305***	0.006	0.268***	0.006
West WA	1.182***	0.022	0.933***	0.024
Urban county	0.938***	0.021	0.519***	0.023
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.006***	0.001	0.004***	0.001
Average quarterly earnings	−0.010***	0.001	−0.013***	0.001
Mean, earnings trend	−0.001	0.002	−0.000	0.002
Mean, earnings variance (in 10^8 $)	0.018	0.056	0.025	0.065
Percentage of quarters with multiple jobs	−0.002***	0.001	0.002**	0.001
Had earnings dip	−0.312***	0.060	−0.602***	0.065
Mean, number of quarters since dip at registration	0.010	0.007	0.081***	0.008
Average earnings dip size in percentage	0.293***	0.063	0.741***	0.069
Observations	221,861		114,111	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The coefficient estimates seem quite reasonable. The following variables are significantly correlated with being in the treatment group (i.e., student at a private career school): Female, years of education at time of registration, residing in western Washington, residing in an urban county, prior employment rates, and length of time and magnitude of an earnings dip. The following variables are significantly correlated with being in treatment group: minority status, age at registration, disability, average prior quarterly earnings, and having an earnings dip.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive

capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. Table 9.3 provides these means as well as the 20th percentile indicator for the private career school exiters. The mean propensity scores for the treatment group are approximately 0.19 and 0.22; whereas they are 0.05 and 0.09 for the comparison group. The 20th percentile indicators are between 65 and 71 percent. The means and the 20th percentile statistic indicate that the logit model of participation discriminates fairly well between treatment and comparison group observations.

Table 9.3 Indicators of Propensity Score Model Quality for Private Career Schools

Statistic	2005/2006	2007/2008
Mean p-score, WIA Adult	0.187	0.222
Mean p-score, Labor Exchange	0.049	0.085
Percentile Labor Exchange, at 20th percentile WIA Adult	71.3%	65.4%

Statistical Match

The statistical matching that was done was to use a nearest neighbor approach with the propensity score. For every observation *j* in *T*, we found the observation *k* in *U* that minimized the absolute value of the difference between the propensity score for *j* and *k*. We then added *k* to the comparison group sample as long as the difference between the two p-scores did not exceed the caliper. The statistical match was done with replacement, so some observations in *U* were the "matches" for more than one observation in the treatment group and were duplicated in the comparison sample. Table 9.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment and comparison group observations. The balance between the private career school participants and matched comparison group is not especially strong. Several of the differences in

means in the table are significant, and more than 10 percent of the comparison group pool observations were used multiple times.

Table 9.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Private Career Schools

	2005/2006		2007/2008	
Statistic/Characteristic	Private Career School	Labor Exchange	Private Career School	Labor Exchange
Sample size	15,570	235,827	12,452	112,039
Sample size used in match	12,691	209,170	11,269	102,842
Matched sample size	12,689	12,689	11,262	11,262
Number of observations used once	—	9,124	—	7,597
Number of observations used multiple times	—	1,502	—	1,549
Maximum number of repeats	—	18	—	8
Demographics and Education				
Mean, age at registration	30.1**	30.4**	30.3**	30.8**
Female	59.5%	58.6%	59.8%	58.6%
Minority	28.0%	28.2%	29.5%**	28.3%**
Mean, years of education at registration	13.2**	13.3**	13.2**	13.4**
Disability	0.6%**	1.0%**	0.4%**	0.6%**
Urban county	64.9%	64.8%	59.4%	59.2%
West WA	74.3%	74.8%	71.2%	72.0%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	56.5%	55.9%	54.0%	54.1%
Average quarterly earnings[a]	$2,669	$2,751	$2,488**	$2,599**
Mean, earnings variance[b] (in 10^6 $)	$6.2	$6.6	$6.1	$6.7
Mean, earnings trend[b]	$59.7	$53.5	$77.8	$69.3
Percentage of quarters with multiple jobs	12.7%	12.4%	13.0%	13.1%
Had earnings dip	36.7%	36.5%	35.5%	35.2%
Mean, number of quarters since dip at registration[a]	1.3	1.2	1.2	1.2
Average earnings dip size in percentage[a]	26.9%	26.8%	26.0%	25.8%
Sample Size of matched sample	12,689	12,689	11,262	11,262

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
** Difference in means is statistically significant at the 0.05 level (t-test).

Net Impacts

Tables 9.5 and 9.6 provide the estimated net impacts of attending private career schools on clients. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means

between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, although for some programs we use the levels of the outcome variables as the dependent variable and, for others, we use difference-in differences. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff.

Table 9.5 Net Impact Estimates for Private Career School Programs for 2005/2006 Cohort

	Matched Sample Estimator		Comparison Group Means			
	Diff. in	Regr.	Full Sample		Matched Sample	
Outcome	Means	Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	1.6***	1.7***	62.1	—	60.0	—
Ever-employed, longer term (%)	−2.0***	−2.4***	67.5	—	66.6	—
Percent of quarters, longer term	0.4	0.1	56.7	—	55.8	—
Percent of quarters, longer term, diff-in-diff	3.2***	3.4***	−4.0	—	2.3	—
Average hourly wage						
Short term ($)	0.33***	0.41***	9.18	14.58	8.62	14.11
Short term, diff-in-diff ($)	1.02***	0.97***	−0.33	−0.32	0.02	0.46
Longer term ($)	−0.01	0.09	9.14	15.46	9.15	15.66
Longer term, diff-in-diff ($)	0.85***	0.80***	−1.54	0.57	−0.35	2.03
Average quarterly hours						
Short term	23.7***	23.3***	238.8	379.1	223.6	365.9
Short term, diff-in-diff	33.2***	32.1***	4.9	17.9	5.6	25.8
Longer term	10.9***	10.4***	232.8	375.9	224.3	368.2
Longer term, diff-in-diff	26.9***	25.5***	−26.1	20.8	−14.5	27.9
Average quarterly earnings						
Short term ($)	264***	316***	3,614	5,737	3,279	5,367
Short term, diff-in-diff ($)	534***	501***	−158	64	55	474
Longer term ($)	57	117**	3,800	6,048	3,709	5,982
Longer term, diff-in-diff ($)	431***	394***	−462	454	99	1,105
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−2.8***	−2.3***	8.9	—	5.3	—
Benefits, short term ($)	−37***	−36***	116	1,310	70	1,333
Percent receiving, longer term	−4.6***	−4.4***	17.5	—	13.4	—
Benefits, longer term ($)	−49***	−49***	160	1,587	127	1,730

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 9.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

With the exception of the employment rate, the short-term impacts displayed in Table 9.6 are quite positive. The employment rate net impact is estimated to go down by 2.7 percentage points; however, the average hourly wage net impact shows an increase of about $0.91 per hour; and average quarterly hours worked increases by 20 hours, which is statistically significant. These positives re-enforce each other so that average quarterly earnings rise by $416, which is approximately a 12 percent increase. Also, in the short-term, recipiency of unemployment insurance benefits decreases significantly.

Table 9.6 Net Impact Estimates for Private Career School Programs for 2007/2008 Cohort

	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
Outcome	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	−2.5***	−2.7***	59.2	—	59.5	—
Average hourly wage						
Short term ($)	−0.34**	−0.16	9.51	15.83	8.86	14.67
Short term, diff-in-diff ($)	0.94***	0.91***	−0.75	−0.70	0.25	0.42
Average quarterly hours						
Short term	−5.9*	−4.0	233.9	389.2	226.3	374.8
Short term, diff-in-diff	21.2***	20.0***	−16.1	−15.0	5.4	14.2
Average quarterly earnings						
Short term ($)	−151**	−60	3,804	6,331	3,409	5,646
Short term, diff-in-diff ($	443***	416***	−660	−752	61	261
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−4.0***	−3.2***	12.6	—	8.3	—
Benefits, short term ($)	−91***	−85***	271	2,153	170	2,049

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 9.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The longer-term net impacts closely mirror the short-term impacts, although in this case, the employment rate impact is positive. Employment is estimated to rise by 3.4 percentage points; hourly wages increase by $0.80 on average; and average quarterly hours rise by 25.5. These increases result in an estimated net increase in quarterly earnings of $394. The longer—term results show a decrease in unemployment insurance benefits.

Subgroup Analysis

Tables 9.7 and 9.8 provide net impact estimates for the subgroup of the private career school participants for whom the administrative data indicated had completed their programs. Over 80 percent of the private career school students were reported to be completers, so that subsample consists of a large share of the total treatment sample. Nevertheless, the results are different and much stronger for completers than noncompleters, for the most part. The short-term employment rate impact is essentially zero, but the average hourly wage goes up by $1.17 an hour, and average quarterly hours worked goes up by about 24 hours. The short-term net impact for quarterly earnings is just over $500. The entries in the first column of Table 9.8 show rather bleak estimated outcomes for noncompleters—a negative employment effect and average hourly wage, quarterly hours, and quarterly earnings impacts that are not significantly different from zero.

In Table 9.7, we find almost identical results for the longer-term net impacts as the short-term net impacts. One difference is that completers had a significant increase in employment rate of 4.7 percentage points. But the estimates for net impacts on average hour wage rates, quarterly hours worked, and average quarterly earnings are very close to the short-term impacts. Noncompleters in the longer-term time period again had outcomes that are not significantly different from zero.

Table 9.7 Selected Longer-Term Net Impact Estimates for Subgroups of Private Career School Participants: 2005/2006 Cohort

	Subgroup		Matched Comparison
	Noncompleters	Completers	Group Mean
Employment	−2.2%	4.7%**	55.8%
Hourly Wage	−$0.21	$1.07**	$9.15
Hours Worked	4.8	30.3**	224.3.
Earnings	−$67	$511**	$3,272
UI Receipt	−4.0%**	−4.5%**	13.4%
Subgroup Sample Size	2,409	10,280	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

Table 9.8 Selected Short Term Net Impact Estimates for Subgroups of Private Career School Participants: 2007/2008 Cohort

Outcome	Subgroup		Matched Comparison
	Noncompleters	Completers	Group Mean
Employment	−10.9%**	−0.7%	59.5%
Hourly Wage	-$0.22	$1.17**	$8.86
Hours Worked	4.0	23.7**	226.3
Earnings	−$8	$511**	$3,409
UI Receipt	−2.8%**	−3.3%**	8.3%
Subgroup Sample Size	2,000	9,262	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

10 APPRENTICESHIP PROGRAMS

The workforce development program that is the "treatment" in this chapter is apprenticeship programs. Apprenticeships are formal arrangements between employed individuals, employers, and the state in which classroom instruction and formal on-the-job training are combined. They are typically multi-year efforts, and are supervised by journey-level craftpersons or other trade professionals. Completion standards typically include 2000 total work hours and at least 144 hours of related and supplemental formal instruction. Apprenticeships are administered in Washington by the Department of Labor and Industries.

Participant Characteristics

Table 10.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. As with the community college programs, the comparison group consists of Labor Exchange clients who were 16 to 60 at the time of LE registration. The individuals who were served by Washington's education and training programs were removed from the data. The first two columns of numbers compare the apprenticeship participants who exited in 2005/2006 to individuals in the comparison group. The final two columns compare the exiters in 2007/2008 to LE exiters in the same year.

One major data limitation in our analyses of apprenticeship programs is the paucity of information about the individuals' characteristics. The only administrative data available are gender, age, minority status, and residency. We have no data on education background, disability, limited English proficiency status, or employment or public assistance status at the time of registration for the apprenticeship. This data deficiency limits severely the quality of the participation model estimation and the statistical match as documented below.

Table 10.1 Descriptive Statistics for Apprenticeship Treatment Group and Comparison Group Universe

Characteristics	2005/2006		2007/2008	
	Apprentice-ship	Labor Exchange	Apprentice-ship	Labor Exchange
Demographics and Education				
Female	11.9%	44.9%	10.8%	43.7%
Minority	25.6%	35.0%	28.3%	32.6%
Mean, age at registration	29.5	35.9	29.4	35.8
West WA	62.2%	44.5%	82.7%	51.4%
Urban county	67.9%	41.7%	69.4%	46.7%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	72.9%	64.1%	70.9%	64.3%
Average quarterly earnings[a, b]	$4,286	$3,846	$4,089	$4,349
Mean, earnings trend[c]	$111.2	$41.8	$121.7	$89.0
Mean, earnings variance[c] (in 10^6 $)	$8.2	$10.5	$8.4	$13.2
Percentage of quarters with multiple jobs	18.4%	15.0%	18.7%	13.6%
Had earnings dip	45.3%	41.9%	42.1%	36.0%
Mean, number of quarters since dip at registration[b]	1.6	1.5	1.5	1.1
Average earnings dip size in percentage[b]	31.1%	29.7%	28.2%	24.2%
Sample Size	3,214	209,170	4,082	102,842

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
[††]Differences in means are not statistically significant at 0.05 level (t-test).

Even with the few characteristics that are available, we see that the populations are different. Only about 11-12 percent of apprenticeship participants are females compared to just almost 45 percent of the LE registrants. The apprentices are considerably younger as well; they average over 6 years younger in both cohorts, and a smaller share of the apprentices are minorities. The prior employment rates of the apprentices are higher than the LE comparison group pool, and the trend in average quarterly earnings prior to registration is much higher. Most of the other employment and earnings variables have similar means.

Participation Model

Table 10.2 provides the results from the logit estimation of apprenticeship participation. The independent variables included the few demographic variables available plus prior employment and earnings variables. The table provides the logit coefficient estimates and

standard errors. While the magnitude of the coefficients is not particularly meaningful, the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being an apprentice.

Table 10.2 Coefficient Estimates from a Logit Model of Participation in Apprenticeships

	2001/2002		2003/2004	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics and Education				
Female	−1.565***	0.057	−1.586***	0.053
Minority	−0.437***	0.043	−0.210***	0.038
Age at registration	−0.073***	0.002	−0.060***	0.002
West WA	0.690***	0.038	1.453***	0.044
Urban county	1.133***	0.040	0.899***	0.038
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	0.009***	0.001	0.005***	0.001
Average quarterly earnings	0.004***	0.001	−0.001	0.001
Mean, earnings trend	0.008*	0.004	−0.006	0.004
Mean, earnings variance (in 10^8 $)	−1.314***	0.180	−0.973***	0.156
Percentage of quarters with multiple jobs	0.007***	0.001	0.010***	0.001
Had earnings dip	−0.304**	0.101	−0.542***	0.092
Mean, number of quarters since dip at registration	0.056***	0.012	0.120***	0.011
Average earnings dip size in percentage	0.387***	0.108	0.440***	0.101
Observations	212,384		106,924	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The coefficient estimates seem quite reasonable. The following variables are significantly correlated with being in the treatment group (i.e., apprenticeship participant) in both years of data: Being from Western Washington, residing in an urban county, prior employment rate, percentage of quarters with multiple employers, and length of time since an earnings dip and magnitude of the dip. The following variables are significantly correlated with being in treatment group: Female, minority, age at registration, average quarterly earnings prior to registration, variance in earnings prior to registration, and having experienced an earnings dip.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile. Table 10.3 provides these data for apprenticeships. The mean propensity scores for the treatment groups are roughly 0.08 and 0.15 whereas they are 0.014 and 0.034 for the comparison group for 2005/2006 and 2007/2008 respectively. The 20th percentile indicator is approximately 70 percent for 2005/2006 and 74 percent for 2007/2008. The means and the 20th percentile statistics indicate that the logit model of participation discriminated reasonably well between treatment and comparison group observations.

Table 10.3 Indicators of Propensity Score Model Quality for Apprenticeships

Statistic	2005/2006	2007/2008
Mean p-score, apprenticeship	0.078	0.151
Mean p-score, Labor Exchange	0.014	0.034
Percentile Labor Exchange, at 20th percentile apprenticeship	69.5%	73.5%

Statistical Match

Table 10.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment group, comparison group, and pool of observations from which the comparison group was chosen. Notice that means for the comparison group are quite close to the treatment group as would be expected and that only about ten percent of the matched comparison group have multiple

records. None of the differences in means is statistically significant suggesting that the treatment and comparison groups are well-balanced.

Table 10.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Apprenticeships

	2005/2006		2007/2008	
Statistic/Characteristic	Apprentice-ship	Labor Exchange	Apprentice-ship	Labor Exchange
Sample size	3,301	235,827	4,082	112,039
Sample size used in match	3,214	209,170	4,082	102,842
Matched sample size	3,207	3,207	4,075	4,075
Number of observations used once	—	2,810	—	3,168
Number of observations used multiple times	—	171	—	399
Maximum number of repeats	—	9	—	9
Demographics and Education				
Mean, age at registration	29.5	29.8	29.4	29.3
Female	11.9%	12.1%	10.8%	11.0%
Minority	25.6%	25.5%	28.4%	26.5%
Urban county	67.8%	67.9%	69.4%	68.4%
West WA	62.2%	61.8%	82.6%	82.0%
Employment and Earnings (prior to registration)				
Percentage employed prior to registration	72.9%	73.5%	70.9%	71.4%
Average quarterly earnings[a]	$4,285	$4,246	$4,093	$4,068
Mean, earnings variance[b] (in 10^6 $)	$8.2	$8.7	$8.4	$8.6
Mean, earnings trend[b]	$110.1	$114.0	$120.8	$113.2
Percentage of quarters with multiple jobs	18.4%	18.7%	18.7%	18.5%
Had earnings dip	45.3%	44.3%	42.0%	42.8%
Mean, number of quarters since dip at registration[a]	1.6	1.6	1.5	1.5
Average earnings dip size in percentage[a]	31.1%	30.5%	28.1%	28.8%
Sample Size of matched sample	3,207	3,207	4,075	4,075

NOTES: Monetary data in 2005 $.
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.
** Difference in means is statistically significant at the 0.05 level (t-test).

Net Impacts

Tables 10.5 and 10.6 provide the estimated net impacts of participating in apprenticeships. Short-term and longer-term impacts for apprenticeship participants are quite positive. In the short term, average quarterly earnings increase by over $3,200, which is almost 80 percent. These earnings gains come from increased employment impacts of 7.8 percentage points, hourly wage increases of $6.03, and increased hours per quarter of about 54 hours. The

Table 10.5 Net Impact Estimates for Apprenticeship Programs for 2005/2006 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
	Diff. in Means	Regr. Adj.	Full Sample		Matched Sample	
			With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	7.4***	8.0***	62.1	—	68.2	—
Ever-employed, longer term (%)	5.3***	5.5***	67.5	—	73.6	—
Percent of quarters, longer term	8.3***	8.5***	56.7	—	61.7	—
Percent of quarters, longer term, diff-in-diff	9.9***	9.8***	−4.0	—	−7.0	—
Average hourly wage						
Short term ($)	6.69***	6.69***	9.18	14.58	11.09	16.07
Short term, diff-in-diff ($)	6.46***	6.49***	−0.33	−0.32	−0.18	0.41
Longer term ($)	7.00***	6.97***	9.14	15.46	11.11	17.34
Longer term, diff-in-diff ($)	7.24***	7.27***	−1.54	0.57	−1.23	1.62
Average quarterly hours						
Short term	52.1***	53.0***	238.8	379.1	273.3	395.9
Short term, diff-in-diff	35.8***	36.5***	4.9	17.9	8.0	35.7
Longer term	55.5***	56.0***	232.8	375.9	253.1	376.5
Longer term, diff-in-diff	50.4***	50.9***	−26.1	20.8	−36.6	19.1
Average quarterly earnings						
Short term ($)	3,314***	3,303***	3,614	5,737	4,519	6,546
Short term, diff-in-diff ($)	3,017***	3,045***	−158	64	130	673
Longer term ($)	3,561***	3,539***	3,800	6,048	4,628	6,812
Longer term, diff-in-diff ($)	3,482***	3,511***	−462	454	−202	1,015
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	3.6***	3.7***	8.9	—	8.5	—
Benefits, short term ($)	73***	76***	116	1,310	117	1,375
Percent receiving, longer term	5.2***	5.6***	17.5	—	20.9	—
Benefits, longer term ($)	71***	74***	160	1,587	227	1,852

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 10.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

increased earnings gains were offset with a slight increase in receipt of unemployment insurance benefits, although these estimates are not statistically significant.

The longer-term earnings impacts are also very positive and slightly larger than the short-term net impacts. The employment rate increases by 9.8 percentage points; and the hourly wage increase is estimated to be $7.27. These are quite substantial and exceed slightly the short-term impacts. The hours per quarter net impacts of about 51 hours is less than the short-term estimate.

Table 10.6 Net Impact Estimates for Apprenticeship Programs for 2007/2008 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	7.0***	7.8***	59.2	—	63.9	—
Average hourly wage						
Short term ($)	9.32***	9.22***	9.51	15.83	10.39	16.01
Short term, diff-in-diff ($)	6.02***	6.03***	−0.75	−0.70	−0.29	0.42
Average quarterly hours						
Short term	37.4***	38.2***	233.9	389.2	254.7	392.7
Short term, diff-in-diff	54.1***	53.7***	−16.1	−15.0	−20.7	−8.8
Average quarterly earnings						
Short term ($)	3,402***	3,397***	3,804	6,331	4,139	6,382
Short term, diff-in-diff ($)	3,234***	3,243***	−660	−752	−327	−95
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	0.4	0.7	12.6	—	14.8	—
Benefits, short term ($)	25	27	271	2,153	299	2,021

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 10.4.
* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

The quarterly earnings impact of apprenticeships is about $3,500 per quarter. In the longer-term framework, apprentices are projected to increase significantly their usage of unemployment compensation.

Subgroup Analyses

According to the administrative data, only about 40 percent of the apprenticeship treatment group actually complete their apprenticeships, which is comparable to historical, national data. Tables 10.7 and 10.8 display selected net impact estimates for the completers and for the noncompleters subgroup. The estimates for completers are very large and statistically significant. The positive net impacts for the entire treatment group are heavily weighted by the completers. In the short term, relative to the comparison group and the non-completers, the employment rates rise by 24.1 percentage points, wage rates by about $13.00, and quarterly earnings by over $7,000. The longer-term net impact estimates for completers are slightly larger

than the short-term estimates. The net impact for employment is 25.5 percentage points in the longer term as compared to 24.1 percentage points in the short term. The average hourly wage and average quarterly hours net impacts in the longer term are $15.00 per hour and about 102 hours as compared to $13.19 and about 100 hours in the short term. Average quarterly earnings are about $400 greater in the longer term as well. Note that the net impact estimates trend in the opposite direction for noncompleters. The short-term impacts for average hourly wage and average quarterly hours of employment are larger than the longer-term net impacts. Participating in an apprenticeship seems to bestow quite significant labor market impacts for individuals; the completers subgroup are estimated to have very large labor market returns. Even though they are much smaller, the estimated net impacts for quarterly earnings for noncompleters are quite significant—about $950 in the short term and about $800 in the longer-term.

Table 10.7 Selected Long Term Net Impact Estimates for Subgroups of Apprenticeships: 2005/2006 Cohort

	Subgroup		Matched Comparison
Outcome	Noncompleters	Completers	Group Mean
Employment	−0.4%	25.5%**	61.7%
Hourly Wage	$1.81**	$15.00**	$11.11
Hours Worked	6.7	119.7**	253.1
Earnings	$782**	$7,413**	$4,628
UI Receipt	2.0%	12.0%**	20.9%
Subgroup Sample Size	1,869	1,338	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

Table 10.8 Selected Short Term Net Impact Estimates for Subgroups of Apprenticeships: 2007/2008 Cohort

	Subgroup		Matched Comparison
Outcome	Noncompleters	Completers	Group Mean
Employment	−2.7%	24.1%**	63.9%
Hourly Wage	$2.09**	$13.19**	$10.39
Hours Worked	23.6**	100.5 **	254.7
Earnings	$955**	$7,002**	$4,139
UI Receipt	−2.2%**	8.6%**	14.8%
Subgroup Sample Size	2,524	1,551	—

NOTE: Monetary data in '05 $.
**Significant at the 0.05 level (two-tailed test).

11 HIGH SCHOOL CAREER AND TECHNICAL EDUCATION (CTE) PROGRAMS

Secondary career and technical education (vocational education) provides general workplace and, to some extent, specific occupational skills instruction to high school students. In other programs analyzed in this project, the participating population included completers as well as "non-completers." However, with the high school career and technical education students, the "treatment" is full-time equivalent vocational completers only, defined as completing 360 hours of sequenced vocational classes. The Office of the Superintendent of Public Instruction (OSPI) provided the WTECB with individual-level data from general administrative information provided by public high schools in the state about their student enrollment (Form SPIP-210). The intent of the data collection was to have universal coverage, but some high schools did not provide the data. So the representativeness and generalizability of the data may be at question. A significant advantage to our analyses, however, is the ability to use the same data set for the comparison group pool as the treatment. That is, the observations in the high school data that are not classified as vocational completers (by the high school) comprise the comparison group pool.

CTE programs are designed to develop the skills, understanding, and attitudes needed by workers in their occupations. Instructional programs organized within career pathways include agriculture, family and consumer sciences, trade and industry, marketing, business, diversified occupations, technology education, cosmetology, health education, and others.

Participant Characteristics

Table 11.1 provides descriptive data that compare the students in the treatment group to those in the comparison group pool. The first two columns of numbers compare the high school career and technical education completers who graduated in 2005/2006 to the remaining students

in the sample. The final two columns compare the 2007/2008 career and technical education graduates to other graduates.[25]

Table 11.1 Descriptive Statistics for High School Career and Technical Education Treatment Group and Comparison Group Pool

	2005/2006		2007/2008	
Characteristics	CTE Graduates	Non-CTE Graduates	CTE Graduates	Non-CTE Graduates
Demographics				
Female	48.1%	53.0%	49.5%	51.9%
Minority	21.6%	23.3%	21.0%	24.9%
Disability	6.7%	5.4%	0.4%	6.2%
West WA	62.4%	65.2%	72.2%	63.4%
Employment and Earnings (prior to grade 12)[a]				
Ave. percentage of (prior) quarters with employment[b]	37.8%	32.6%	40.4%	37.1%
Average quarterly earnings[b, c]	$460	$388	$462	$438
Mean, earnings trend[d]	$56.4	$15.6	$26.0††	$22.1††
Mean, earnings variance[d] (in 10^6 $)	$0.1	$0.4	$0.4††	$0.4††
Percentage of quarters with multiple jobs	4.6%	3.5%	4.9%††	4.6%††
Had earnings dip	9.4%	25.4%	29.2%††	28.5%††
Mean, number of quarters since dip at grade 12[c]	0.1	0.9	0.9††	0.9††
Average earnings dip size in percentage[c]	6.7%	20.3%	22.4%††	22.3%††
Sample Size	13,661	25,977	9,827	26,309

NOTE: Monetary data in 2005 $.
[a]Prior to registration is defined as prior to September 1 of grade 12.
[b]Observations with no quarters of prior earnings were excluded from analyses.
[c]Averages include observations with values of zero.
[d]Trend and variance calculations include quarters with zero earnings, if any.
††Differences in means are not statistically significant at 0.05 level (t-test).

The two populations of high school graduates are closely aligned to each other. There appear to be slightly more males and slightly fewer minority students in the career and technical education programs. Prior to graduation, a higher percentage of career and technical education students had been employed, and their average quarterly earnings, while quite modest, are nonetheless slightly higher. Other than that, the employment and earnings histories of the two groups are quite similar, and in the latter cohort, they are statistically indistinguishable. In fact,

[25]We also matched the career and technical students from high schools to individuals on the ES file who were 16–19 years old. However, the participation model and the quality of the matches were not as believable or as statistically robust as the models using the high school data.

because the two populations are so similar, we had difficulties estimating the participation model, as described in the next section of the chapter.

Participation Model

Table 11.2 provides the results from the logit estimation of participation. Using the high school data base, we estimated a model of being a CTE graduate. Being a CTE graduate is the dependent variable, which takes on a value of 1 for the treatment group, and 0 for the other students. The table provides the logit coefficient estimates and standard errors. As with the previous programs, the magnitude of the coefficients is not particularly meaningful, but the sign and statistical significance are. If the coefficient is negative, then a (positive) change in that variable will decrease the likelihood of being a career and technical education completer.

Table 11.2 Coefficient Estimates from a Logit Model of being a High School CTE Graduate

	2005/2006		2007/2008	
Characteristics	Coefficient	Std. Error	Coefficient	Std. Error
Demographics				
Female	−0.238***	0.022	−0.146***	0.024
Minority	−0.077**	0.027	−0.195***	0.029
Disability	0.185***	0.046	−2.824***	0.165
West WA	−0.162***	0.023	0.397***	0.026
Employment and Earnings (prior to grade 12)				
Percentage employed prior to grade 12	0.003***	0.000	0.001***	0.000
Average quarterly earnings	0.014***	0.002	--[a]	--[a]
Mean, earnings trend	−0.000	0.004	--[a]	--[a]
Mean, earnings variance (in 10^8 $)	−24.454***	2.382	--[a]	--[a]
Percentage of quarters with multiple jobs	0.005***	0.001	--[a]	--[a]
Had earnings dip	1.845***	0.130	--[a]	--[a]
Mean, number of quarters since dip at grade 12	−1.613***	0.059	--[a]	--[a]
Average earnings dip size in percentage	−0.252*	0.127	--[a]	--a
Observations	39,638		36,136	

NOTE: Standard errors in second column. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]Variable not used in matching.

In the estimation of the participation model for the 2007/2008 cohort, we experienced difficulty in getting the logit model to converge because of the lack of variation between CTE graduates and non-CTE graduates in many of the prior employment and earnings variables. As a

consequence, the final specification for the latter cohort only uses prior employment rate in addition to the demographic variables. The estimation of the participation model uses all of the prior employment and earnings variables for the 2005/2006 cohort.

In both cohorts, being a female or being a minority are negatively related to CTE graduation. On the other hand, the individuals' prior employment rates are positively related. In the earlier cohort, prior average quarterly earnings, turnover, and having had an earnings dip are positively associated with being a CTE graduate, and prior earnings variance and mean number of quarters since the earnings dip are negatively associated.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients and the observation's actual data. If the logit model has substantial predictive capability, then the mean propensity score for the comparison group should be small (near zero) and should be much less than the mean score for the treatment. As argued earlier, a measure of how well the logit model discriminates between comparison group members and treatment group members is the cumulative percentile for the comparison group at the propensity score that is the 20th percentile.

Table 11.3 provides these data for the secondary CTE graduates. The mean propensity scores for the treatment groups are roughly 0.41 and 0.29, whereas they are 0.31 and 0.27 for the comparison group for 2005/2006 and 2007/2008 respectively. The 20th percentile indicator is approximately 41 percent for 2005/2006 and 31 percent for 2003/2004. The means and the 20th percentile statistics indicate that the logit model of participation did not discriminate well between treatment and comparison group observations. We could have used the entire comparison group pool for the analyses.

Table 11.3 Indicators of Propensity Score Model Quality for High School CTE Graduate Analyses

Statistic	2001/2002	2003/2004
Mean p-score, HS CTE Graduates	0.405	0.290
Mean p-score, Non-completers	0.313	0.265
Percentile Non-completers, at 20th percentile HS CTE Completers	41.2%	33.8%

Statistical Match

Nevertheless, we performed a match. For every observation *j* in *T*, we found the observation *k* in *U* that minimized the absolute value of the difference between the propensity score for *j* and *k*. We then added *k* to the comparison group sample if the difference was less than the caliper. When we tried to do the statistical match with replacement, we found that the small number of potential matching variables led to one or two observations in the comparison group being used several hundred times. To avoid this situation, we conducted the statistical match without replacement, so none of the observations in *U* were used more than once. Table 11.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment group and comparison group. The number of observations used multiple times and the maximum number of repeats are 1 and 0, respectively, because the match was done without replacement.

In the 2005/2006 cohort's results, a number of the characteristics' means differ significantly. This is likely because the statistical match was done without replacement. That results in matches that are not as close as would happen if the match were done with replacement. Nevertheless, the matches of the 2007/2008 cohort data do not have any variable for which the difference in means is significant suggesting that the comparison and treatment groups in this cohort are more balanced.

Table 11.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for High School CTE

Statistic/Characteristic	2005/2006		2007/2008	
	CTE Graduates	Non-CTE Graduates	CTE Graduates	Non-CTE Graduates
Sample size	13,661	25,977	9,843	26,370
Sample size used in match	13,661	25,977	9,827	26,309
Matched sample size	12,037	12,037	9,827	9,827
Number of observations used once	—	12,037	—	9,827
Number of observations used multiple times	—	0	—	0
Maximum number of repeats	—	1	—	1
Demographics				
Female	51.2%**	49.1%**	49.5%	49.4%
Minority	22.7%	21.9%	21.0%	21.2%
Disability	6.0%	6.6%	0.4%	0.4%
West WA	64.6%**	63.2%**	72.2%	72.2%
Employment and Earnings (prior to grade 12)				
Percentage employed prior to grade 12	29.5%**	27.3%**	40.4%	40.4%
Average quarterly earnings[a]	$291	$281	$462	$466
Mean, earnings variance[b] (in 10^6 $)	$0.1	$0.1	$0.4	$0.4
Mean, earnings trend[b]	$46.4	$44.5	$26.0	$25.3
Percentage of quarters with multiple jobs	1.2%**	2.0%**	4.9%	4.8%
Had earnings dip	8.3%**	6.6%**	29.2%	30.1%
Mean, number of quarters since dip at grade 12[a]	0.1**	0.1**	0.9	1.0
Average earnings dip size in percentage[a]	6.7%**	5.2%**	22.4%	23.3%
Sample Size of matched sample	12,037	12,037	9,827	9,827

NOTES: Monetary data in 2005 $. **Difference in means significant at the 0.05 level (t-test).
[a]Averages include observations with values of zero.
[b]Trend and variance calculations include quarters with zero earnings, if any.

Net Impacts

The major purpose of the study is to estimate the net impacts of the education and training programs on clients. Tables 11.5 and 11.6 provide the estimated net impacts for secondary career and technical education. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, which in this case uses the levels of the outcome variables

Table 11.5 Net Impact Estimates for High School CTE Graduates for 2005/2006 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	10.1***	10.3***	46.1	—	43.6	—
Ever-employed, longer term (%)	8.7***	8.4***	67.2	—	64.8	—
Percent of quarters, longer term	10.7***	10.4***	49.8	—	47.6	—
Percent of quarters, longer term, diff-in-diff	21.9***	21.7***	31.5	—	36.0	—
Average hourly wage						
Short term ($)	1.00***	0.97***	4.55	9.53	4.26	9.42
Short term, diff-in-diff ($)	−0.01	0.02	0.15	1.46	0.03	1.81
Longer term ($)	1.31***	1.28***	5.60	10.79	5.28	10.64
Longer term, diff-in-diff ($)	−0.09***	−0.06**	0.42	2.92	0.11	3.20
Average quarterly hours						
Short term	39.1***	38.7***	113.5	237.7	106.6	236.0
Short term, diff-in-diff	−13.6***	−13.3***	25.1	115.6	14.8	127.3
Longer term	48.2***	47.7***	150.1	267.5	143.0	265.7
Longer term, diff-in-diff	−18.5***	−18.4***	37.8	153.8	20.4	164.1
Average quarterly earnings						
Short term ($)	389***	386***	1,107	2,320	1,011	2,236
Short term, diff-in-diff ($)	−181***	−179***	306	1,369	196	1,565
Longer term ($)	579***	574***	1,682	2,948	1,566	2,864
Longer term, diff-in-diff ($)	−305***	−304***	556	2,162	329	2,368
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	0.1	0.1	0.4		0.3	
Benefits, short term ($)	1	1	3	858	2	758
Percent receiving, longer term	2.2***	2.1***	3.9		3.4	
Benefits, longer term ($)	13***	14***	27	1,319	24	1,308

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 11.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

as the dependent variable. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final four columns of the tables provide the means of the comparison group, both the full comparison group pool and the matched comparison group. These columns are provided so that the net impacts can be estimated on a percentage basis.

Table 11.6 Net Impact Estimates for High School CTE Graduates for 2007/2008 Cohort

Outcome	Matched Sample Estimator		Comparison Group Means			
			Full Sample		Matched Sample	
	Diff. in Means	Regr. Adj.	With 0	W/O 0	With 0	W/O 0
Employment						
Short term (%)	5.6***	6.0***	39.3	—	40.0	—
Average hourly wage						
Short term ($)	0.47***	0.48***	3.95	9.60	4.05	9.64
Short term, diff-in-diff ($)	0.17***	0.16	0.00	1.64	−0.07	1.66
Average quarterly hours						
Short term	21.7***	21.9***	91.8	223.1	92.9	221.4
Short term, diff-in-diff	10.3***	10.3***	16.3	89.5	14.9	85.6
Average quarterly earnings						
Short term ($)	209***	211***	880	2,139	894	2,130
Short term, diff-in-diff ($)	102***	101***	226	1,120	214	1,081
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	−0.1	−0.1	1.1	—	1.0	—
Benefits, short term ($)	−4**	−4**	12.0	1,107	11.7	1,195

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 11.4.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

Career and technical education pays off for secondary school students economically. The short-term impacts include increases in employment (6.0 percentage points), average hourly wage ($0.48 per hour), average quarterly hours working (21.9 hours), and quarterly earnings ($211). The estimated earnings impact is on the order of 9–10 percent. The economic advantages persist, and even grow, in the longer term. The employment net impact estimate is 10.4 percentage points; the average hourly wage increases by $1.28 per hour; the average quarterly hours worked increase by 47.7 hours per quarter; and earnings increase by about $574 or over 33 percent. High school career and technical education is estimated to have a longer-term increase in UI benefits.

12 DIVISION OF VOCATIONAL REHABILITATION PROGRAMS

Housed within the Department of Social and Health Services, the Division of Vocational Rehabilitation (DVR) offers training and other services to help eligible individuals with disabilities become employed. The primary objective is competitive, full-time employment. However, depending on the individual's disability and functional limitations, other outcomes are more appropriate such as part-time employment, self-employment, or sheltered or supported employment. The services that are provided on a customized basis include assessment, counseling, vocational training, physical and restorative services (including corrective surgery), and job search and placement assistance. Eligibility requirements include certification that the individual:

- has a physical, mental, or sensory impairment that constitutes or results in a substantial impediment to employment,
- can benefit in terms of an employment outcome form the provision of vocational rehabilitation services, and
- requires vocational rehabilitation services to prepare for, enter into, engage in, or retain gainful employment.

Note that approximately 90 percent of active clients in the program have severe disabilities.

Participant Characteristics

As with the high school CTE completers, we have been able to use the same data base for treatment and comparison group cases for the DVR programs. The administrative data has a field that identifies eligible clients who did not get served. These individuals became the comparison group pool.[26] Table 12.1 provides descriptive data that compare the individuals in the treatment

[26] We also matched the DVR participants who had been served to individuals on the LE file who were 16–60 years old. However, the participation model and the quality of the matches were not as believable or as statistically robust as the models using the non-served clients.

group to those in the comparison group pool. The first two columns of numbers compare the DVR exiters in 2005/2006 to the remaining (unserved) individuals in the sample. The final two columns compare the 2007/2008 exiters to their comparison group pool of eligible, but unserved individuals.

Table 12.1 Descriptive Statistics for Vocational Rehabilitation Treatment Group and Comparison Group Pool

	2005/2006		2007/2008	
Characteristics	Had VOC Rehabilitation Services	No VOC Rehabilitation Services	Had VOC Rehabilitation Services	No VOC Rehabilitation Services
Demographics and Education				
Female	45.3%	42.5%	45.9%††	43.1%††
Minority	25.2%	27.4%	25.5%	32.3%
Mean, age at registration	36.4	37.3	36.5	37.7
Mean, years of education at registration	12.2	12.2	12.3††	12.2 ††
West WA	72.7%	53.0%	62.5%	56.1%
Urban county	50.1%	45.2%	50.2%	38.1%
Employment and Earnings (prior to registration)				
Ave. percentage of (prior) quarters with employment[a]	40.8%††	40.1%††	44.6%	56.0%
Average quarterly earnings[a, b]	$1,294	$1,573	$1,538	$2,082
Mean, earnings trend[c]	-$44.6††	-$48.9††	-$26.9	$9.3
Mean, earnings variance[c] (in 10^6 $)	$3.2††	$3.8††	$3.6	$5.2
Percentage of quarters with multiple jobs	9.8%	11.2%	10.3%	17.8%
Had earnings dip	42.3%††	42.1%††	38.9%	55.3%
Mean, number of quarters since dip at registration[b]	1.5††	1.5††	1.4	1.9
Average earnings dip size in percentage[b]	35.9%††	36.2%††	32.3%	44.9%
Sample Size	4,208	4,258	3,502	1,298

NOTE: Monetary data in 2005 $.
[a]Observations with no quarters of prior earnings were excluded from analyses.
[b]Averages include observations with values of zero.
[c]Trend and variance calculations include quarters with zero earnings, if any.
††Differences in means are not statistically significant at 0.05 level (t-test).

The two populations are quite similar to each other. Many of the differences in characteristics are not statistically significant. Relative to the individuals who did not receive services, the means presented in the table show that the individuals who received services are more likely to be female, less likely to be a minority, more likely to be from western Washington and from an urban county, have lower average quarterly earnings prior to applying for services, and have less job turnover prior to applying.

Because the sample sizes for the comparison group pool is approximately the same as the size of the treatment group in 2005/2006, and is much smaller in 2007/2008, we did not conduct a statistical match for DVR. Rather, we estimate the net impacts through regression analyses of the whole sample. These impacts are discussed in the next section.

Net Impacts

The major purpose of the study is to estimate the net impacts of the education and training programs on clients. Tables 12.2 and 12.3 provide the estimated net impacts for receiving services from DVR. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9–12 quarters after exit) outcomes for the 2005/2006 cohort of program exiters. The second table is limited to the short-term net impacts for the 2007/2008 cohort. The first column in each of the tables presents a comparison of means between the treatment group and the matched comparison group. The second column presents an estimate from a regression adjustment of that mean. This column represents the preferred specification, although for some programs we use the levels of the outcome variables as the dependent variable and, for others, we use difference-in differences. The coefficient estimates that are in "boxes" represent the final, "official" estimates using the preferred specification as chosen by WTECB staff. The final columns of the tables provide the means of the comparison group, i.e., the individuals that did not receive services. These columns are provided so that the net impacts can be estimated on a percentage basis.

The DVR programs are estimated to have substantial payoffs for the individuals who participate in them relative to those who are not served in the longer term. The short-term impacts are positive also, although they are smaller, and not statistically significant. Those short-term impacts include an increase in employment rate that is statistically significant (8.3

Table 12.2 Net Impact Estimates for Vocational Rehabilitation Programs for 2005/2006 Cohort

	Net Impact Estimator		Comparison Group (No VR Service) Means	
Outcome	Diff. in Means	Reg. Adj.	With 0	W/O 0
Employment				
Short term (%)	14.7***	15.8***	28.3	—
Ever-employed, longer term (%)	11.8***	10.9***	33.3	—
Percent of quarters, longer term	10.9***	10.0***	26.3	—
Percent of quarters, longer term, diff-in-diff	11.4***	10.2***	−3.3	—
Average hourly wage				
Short term ($)	1.02**	1.11***	3.64	12.40
Short term, diff-in-diff ($)	0.63**	0.56***	0.53	0.34
Longer term ($)	0.79**	0.85***	3.59	12.61
Longer term, diff-in diff ($)	1.16**	0.86***	−1.25	0.86
Average quarterly hours				
Short term	35.2***	37.7***	99.5	338.8
Short term, diff-in-diff	20.9***	19.0***	28.0	85.0
Longer term	28.7***	29.3***	94.5	308.2
Longer term, diff-in-diff	32.3***	24.8***	−13.2	61.8
Average quarterly earnings				
Short term ($)	240***	339***	1,286	4,382
Short term, diff-in-diff ($)	222***	170***	346	1,087
Longer term ($)	178***	244***	1,327	4,244
Longer term, diff-in-diff ($)	428***	1,257***	−111	1,121
Unemployment Insurance Benefits (average quarterly)				
Percent receiving, short term	0.5*	0.6**	1.7	—
Benefits, short term ($)	3	6	23	1,328
Percent receiving, longer term	−0.6	−0.1	6.3	—
Benefits, longer term ($)	−7	−2	52	1,475

NOTE: Monetary impacts in 2005 $. See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 12.1.

* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

percentage age points), average hourly wage ($0.21), average quarterly hours working (7.7 hours in a quarter), and quarterly earnings ($88). Furthermore, in the short term, the treatment group is estimated to decrease their take-up of unemployment insurance benefits. The economic advantages grow in the longer-term. The employment net impact estimate is 10.0 percentage points; the hourly wage increases by $0.86 per hour; the hours worked increase by 24.8 hours per quarter; and earnings increase by about $247.

Table 12.3 Net Impact Estimates for Vocational Rehabilitation Programs for 2007/2008 Cohort

	Net Impact Estimator		Comparison Group (No VR Service) Means	
Outcome	Diff. in Means	Reg. Adj.	With 0	W/O 0
Employment				
Short term (%)	5.0***	8.3***	45.8	—
Average hourly wage				
Short term ($)	0.07	0.53**	5.59	11.73
Short term, diff-in-diff ($)	0.58***	0.21	0.95	0.79
Average quarterly hours				
Short term	−1.2	14.3**	159.2	333.9
Short term, diff-in-diff	14.1**	7.7	34.6	61.4
Average quarterly earnings				
Short term ($)	−56	194**	1,864	3,910
Short term, diff-in-diff ($)	163*	88	430	778
Unemployment Insurance Benefits (average quarterly)				
Percent receiving, short term	−5.0***	−2.5***	9.2	—
Benefits, short term ($)	−86***	−58***	153	1,657

NOTE: See Appendix B for explanatory notes. Sample sizes differ for virtually every entry in the table because of observations with missing data. If there were no missing data, the sample sizes would be those displayed in rows 2 and 3 of Table 12.2.
* significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

13 BENEFIT-COST ANALYSES

In addition to the net impact analyses, we have conduct benefit-cost analyses for the workforce development programs. This chapter documents the methodology that we used and the results of these analyses.

The essential task of a benefit-cost analysis (BCA) is to measure the benefits and costs of a program, place weights on each, and arrive at a conclusion as to the net benefits of the program. To conduct a BCA, it is necessary to measure the benefits and costs in a common unit, usually dollars. Note that the benefits and costs may differ depending on the decision making groups whose interests are affected by the action. For example, increased earnings are a benefit for individuals, but a cost for employers (who get the benefits of increased production of goods or services). In considering whether the workforce programs that are administered in Washington had net benefits, we explicitly estimated benefits and costs for two groups: 1) the program participants and 2) the rest of society (i.e., taxpayers).

For this project, the benefits that are calculated include the following:

- Increased lifetime earnings
- Fringe benefits associated with those earnings
- Taxes on earnings (negative benefit to participants; positive benefit to society)
- Reductions in UI benefits (negative benefit to participants; positive benefit to society)

The costs included the following:

- Forgone earnings (reduced earnings during the period of program participation)
- Forgone tax receipts (cost to the public)
- Tuition payments, if any
- Program costs

Most of these costs and benefits are derived from the net impact estimates presented in prior chapters or by calculating some simple descriptive statistics from the underlying data. The next sections of the chapter document the assumptions and data that we have used to calculate each of those benefits and costs. The final part of the chapter presents the results and discussion.

Lifetime Earnings

Figure 13.1 shows the earnings profiles for the average individual in the treatment group and in the comparison group. The hypothesis used to construct these profiles is that encountering a workforce development program enhances an individual's skills and productivity (thus increasing wage rates) and increases the likelihood of employment. Thus, after the period of time spent participating in the program, the earnings profile of the average treatment individual is above the earnings profile of the average comparison group member (both hourly wage and employment net impacts are positive). During the period of participation, the treatment individual's earnings will be below the comparison group member's earnings, on average. These

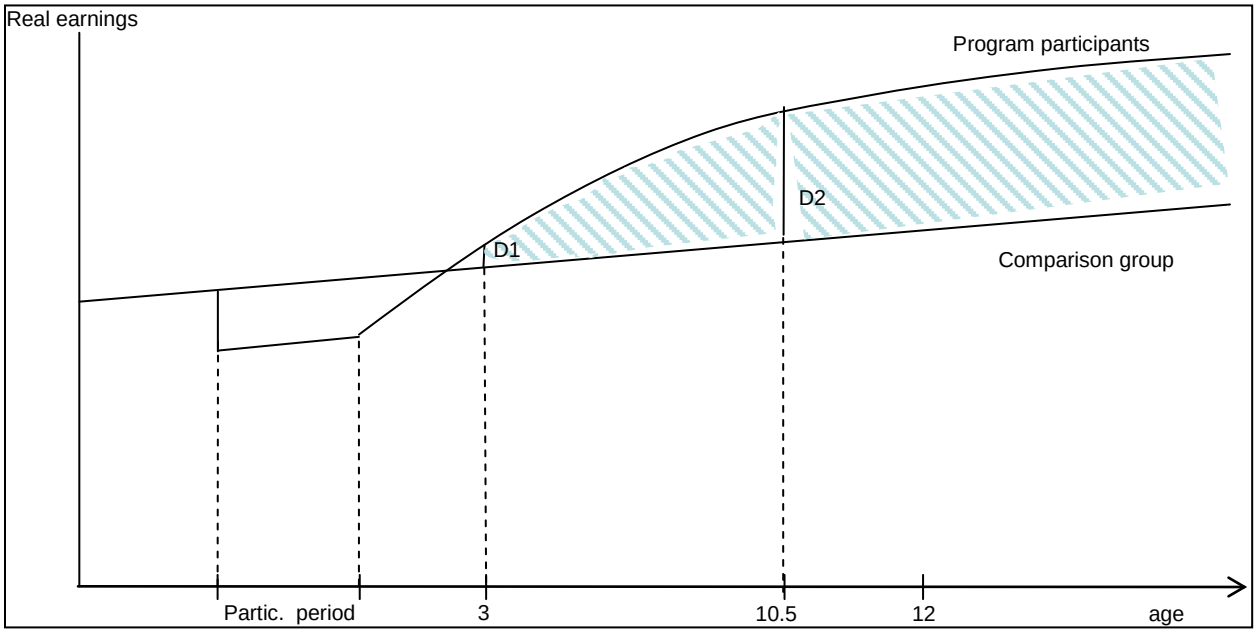


Figure 13.1 Hypothetical Earnings Profiles of Training Participants and Comparison Group Members

are the forgone costs in the form of wages that are given up by the participant while he or she is receiving services.

The theoretical lifetime earnings benefit would be the shaded area in the graph. The average comparison group member's real earnings grow at a constant rate (increase in productivity). The average treatment group member's earnings eventually become higher after program participation and likely grow faster as they accumulate additional human capital in the form of work experience.

The problem that needed to be solved in this project is how to estimate the shaded area. The two lines D1 and D2 represent the difference in average earnings at three quarters after exiting from the training program and at 10.5 quarters after exit. These are essentially the short-term and longer-term net impact estimates that have been documented in the prior chapters. (Note that 10.5 is the midpoint of quarters 9-12). Because the profiles represent the *average* individual, we use the *unconditional* net earnings impacts to calculate these benefits. (They automatically control for employment, hourly wage, and hours worked impacts.)

What is unknown (and unknowable) is the shape of the earnings profiles into the future after the D2 point. The profiles could continue to move apart from each other if the program participants continue to be more and more productive relative to the comparison group member, or the profiles eventually may converge over time if the participation effect depreciates. Alternatively, the profiles may become parallel to reflect a scenario in which the program participants gain a permanent advantage, but then their productivity growth eventually matches the comparison group members.

To estimate the time path of unconditional earnings impacts in this study, a simple linear interpolation is used. The short-term net impact occurs in quarter three after exit. For

interpolation purposes, it is assumed that the longer-term net impact occurs in quarter "10.5". The quarterly growth (or decline) in the net impact is the longer-term impact minus the short-term impact divided by 7.5. Then in each quarter, we then add that quarterly change to the prior quarter's estimate to derive an estimate of that quarter's average unconditional earnings. Equations (1) through (3) specify the interpolation.

(1) $QtrEarnchange_j = (Longterm_j - Shortterm_j)/ 7.5$

(2) $Netearningsimpact_{j1} = Shortterm_j - 2 * QtrEarnchange_j$

(3) $Netearningsimpact_{jt} = Netearningsimpact_{j,t-1} + QtrEarnchange_j \ , \ t = 2, 12$

where

$Longterm_j$, $Shortterm_j$ = longer-term and short-term average quarterly unconditional earnings net impact estimates for program *j*,

$Netearningsimpact_{jt}$ = interpolated average quarterly unconditional earnings net impact estimates for program *j* in quarter *t*

To extrapolate for quarters beyond the three years of follow-up data, the assumption was made that all quarters after quarter 12 until the average participant turned 65 would be set to the quarter 12 value. Table 13.1 provides the data that were used in the interpolations and extrapolations.

Fringe Benefits

With additional earnings, workers will also accrue additional fringe benefits in the form of paid leave, paid insurances, retirement/savings plan contributions, and other non-cash benefits. We did a literature search on fringe benefit estimates, and found no more recent estimates than the ones we had used in the prior study. Consequently, we used those again. In that study, we relied on two sources of data that provided estimates of the ratio of fringe benefits (defined as paid leave plus paid insurances plus retirement plan contributions plus other) to gross

Table 13.1 Data Used in Earnings Interpolations and Extrapolations

Program	Short-term Net Impact[a] ($) (1)	Longer-term Net Impact[b] ($) (2)	Quarterly Change[c] ($) (3)	Quarter 12 Interpolated Value[d] ($) (4)	Average Age at Exit[e] (5)	Number of Quarters until 65 (6)
WIA Adults	1,189	789	−56.4	681.4	36.75	113
WIA Dislocated Workers	589	850	34.8	402.0	45	80
WIA Youth	330	343	1.7	551.3	18.75	185
Job Prep	1,365	1,557	22.6	1,613.4	33.75	125
Worker Retraining	705	939	33.9	1,010.0	43.5	86
Adult Basic Education	131	90	−5.5	82.0	33.5	126
Private Career Schools	416	394	−3.0	389.0	31.0	136
Apprenticeship	3,245	3,511	35.7	3,564.3	31.5	134
Career and Technical Education	210	574	48.5	646.51	18.0	188
Vocational Rehabilitation	88	257	22.5	290.5	38.0	108

[a] Unconditional average quarterly earnings net impact estimated from 2007/2008 cohort.
[b] Longer-term unconditional average quarterly earnings net impact estimate from 2005/2006 cohort.
[c] [Column (2) – Column (1)] ÷ 7.5
[d] Column (1) + 9 × Column (3).
[e] Arithmetic average of average age at exit for 2005/2006 and 2007/2008 cohorts.

wages and salaries (including supplemental pay such as overtime) that were in the 20 to 25 percent range. Specifically, the U.S. Department of Labor Bureau of Labor Statistics, *News*, No. 02-346, June 19, 2002, reports this ratio to be 23.3 percent for "All U.S." and 20.4 percent for the "West Census Region." The U.S. Chamber of Commerce report, *The 2001 Employee Benefits Study*, 2001, reports a ratio of 24.3 percent for the Pacific region (Table 5 of that report). Under the assumption that workforce development program participants are less likely to get fringe benefit coverages than the average worker, and to be conservative in our benefit estimation, we used the assumption that this ratio would be 20 percent (applied to the discounted annual earnings increments).

Employee Tax Liabilities

Higher earnings will lead to payment of increased payroll, sales/excise, and federal income taxes.[27] The increased taxes are a cost to participants and a benefit to the public. We used

[27]Washington does not have state income taxes.

average (marginal) tax rates for each of the three types of taxes and applied these rates to the annual earnings changes.

Payroll Taxes

Payroll taxes include social security and Medicare tax rates. The current rate of 7.65 percent was used to estimate the future liabilities. This requires three assumptions: this rate will not increase in future years, the average participant will be employed in covered employment (not self-employed), and that the average participant will not exceed the maximum earnings levels against which this payroll tax is applied. The assumption that the rate will remain fixed at its current rate seemed like a reasonable compromise since it is likely that the rate will continue to increase somewhat over time as it has in the past, but it is also likely that some participants will work in non-covered employment (such as agriculture) and that a few participants will exceed the taxable earnings maximums. Thus we may be underestimating future tax rates, but overestimating the taxable base.

Note that, under FICA, employers also pay additional payroll taxes. However, these taxes do not need to be factored into the benefit-cost analysis since they are a transfer from employers to the public. Similarly, the document W. Vroman, *Tax Equity Study*, 1999, showed that employers bore, on average, a payroll tax rate of 2.13 percent for unemployment insurance taxes. But, these also represent a transfer from employers to the public that do not affect participants.

Sales/Excise Taxes

We used a methodology similar to the payroll tax estimation to calculate these tax liabilities, but in this case used a rate of 4.6 percent for all of the programs except WIA Title I-B dislocated workers, community and technical college worker retraining, and apprenticeships. For the latter programs, in which recipients had higher incomes, we used a rate or 8.35 percent.

These rates were derived from a table titled, “Current Tax System: Tax Burden on Households, Major State and Local Taxes” from an online document prepared by a State of Washington analyst, Rick Peterson, accessed at http://www1.leg.wa.gov/documents/opr/2005/Tax%20 Alternatives%20Model%2020055%ver2. xls in March 2006. Table 13.2 reproduces a portion of that table along with a calculation of marginal tax rates. The rate that we used for all of the programs except the three mentioned above is the first entry in the marginal tax column (4). The rate used for the programs with participants who have higher household incomes, 8.35 percent, is the arithmetic average of the next two entries in that column.

Table 13.2 Marginal Sales/Excise Tax Rate Calculations

Total household income (1)	Total sales and excise taxes (2)	Approximate average income (3)	Marginal tax rate (4)
$0–$20,000	$1,769	$12,457	
			0.046
$20–$30,000	2,344	24,936	
			0.0903
$30–$40,000	3,184	34,236	
			0.0767
$40–$50,000	4,028	45,258	

Federal Income Tax

We again used a simple average (marginal) tax rate, which is applied to the change in earnings. The source used was the U.S. Department of Commerce, *2006 U.S. Statistical Abstract*, Table 474, p. 326. This table showed average tax payments for the years 2000 and 2002. Table 13.3 includes some of that data (for 2002 only), and displays marginal tax rates. Note that the rows of the table are in categories of adjusted gross income (AGI) and not total income. In general, AGI is less than household income. The average of the marginal tax rates for AGI classes less than $17,000 is 0.0466, and the average of the marginal tax rates for AGIs between $17,000 and $40,000 is 0.1002. Based on these two numbers, we decided to use a (marginal) tax

rate of 0.05 for all the programs except WIA Title I-B dislocated workers, community and technical college worker retraining, and apprenticeship. For the latter three programs, we use 0.10.

Table 13.3 Marginal Federal Income Tax Rate Calculations

Total adjusted gross income (1)	Average tax liability, 2002 (2)	AGI midpoint (3)	Marginal tax rate (4)
$1,000 – 2,999	$ 94	$2,000	
			−0.0050
$3,000 – 4,999	84	4,000	
			0.0305
$5,000 – 6,999	145	6,000	
			0.0395
$7,000 – 8,999	224	8,000	
			0.0175
$9,000 – 10,999	259	10,000	
			0.0910
$11,000 – 12,999	441	12,000	
			0.0850
$13,000 – 14,999	611	14,000	
			0.0680
$15,000 – 16,999	747	16,000	
			0.1005
$17,000 – 18,999	948	18,000	
			0.1064
$19,000 – 21,999	1,214	20,500	
			0.1113
$22,000 – 24,999	1,548	23,500	
			0.0845
$25,000 – 29,999	1,886	27,500	
			0.0981
$30,000 – 39,999	2,622	35,000	

NOTE: Average tax liability in (2) is conditional on having a liability. Marginal tax rate calculated as the (Δ average tax liability) / (Δ midpoint).
SOURCE: U.S. Census Bureau, *Statistical Abstract of the U.S.: 2006*, Table 474, p. 326.

Unemployment Compensation

Unemployment compensation benefits in the future may increase for participants if programs increase employment (and therefore the probability of receiving UI) or increase

earnings (and therefore benefits) or they may decrease if programs decrease the likelihood of unemployment or decrease duration of unemployment spells. Increased UI benefits in the future would be a benefit to participants and cost to the public.

We used a similar empirical strategy as we did for lifetime earnings to interpolate and extrapolate. In particular, the short-term and longer-term net impact estimates presented in each chapter provide an estimate of the unconditional quarterly benefits for quarters three and "10.5" after program exit. We divided the difference in the estimates by 7.5 quarters to get a quarterly change that we applied for interpolation purposes. Then we used the estimate for the 12th quarter after exit to extrapolate for 28 more quarters for all of the programs except WIA Title I-B youth programs and secondary CTE programs, for which we extrapolated an additional 68 quarters. In other words, we assumed that the UI benefit gain or loss would dampen to 0 after 10 years for most of the programs and after 20 years for the two youth programs.

Table 13.4 exhibits the precise estimates that we used in the cost-benefit analyses. The typical pattern for the workforce development programs is that in the short term, unemployment compensation benefits are decreased for participants who exit because, for the most part, employment rates increase—at least, some individuals leave the UI rolls. However, as time progresses, some workers begin to lose employment, and the groups UI net impact benefits become positive, although of relatively small magnitude. There are some exceptions to this general pattern; for some of programs (i.e, job prep and private career schools), the estimated impacts continue to be negative over the entire period. For apprentices, the estimates are quite sizeable and positive, which suggests that a larger share of the workers become unemployed and collect benefits as well as the fact that earnings are large, so benefits are relatively large.

Table 13.4 Interpolation/Extrapolation of Unconditional Quarterly UI Benefits, by Program

Quarter after exit	Program									
	WIA Adult	WIA DW	WIA Youth	Job Prep	Worker Retrain.	ABE	Priv. Career	Appren.	Secon. CTE	DVR
1	−73	−174	−1	−132	2	−78	−95	14	−9	−73
2	−66	−156	0	−123	1	−75	−90	21	−6	−66
3	−59	−140	2	−115	0	−73	−85	27	−4	−58
4	−52	−124	4	−107	−1	−71	−80	33	−2	−51
5	−45	−108	5	−98	−2	−68	−75	40	1	−43
6	−38	−92	7	−90	−3	−66	−71	46	3	−36
7	−31	−76	8	−81	−4	−64	−66	52	6	−28
8	−24	−60	10	−73	−5	−62	−61	59	8	−21
9	−17	−44	12	−65	−6	−59	−56	65	10	−13
10	−10	−28	13	−56	−7	−57	−51	71	13	−6
11	−3	−12	15	−48	−8	−55	−47	77	15	0
12	0	0	16	−39	−9	−52	−42	84	18	0
13–40 or 13–80	0	0	16	−39	−9	−52	−42	84	18	0

NOTE: Entries are in 2005 $. Extrapolation periods were 40 quarters for all programs except WIA Youth and Secondary CTE, for which they were 80 quarters.

Costs

Two types of costs were estimated for each of the programs. The first was forgone earnings and total compensation, which would be reduced earnings, fringe benefits, and taxes while the participants were actually engaged in the workforce development programs. The forgone costs also generated "forgone taxes," which would be costs borne by the public. The second type of cost was the actual direct costs of the program services. In some cases, this involves tuition or fee payments by the participants, and in almost all cases, it involves state subsidies for delivering the services.[28] The data sources for these types of costs are considered in turn.

Forgone Earnings

Forgone earnings represent the difference between what workforce development program participants would have earned if they had not participated in a program (which is unobservable) and what they earned while they did participate. The natural estimate for the former is the earnings of the matched comparison group members during the length of training. Specifically,

[28] The exception is private career schools, which are assumed to get no state subsidy.

we used (4) to estimate mechanistically the forgone earnings. Note that we calculate them in real $. Specifically, we calculate $Forgone_i$ for both 2005/2006 and 2007/2008 exiters and average them. Table 13.5 displays the data as tabulated from administrative records. Table 13.6 displays the estimated forgone earnings.

$$(8) \qquad Forgone_i = \left[0.5 \times \left(\hat{E}_{-1_i} + \overline{E}_{-1_i} \right) - \overline{E}_{0_i} \right] \times d_i \qquad ,$$

where, $\overline{E}_{-1}, \overline{E}_0$ = avg. quarterly earnings (uncond.) for treatment group in quarter –1 and during participation period, respectively.

$\hat{E}_1$ = avg. quarterly earnings in 1st post-exit period for matched comparison group

d = avg. program participation duration

i = indexes program

Table 13.5 Average Quarterly Earnings and Average Training Duration, by Program

	$\overline{E}_{-1}$		$\overline{E}_0$		$\hat{E}_1$		*d (in quarters)*	
Program	2005/2006	2007/2008	2005/2006	2007/2008	2005/2006	2007/2008	2005/2006	2007/2008
WIA Adults	1,873	2,063	1,715	1,931	2,720	2,977	3.45	3.03
WIA Disloc. Workers	6,689	6,918	2,999	3,313	5,012	5,295	4.87	3.48
WIA Youth	667	707	723	788	1,367	1,407	3.34	3.62
CTC Job Prep	3,461	3,793	2,863	3,000	3,195	3,712	4.42	4.49
CTC Worker Retraining	3,842	3,480	2,043	2,587	4,018	4,286	5.68	7.51
CTC ABE	2,983	3,073	3,072	3,056	2,788	3,091	1.06	1.27
Priv. Career Schools	3,631	3,744	2,602	2,702	3,314	3,768	1.76	1.60
Apprentice.	4,961	5,386	6,861	7,487	4,425	4,246	8.93	7.73
Secondary CTE	905	921	1,007	1,105	1,777	1,812	1.82	2.13
DVR Progs.	1,088	1,610	1,285	1,740	2,262	2,503	4.35	4.46

NOTE: Average quarterly earnings data in columns (1)–(6) are in ‘05 $. Median earnings are used instead of means for CTC job prep, private career schools, and apprenticeships.

There is wide variation in these forgone earnings estimates. As might be expected, the largest forgone earnings occur for WIA dislocated workers and CTC worker retraining participants. These individuals have typically lost relatively high paying jobs, and spend several

Table 13.6 Estimated Forgone Earnings, by Program

Program	*Foregone* 2001/2002 (1)	2003/2004 (2)	Average (3)
WIA Adults	2,009	1,787	1,898
WIA Disloc. Workers	13,875	9,719	11,797
WIA Youth	983	977	979
CTC Job Prep	2,057	3,375	2,716
CTC Worker Retraining	10,716	9,734	10,226
CTC ABE	−198	32	−83
Priv. Career Schools	1,535	1,687	1,611
Apprenticeships	−19,316	−20,672	−19,994
Secondary CTE	607	559	583
DVR Programs	1,698	1,411	1,554

NOTE: Dollars in '05 $.

quarters (see Table 13.5) to be retrained. Usually, their new jobs pay only a fraction of what their old jobs did. Job preparation training at community and technical colleges also entailed a significant loss in earnings during the participation period. All of the other programs, except for apprenticeships, had forgone earnings that were between −$100 and $2,000. These are relatively small, and suggest that the participants in the programs were earning approximately the same amount as their comparison group counterparts. (Note that a negative value for forgone earnings means that the program participants were actually earning more than the comparison group; there was a subsidy for participation!!) Apprentices had a very large subsidy of about $20,000. This means that apprentices are earning significantly more than their comparison group counterparts during their apprenticeships.

In the return on investment and benefit-cost analyses discussed later in this chapter, the forgone earnings are assumed to have associated fringe benefits and tax liabilities that factor into the individuals' returns. Furthermore, the forgone tax liabilities are costs (or benefits in the case of apprenticeships) for the public.

Program Costs

For the most part, the program costs that are used in this analysis are precisely the same as those supplied to us by the State for the prior study. All we have done is to convert them to 2005$ using the CPI-U. The following descriptions summarize how those costs were derived for the prior study.

WIA. The WIA costs were calculated from administrative microdata on days in the program and cost data from the program (personal communication from C. Wolfhagen, January 19, 2006). The average duration in days of individuals in WIA Title I-B adult programs, dislocated worker programs, and youth programs were estimated for the 2001/2002 and 2003/2004 cohorts. Furthermore, estimates of daily costs for each of these programs for the two cohorts were derived. Multiplying these two estimates provides an estimate of the total program cost per average participant. We used the arithmetic average of per participant costs for the 2001/2002 and 2003/2004 cohorts. These data are displayed in Table 13.7 (identical to table 14.20 in Hollenbeck and Huang, 2006, except that total costs have been inflated to 2005$). These costs were assigned to the public. There were no programmatic costs for participants.

Table 13.7 WIA Costs per Participant, by Program

	2001/2002			2003/2004			Cost used in
Program	Ave. duration (in days)	Ave. daily cost (nominal)	Total cost (in 2005$)	Ave. duration (in days)	Ave. daily cost (nominal)	Total cost (in 2005$)	c/b analysis (in 2005$)
WIA Adults	327	$16.50	$5,957	333	$15.13	$5,353	$5,655
Dislocated Workers	440	$13.94	$6,773	501	$13.47	$7,170	$6,972
Youth	341	$15.25	$5,742	446	$15.38	$7,286	$6,514

Community/Technical College Costs. Staff from the State Board for Community and Technical Colleges (SBCTC) supplied the cost data for the ABE, Job Preparation, and Worker

Retraining programs to the WTECB. In particular, SBCTC supplied the following average nominal costs for the state support and tuition for a full-time resident student:

Year	State Cost	Tuition
FY2001	$3,850	$1,641
FY2002	3,870	1,743
FY2003	3,839	1,983
FY2004	3,705	2,142

Per state staff's suggestion, we assumed that job prep students averaged 1.9 years; worker retraining participants averaged 1.3 years; and ABE participants average 1.0 years of full-time equivalent coursetaking. We furthermore assumed that ABE students did not pay tuition.

The program and private costs used in the cost-benefit calculations were derived by deflating all of the costs to 2000$ and assigning the FY2002 data to the 2001/2002 cohorts and FY2004 data to the 2003/2004 cohort. In the cost-benefit analyses, the arithmetic average of the two cohorts' costs were used. Thus the public (state) cost for job prep equaled $6,877 [1.9 ftes * 0.5 ($3,768 + $3,471)]. The public cost for worker retraining = $4,705 [1.3 ftes * 0.5 ($3,768 + $3,471)]; and the public cost for ABE = $3,620 [1.0 fte * 0.5 * ($3,768 + $3,471)]. The private (tuition) costs for job prep = $3,519 [1.9 ftes * 0.5 ($1,697 + $1,896)] and for worker retraining = $2,408 [1.3 ftes * 0.5 ($1,697 + $1,896)]. The current study used these values inflated to 2005$, which are the following:

	Private	Public
Job Prep	$3,991	$7,800
Worker Retraining	2,731	5,336
ABE	0	4,106

Note that we are not including any other educational expenses such as books or transportation; nor are we factoring in any sort of financial aid. In the case of ABE, there are no tuition or supply costs to participants by assumption.

Private Career Schools. Because of the tremendous variation in tuitions and fees at private career schools, we did not include private costs in the cost-benefit analysis.

Apprenticeships. The data on tuition and state subsidies from SBCTC were used to calculate private and public apprenticeship costs. Information from the Washington Department of Labor & Industries (L&I) suggested that apprentices are "charged" one-half of the full-time tuition as their share of costs, that they take 144 hours of classroom instruction per year (= 0.16 fte), and that they take formal classroom instruction for 4.0 years. Using these assumptions, we estimated an average public support of apprentices = $2,316 [4.0 years * 0.16 ftes/year * 0.5 ($3,768 + $3,471)]; and the average private tuition cost = $593 [4.0 years * 0.16 ftes/year * 0.50 * .5 ($1,697 + $2,007)]. These are $2,625 and $673 in 2005$. Again, the private costs do not include books, tools, equipment, or transportation.

Secondary Career and Technical Education. The Office of the Superintendent of Public Instruction provided a state and federal cost per FTE student of $719 for FY2002 and $742 for FY2004. These figures were in nominal terms. In the prior study, we deflated these values to 2000$ and assumed that the individuals who were being analyzed, who were classified as completers, had received 1.0 full-time equivalent instruction. We averaged the support for the two cohorts, and derived a public support of $704 ($798 in 2005$) and no private costs.

Division of Vocational Rehabilitation. Very similar procedures were followed for vocational rehabilitation services as for the other programs documented in the preceding paragraphs. The agency provided an estimate of fixed costs per participant (for management and other supports) and a monthly cost. In nominal terms, these were $2,487 for the fixed cost and $183 for the monthly cost for FY2002 (used for the 2001/2002 cohort); and $3,743 for the fixed cost and $161 for the monthly cost for FY2004 (used for the 2003/2004 cohort). Furthermore, we

were given 26.45 as the average case duration in months. Deflating the costs to 2000$ and using the average cost for the two cohorts gave us a public support for each DVR client of $7,381. This is $8,371 in 2005$.

Results

Tables 13.8 – 13.17 provide the benefit-cost analyses for the workforce development system programs. Each table has an estimate for the first ten quarters after exiting the program and an estimated lifetime benefits and costs. The tables provide estimated returns on investment (ROI) for the participant and for the public. For the participant, two ROIs are noted. The smaller of the two has discounted all future benefits and costs by 3.0 percent. The other ROI for participants and the ROI for the public do not discount future benefits or costs. In some cases, when costs are negative or zero, no ROI is computed

Table 13.8 Participant and Public Benefits and Costs per Participant in WIA Adult Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	10,480	0	80,721	0
Fringe Benefits	2,096	0	16,144	0
Taxes	−1,808	1,808	−13,924	13,924
Transfers				
UI	−415	415	−418	418
Costs				
Forgone earnings/taxes	1,950	327	1,950	327
Program costs	0	5,655	0	5,655
Return on investment (annual)			13.0/14.7	1.2

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.9 Participant and Public Benefits and Costs per Participant in WIA Dislocated Workers Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	6,760	0	69,866	0
Fringe Benefits	1,352	0	13,973	0
Taxes	−1,758	1,758	−18,165	18,165
Transfers				
UI	−1,002	1,002	−1,014	1,014
Costs				
Forgone earnings/taxes	11,089	3,067	11,089	3,067
Program costs	0	6,970	0	6,970
Return on investment (annual)			6.2/8.2	−0.5

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.10 Participant and Public Benefits and Costs per Participant in WIA Youth Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	3,360	0	64,527	0
Fringe Benefits	672	0	12,905	0
Taxes	−580	580	−10,665	10,665
Transfers				
UI	60	−60	1,206	−1,206
Costs				
Forgone earnings/taxes	1,006	169	1,006	169
Program costs	0	5,743	0	5,743
Return on investment (annual)			8.0/9.5	1.1

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.11 Participant and Public Benefits and Costs per Participant in Community and Technical College Job Prep Training Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	14,340	0	196,627	0
Fringe Benefits	2,868	0	39,925	0
Taxes	−2,474	2,474	−33,918	33,918
Transfers				
UI	−940	940	−2,130	2,130
Costs				
Forgone earnings/taxes	2,791	469	2,791	469
Program costs	3,991	7,800	3,991	7,800
Return on investment (annual)			9.8/11.4	4.0

NOTE: '05$. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.12 Participant and Public Benefits and Costs per Participant in Community and Technical College Worker Retraining Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	7,897	0	84,624	0
Fringe Benefits	1,580	0	16,925	0
Taxes	−2,053	2,053	−22,002	22,002
Transfers				
UI	−25	25	−294	294
Costs				
Forgone earnings/taxes	9,612	2,659	9,612	2,659
Program costs	2,731	5,336	2,731	5,336
Return on investment (annual)			6.3/8.2	2.7

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.13 Participant and Public Benefits and Costs per Participant in Community and Technical College ABE Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	1,401	0	12,479	0
Fringe Benefits	280	0	2,496	0
Taxes	−242	242	−2,153	2,153
Transfers				
UI	−673	673	−2,244	2,244
Costs				
Forgone earnings/taxes	−85	−14	−85	−14
Program costs	0	2,530	0	2,530
Return on investment (annual)			--	2.4

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text. – not calculable.

Table 13.14 Participant and Public Benefits and Costs per Participant in Private Career Schools Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	4,040	0	53,102	0
Fringe Benefits	808	0	10,620	0
Taxes	−697	697	−9,161	9,161
Transfers				
UI	−730	730	−1,989	1,989
Costs				
Forgone earnings/taxes	1,655	278	1,655	278
Program costs	na	na	na	na
Return on investment				

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text. na – not available.

Table 13.15 Participant and Public Benefits and Costs per Participant in Apprenticeship Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	33,322	0	436,053	0
Fringe Benefits	6,665	0	87,211	0
Taxes	−8,664	8,664	−113,374	113,374
Transfers				
UI	428	−428	2,932	−2,932
Costs				
Forgone earnings/taxes	−18,794	−5,198	−18,794	−5,198
Program costs	673	2,627	673	2,627
Return on investment (annual)			--	--

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text. – not calculable

Table 13.16 Participant and Public Benefits and Costs per Completer in Secondary CTE Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	3,313	0	115,755	0
Fringe Benefits	663	0	23,151	0
Taxes	−571	571	−19,968	19,968
Transfers				
UI	20	−20	1,250	−1,250
Costs				
Forgone earnings/taxes	599	101	599	101
Program costs	0	798	0	798
Return on investment (annual)			10.5/12.0	6.6

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text.

Table 13.17 Participant and Public Benefits and Costs per Participant in DVR Programs

	First 2.5 years		Lifetime (until 65)	
Benefit/Cost	Participant	Public	Participant	Public
Benefit				
Earnings	1,443	0	29,889	0
Fringe Benefits	289	0	5,978	0
Taxes	−249	249	−5,156	5,156
Transfers				
UI	−393	393	−393	393
Costs				
Forgone earnings/taxes	1,597	268	1,597	268
Program costs	0	8,371	0	8,371
Return on investment (annual)			9.4/11.2	--

NOTE: '05 $. Participant ROIs are presented with and without discounting future benefits. See text. – not calculable

APPENDIX A

LONGITUDINAL DATA FILE EDITING

Multiple participant records for a education or training program. The State supplied us with individual-level data for each of the ten programs. In some of the program files, we found duplicate records, despite the fact that the file specifications indicated that each individual would have a single record. For these observations, we kept the record with the latest exit date.

Missing or "out of bounds" quarterly hours data in earnings records. Records that had missing hours, zero hours (despite having reported earnings), and hours greater than 990 in the employment records had hours imputed. The imputation was done in three steps. The first step was to impute the hours using reported (non-imputed) information from adjacent quarters. The same rule was applied as was used by the State contractor, which was basically an interpolation of data from adjacent records. For records that still had missing or zero hours, the next step in the algorithm was to assign the median working hours by the individual's industry and earnings class. If the industry was not available, the last step was to assign the population median working hours by earnings class. When hours exceeded 990, they were truncated to 990. Table A.1 shows the percentage of records for which hours were imputed. We imputed data for about 4 percent of the records; which means that about 96 percent of the records did not have imputed hours.

Table A.1 Percentage of Records with Imputed Hours

Program	2005/2006	2007/2008
WIA Adult	4.5%	4.4%
WIA Dislocated Worker	4.2	4.0
WIA Youth	2.7	2.2
Job Prep	3.6	3.4
Worker Retraining	4.7	4.1
Adult Basic Education	4.7	4.0
Private Career Schools	4.0	3.6
Apprenticeships	3.1	3.1
High School CTE	1.8	1.2
Vocational Rehabilitation	4.1	3.5
Labor Exchange	4.4	3.8

Earnings and wage outliers. The quarterly earnings provided by the State were top-coded at $99,999. For the derived hourly wage, we top-coded the high and low wages at the top and bottom 1 percent value for each program/cohort.

Comparison group records that have received prior intervention. In order to keep the comparison group from being "contaminated" by individuals who may have participated in one of the workforce development programs, we excluded the individuals from the Labor Exchange sample who were in the administrative data for any of the programs in the same cohort.[29] They were identified by matching Labor Exchange participants with participants in all 10 programs in the same cohort.

The numbers of excluded individuals are listed in Table A.2 below.

Table A.2 Number of Deleted Labor Exchange Participants, by Exclusion Rules

	Number of participants before deletion	Number of participants excluded	Number of participants after deletion
2005/06	267,497	18,914 (7%)	248,583
2007/08	200,727	15,867 (8%)	184,860

[29] These exclusions do not totally solve the issue of contamination because individuals in the Labor Exchange data set may have participated in one of the workforce development programs in other years or may have participated in the same program year as the cohort, but did not exit.

Start date problems. The program start and end dates in CTE programs are set to July 1, 2005 and June 30, 2006 for all the 2005/2006 participants, and July 1, 2007 and June 30, 2008 for all the 2007/2008 participants.

APPENDIX B

EXPLANATORY NOTES FOR NET IMPACT ESTIMATE TABLES AND PRICE DEFLATORS

Outcomes

Table entries in the two columns give net impact estimates for each outcome calculated in different ways. The column labeled, "Diff. in Means," gives unadjusted differences in means calculated as treatment group minus comparison group. The column labeled, "Regr. Adj." provides coefficients on the treatment dummy in an OLS-estimated model of the outcomes (for continuous variables). The entries in the row for outcomes that are binary are logit coefficients transformed to be marginal effects.

Two types of outcomes measured at two time periods, are displayed in the tables. The two time periods are three quarters after program exit (short term) and average of quarters 9–12 or recipiency during one of the quarters (longer-term). The two types of outcomes are levels and difference-in-differences. Levels measure the outcomes at the particular time period. "Diff-in-diff" differences the levels at the post-training period minus a base-period measure. In particular, quarters 3–6 before entry were used as the base period.

"Employment" means having earnings in the quarter ≥ $100 (2005 $). "Ever employed" means being employed in at least one quarter of the time period. "Employment – longer term" means arithmetic average of employment during quarters 9–12 after exit. "Employment – diff-in diff" means (employment – longer term) minus (employment – base period).

Receipt means non-zero quarterly benefits for UI.

Monetary outcomes measured in 2005 $.

Regression Adjustment

The independent variables used in the regression adjustments of outcomes are displayed in table B.1. They varied somewhat by program (and cohort). All of the models had a treatment dummy. In addition, all had a set of demographic variables, regional variables, and employment and earnings history/labor market variables. All of the programs except apprenticeship and secondary CTE used educational variables in the adjustment equations.

Table B.1 Independent Variables Used in Regression Adjustments of Outcomes, by Program

	Type of Variable			
Program	Demographic	Educational	Regional	Employment and Earnings History/Labor Market
WIA Adults, Dislocated Workers, and Youth	Age, sex, minority, veteran (except Youth 05/06), disability	Years of education	Urban county, western WA	8 prior employment/earnings, TANF(except Dislocated Workers), on public assistance at registration (Adults and Youth, 07/08 only)
CTC Job Prep and WR	Age, sex, minority, disability	Years of education (WR only)	Urban county, western WA	8 prior employment/earnings
CTC ABE	Age sex, minority, disability, single parent (07/08 only), veteran (07/08 only)	Years of education (07/08 only)	Urban county western WA	8 prior employment/earnings
Private Career Schools	Age, sex, minority, disability	Years of education	Urban county western WA	8 prior employment/earnings
Apprenticeship	Age, sex, minority	—	Urban county western WA	8 prior employment/earnings
Secondary CTE	Sex, minority, disability,	—	Urban county western WA	8 prior employment/earnings
DVR	Age, sex, minority,	Years of education	Urban county western WA	8 prior employment/earnings

The set of demographic variables included age, sex, and minority status for all programs save secondary CTE, for which there was no variation in age. In addition, we used the following variables if they were in the administrative data: veteran status, disability status, and single parent status.

All of the adjustments used two regional variables: residence in urban county and residence in western WA. The educational variables are prior years of education at the time of program registration. As noted above, ABE and secondary CTE had no education variables.

Finally, all of the models used the eight employment and earnings history variables that were used in the statistical matching. They are described fully in the text, but are listed here: percentage employment prior to registration, average prior quarterly earnings, prior earnings trend, variance of prior earnings, number of quarters with job changes prior to registration, earnings dip prior to registration, number of quarters between dip and registration, and percentage dip in earnings. In addition to these variables, we used TANF and public assistance status at time of program registration if we had those variables.

Comparison Group Means

The last two columns of the tables present the means for the comparison groups for the outcome variable measurement periods (post-training). They are given so that impacts can be gauged on a percentage basis.

Price Indices

Table B.2 provides the price indices used to inflate/deflate earnings, benefits, and wages.

Table B.2 Price Indices

Year	Quarter	Price Index	Year	Quarter	Price Index
1995	1	85.845	2003	1	94.151
1995	2	86.046	2003	2	94.223
1995	3	86.334	2003	3	94.836
1995	4	86.602	2003	4	95.278
1996	1	86.875	2004	1	96.068
1996	2	87.371	2004	2	96.779
1996	3	87.828	2004	3	97.376
1996	4	88.311	2004	4	98.167
1997	1	89.099	2005	1	98.754
1997	2	89.492	2005	2	99.374
1997	3	90.011	2005	3	100.495
1997	4	90.508	2005	4	101.377
1998	1	91.142	2006	1	101.803
1998	2	91.577	2006	2	102.567
1998	3	91.593	2006	3	103.316
1998	4	91.643	2006	4	103.298
1999	1	91.855	2007	1	104.311
1999	2	92.572	2007	2	105.212
1999	3	93.040	2007	3	105.813
1999	4	93.478	2007	4	106.919
2000	1	85.845	2008	1	107.954
2000	2	86.046	2008	2	109.185
2000	3	86.334	2008	3	110.367
2000	4	86.602	2008	4	108.736
2001	1	86.875	2009	1	108.290
2001	2	87.371	2009	2	108.810
2001	3	87.828	2009	3	109.598
2001	4	88.311	2009	4	110.333
2002	1	89.099	2010	1	110.901
2002	2	89.492	2010	2	110.888
2002	3	90.011	2010	3	111.102
2002	4	90.508	2010	4	111.602

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