

NET IMPACT AND BENEFIT-COST ESTIMATES OF THE WORKFORCE DEVELOPMENT SYSTEM IN WASHINGTON STATE

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ABSTRACT

This study estimates the net impacts and private and social benefits and costs of 12 workforce development programs administered in Washington State. Seven of the programs serve job-ready adults: Workforce Investment Act (WIA) Adult programs, WIA Dislocated Worker programs, Community and Technical College Workforce Education, Community and Technical College Worker Retraining, Private Career Schools, Apprenticeships, and Aerospace Training. Three of the programs serve adults with employment barriers: Community and Technical College Basic Education for Adults (BEaA), Community and Technical College Integrated Basic Education Skills Training (I-BEST), and Division of Vocational Rehabilitation programs. The other two programs serve youth: WIA Youth programs and Secondary Career and Technical Education.¹

The net impact analyses were conducted using either a nonexperimental, statistical matching methodology or econometric estimation. In particular, propensity score matching was undertaken for ten of the 12 programs. 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 Wagner-Peyser program registrants (who served as the comparison group pool) supported the analyses. These data included several years of pre-program and post-exit outcome information including demographics, employment and earnings information from the Unemployment Insurance wage record system, and benefits from the Unemployment Insurance system. For Vocational Rehabilitation and Secondary Career and Technical Education, it was not feasible to conduct propensity score matching. So for these programs, we relied on regression modeling.

The net impacts of these programs were estimated for two time frames. These were *short-term* (defined as three full quarters after exit) net impacts² and *longer-term* (nine to 12 full quarters after exit) net impacts for individuals who exited in the fiscal year 2010/2011.³ Short-term employment impacts are positive for 11 of the 12 programs and negative for the other one; whereas the short-term quarterly earnings impacts are positive for 10 of the 12 programs. The longer-term impacts are similar. Employment impacts are positive for 10 of the 12 programs and negative for the other 2 programs. However, the negative employment net impacts are not statistically significant. The longer-term net impacts for quarterly earnings are positive and statistically significant for 10 of the 12 programs; positive and not statistically significant for one program; and negative and not statistically significant for the other program. The benefit-cost analyses show that all of the programs have discounted future benefits that far exceed the costs for participants in both the first 10 quarters following program exit and over the average working lifetime.⁴ However, for the public, only four of 11 programs have benefits that exceed costs in the first 10 quarters,⁵ whereas the public ultimately receives a positive return for 9 of the 11 over the average participant's working lifetime.

¹ The Workforce Investment Act was superseded by the Workforce Innovation and Opportunity Act of 2015. Because the years of analyses pre-dated the new legislation, this report will use the WIA acronym.

² Our estimate of the short-term impacts averaged the (three quarters after exit) estimated net impacts for the individuals who exited in fiscal years 2010/2011 and 2012/2013. For Secondary Career and Technical Education, we used 2011/2012 instead of 2012/2013.

³ For Aerospace Training, we used 2011 Q3 to 2012 Q2 for the *longer-term* net impact estimation.

⁴ There is one exception. For Community and Technical College Worker Retraining, the average participant's discounted future benefits during the first 10 quarters after exit are slightly less than costs.

⁵ As explained in the text, we do not have cost data for private career schools.

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

1 OVERVIEW OF THE STUDY

By legislative mandate (RCW 28C.18.060), Washington’s Workforce Training and Education Coordinating Board (Workforce Board) administers outcome evaluations of the state workforce training system every two years based on surveys of program participants, surveys of employers of program participants, and linkages with Employment Security Department payroll and wage files. These evaluations report participant success in finding employment, levels of earnings, and participant and employer satisfaction with program services and outcomes.

The Workforce Board’s duties also include administering a scientifically based net impact and cost-benefit evaluation of the state training system. The net impact and cost-benefit evaluations are most appropriately calculated by using data from nonparticipants as well as participants. The data burden is thus greatly expanded as compared to what is required for the biennial outcome evaluations, and so the legislation requires that the Workforce Board conduct this evaluation every five years. Net impact/return on investment studies were done in 1997, 2002, 2006, and 2012.⁶ 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.

⁶The 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. The 2012 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. TR13-029, Revised December 2014.

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.⁷ Presumably, the Washington legislature recognizes that investment in workforce development requires 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 on 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 employment or increased earnings. 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. The main issue for this study is to determine whether participants’ successes can be *attributed* to participation in the program, or might other factors coincidental to the program have played a role?

A net impact analysis addresses the attribution question. It attempts to answer the question of how 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 and would, otherwise have qualified for the program, but who chose not to receive training or enroll in education.⁸ We observe both the participants and comparison group members over time. We then

⁷ The WIOA legislation has mandated assessments and evaluations similar to what Washington has been doing for all states. See Section 116 (e) “Evaluation of State Programs.”

⁸Experimental 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 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' benefits to their costs.

Programs, Outcomes, and Time Periods

The report describes analyses (net impact and benefit-cost) of 12 programs. Seven of the programs serve job-ready adults: Workforce Investment Act (WIA) Adult programs, Dislocated Worker programs, Community and Technical College Workforce Education, Community and Technical College Worker Retraining, Private Career Schools, Apprenticeships, and Aerospace Training. Three programs serve adults with employment barriers: Community and Technical College Basic Education for Adults (BEaA), Community and Technical College Integrated Basic Education and Skills Training (I-BEST), and Division of Vocational Rehabilitation (DVR) programs. The other two programs serve youth: WIA 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 supplied by employers to the Unemployment Insurance (UI) system when they file their quarterly UI tax payments.⁹

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 (2014\$) in earnings in a calendar quarter. Hourly wages are defined as total quarterly wages divided by hours worked in the quarter.

Unemployment Insurance benefits data were gathered from the Washington's Employment Security Department. 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. For the nine programs in which we used propensity score matching, the general idea is that we constructed data bases containing longitudinal data over a lengthy period about individuals who had participated in the programs of interest or who had registered for Wagner-Peyser (WP) services. The latter data were used to construct the comparison groups.¹⁰ We then

⁹ 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.

¹⁰ 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

statistically matched individuals who had participated in the programs to individuals in the comparison group, and compared outcomes. Differences in outcomes were attributed to the programs.

Two time periods were used for defining the populations of study. The first period was the fiscal year running from July 2010 to June 2011 (hereafter referred to in this report as 2010/2011), and the second period was July 2012 to June 2013 (2012/2013). 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 registered for Wagner-Peyser services at a Work Source office during either of those years.¹¹

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-

Rehabilitation programs. In these cases, there were administrative data on students (in the case of Career and Technical Education) and customers (in the case of DVR) who did not participate/receive services.

¹¹ 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 Workforce Education programs or Registered 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.

month period means that the individual exited the program; some programs use a six-month or a 90-day rule. 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 Results¹²

Table 1.1 provides a summary of short-term net impacts of the 12 programs on employment and earnings. The elements reported in the table show the increase (or decrease) in employment, defined as having at least \$100 (2014 \$) in earnings in the third quarter after exiting from the program, and the increase (or decrease) in quarterly earnings, on average, for that quarter.¹³ 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

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 (2014 \$)
WIA Adults	11.9	1,625
WIA Dislocated Workers	11.5	1,667
WIA Youth	1.5 [‡]	-395
Comm. and Tech. College Workforce Education	6.5	1,285
Comm. and Tech. College Worker Retraining	8.1	850
Comm. and Tech. College BEdA	-2.2	-291
Comm. and Tech. College I-BEST	4.7	586
Private Career Schools	4.5	446
Registered Apprenticeships	7.5	3,715
Aerospace Training	15.0	2,881
Secondary Career Technical Ed.	2.4	104
Vocational Rehabilitation (WIA Title IV)	21.0	120

NOTE: Specific estimation techniques are described in later chapters.

^aDefined as three quarters after exit.

[‡]Table entry not statistically significant.

¹² As described in the next chapter, we attempted to replicate as closely as possible the methodology used in our prior studies for the WORKFORCE BOARD. 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.

¹³ The earnings impacts are not conditional on individuals having earnings, i.e., the means include observations with values of zero.

for subgroups of participants, including completers only, are reported later in this document.

The employment impacts are in percentage point terms. Eleven of the 12 are positive and all but one of them are statistically significant. One program has negative short-run employment impacts—Community and Technical College BEdA programs. The employment rates of the comparison groups for all of the programs are on the order of 60 to 70 percent, so the positive impacts range from about seven to 20 percent.¹⁴ All but two of the short-term earnings impacts are positive, and they vary considerably in terms of magnitude. All of the impacts are statistically significant¹⁵ and range from a low of about \$100 per quarter to over \$3,700 per quarter. Note that Registered Apprenticeships, Aerospace Training, WIA Adults and Dislocated Workers, and Community and Technical College Workforce Education have quite large impacts. The only programs with decreases in earnings are WIA Youth and Community and Technical College BEdA courses.

Table 1.2 provides estimates of the longer-term payoffs to education and training. All but two of the employment net impacts are positive, and the two that are negative are not statistically significant. As far as earnings are concerned, 10 of the 12 programs have positive and statistically significant net impacts; one has a positive but not significant net earnings impact; and one has a negative, but not significant net impact. Because of depreciation of the impacts and regression to the mean, one might expect the short-term employment net impacts to be larger than the longer-term net impacts. However, this is not the case. All but three of the longer-term earnings net impacts are larger (or less negative) than the short-term earnings net impacts. Note

¹⁴ The Vocational Rehabilitation estimated employment impact of 35.6 percentage points is an outlier caused by the fact that employment helped to define the treatment group.

¹⁵ The statistical significance of an estimate reflects the probability that the “true value” in the population is nonzero. In subsequent chapters, we will indicate significance at a particular p-value. That implies that the true value is nonzero with a probability of $(1.0 - p)$. So $p = 0.05$, 0.01 , and 0.001 indicate that the probability that the true value is nonzero are 95 percent, 99 percent, and 99.9 percent, respectively. In this chapter, we are using $p = 0.05$.

that in percentage terms, the earnings net impacts for the 12 programs are on the order of 20 percent.

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 (2014 \$)
WIA Adults	4.1	1,319
WIA Dislocated Workers	7.4	1,455
WIA Youth	6.7	250 [‡]
Comm. and Tech. College Pro./Tech.	1.1	1,372
Comm. and Tech. College Worker Retraining	8.0	1,132
Comm. and Tech. College BEdA	2.9	-85 [‡]
Comm. and Tech. College I-BEST	12.3	976
Private Career Schools	-0.4 [‡]	509
Registered Apprenticeships	-0.8 [‡]	3,447
Aerospace Training	15.4	4,132
Secondary Career Technical Ed.	2.7	214
Vocational Rehabilitation	2.4	228

NOTE: Specific estimation techniques are described in later chapters.

^aDefined as average over quarters 9-12 after exit.

[‡]Table entry not statistically significant.

Table 1.3 summarizes the benefit-cost estimates for the 12 programs. 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. All of the benefits and costs are adjusted for inflation. For participants, the benefits include net earnings changes (earnings plus fringe benefits minus taxes) and UI benefits. These benefits are discounted at an annual rate of 3.0 percent. The benefits 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 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 compensation 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.¹⁶ The public costs are positive in all programs, but participant costs are negative in over half the programs because forgone compensation is negative in those programs (participants actually earn more during their program participation than if they had not participated).

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 one programs does not. Community and Technical College Worker Retraining participants have large forgone compensation that outweighs the net earnings impacts 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, the programs are, for the most part, quite beneficial for participants; their benefits significantly exceed costs in all cases, except for Community and Technical College BEdA. From the public's perspective, nine of the programs have benefits that exceed costs in the long-run for the average participant; only Community and Technical College BEdA and Vocational Rehabilitation are estimated to have costs exceed benefits for the public over the lifetime of the average participant. The benefit-cost analyses are detailed in chapter 15.

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 twelve chapters examine the results for the 12 workforce development system programs. The final chapter documents the cost-benefit

¹⁶Note that they may be negative costs (i.e., savings) if the forgone earnings of participants are negative.

analyses. Appendix A discusses data editing and Appendix B presents explanatory notes for the regression estimation models and the price indices used to convert nominal dollar figures into real terms.

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

Program	First 2.5 years				Lifetime			
	Participant		Public		Participant		Public	
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
WIA Adults	19,567	-3,135	3,484	1,799	119,302	-3,135	22,432	1,799
WIA Dislocated Workers	16,139	6,798	7,537	4,368	78,478	6,798	22,132	4,368
WIA Youth	3,861	-288	545	2,973	29,167	-288	7,128	2,973
Comm. and Tech. College Workforce Educ.	15,374	2,192	3,960	8,412	139,781	2,192	31,568	8,412
Comm. and Tech. College Worker Retraining	8,278	8,621	3,597	5,919	79,609	8,621	24,973	5,919
Comm. and Tech. College BEdA	-24	-293	875	5,072	-477	-293	1,015	5,072
Comm. and Tech. College I-BEST	8,535	-77	3,515	5,101	99,421	-77	26,899	5,101
Private Career Schools ^a	6,953	1,045	2,199	--na--	61,704	1,045	14,359	--na--
Registered Apprenticeships	36,159	-51,039	12,746	-8,906	287,521	-51,039	117,117	-8,906
Aerospace Training	41,453	4,016	11,912	8,626	383,631	4,016	133,863	8,626
Secondary Career Technical Ed.	2,216	-149	315	1,724	46,048	-149	11,963	1,724
Vocational Rehabilitation	1,883	-4,634	384	5,988	20,017	-4,634	5,084	5,988

NOTE: Benefits for a participant include earnings and fringe benefits less taxes plus UI benefits discounted at 3.0 percent annually; for the public, benefits include undiscounted tax receipts minus UI benefit payments. Costs include direct program costs (public and participant, if tuition/fees) and forgone compensation (participant) and forgone taxes (public). Table entries in 2014 \$.

--na-- not available; no data were available on the tuition and fees at private career schools.

^aPrivate costs only include forgone earnings; tuition rates unavailable.

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 a high level of statistical confidence that the program was responsible for any differences in outcomes.¹⁷

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 for ten of the 12 programs. 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

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

¹⁷ 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.

have outcome(s) $Y_{it}(0)$ if she doesn't participate. The net impact of the treatment for individual i 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 T represent a 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 a data set with observations about individuals who may be similar to individuals who received the treatment but who did *not receive the treatment* for whom we have data, and let n_U be its sample size. 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:

$$(1) \quad W_i = g(X_i, e_i), \quad \text{where}$$

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 the function g 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 .

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:

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

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

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

Let $\hat{f}_k(X_i) = E(Y_i(k)|X_i)$, 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:

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

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

$$\begin{aligned} (5) \quad E[Y_i(1) - Y_i(0)|X, W_i = 1] &= E(\Delta Y | X, W = 1) \\ &= E[Y(1)|X, W = 1] - E[Y(0)|X, W = 0] \\ &\quad + E[Y(0)|X, W = 0] - E[Y(0)|X, W = 1] \\ &= \hat{f}_1(X) - \hat{f}_0(X) + \text{BIAS}, \quad \text{where} \end{aligned}$$

$\hat{f}_k(X)$, $k = 1, 0$, 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

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

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.

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 .

There are numerous methods for constructing the comparison group. The *nearest-neighbor algorithm* minimizes 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 j th observation in T and k th 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 . 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. In general, the literature on statistical matching has a discussion of the effect of using different metrics, although in practice the Mahalanobis metric is used most often.

An alternative matching algorithm, which we used in this study, involves use of propensity scores. Essentially, observations in T and U are pooled, and the probability of being in T is estimated, using logistic regression. The predicted probability of being a treatment case 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 result that $Y(0) \perp W|X$ implies that $Y(0) \perp W|p(X)$, where $p(X)$ is the propensity score. Treatment observations are matched to observations in the comparison sample with the closest propensity scores. In this study, we used propensity score matching, although we required an exact match on sex. Our justification for this latter requirement was twofold. First, it follows the usual practice in the literature. Second, labor economics studies typically suggest that the labor market behavior of men and women differ substantially.

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 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. Often balance is tested by examining t-tests of the difference in means for the treatment and comparison group covariates. The literature suggests that even though it is the usual convention, using t-tests is not appropriate because assessing balance is not a test of hypothesis. Two other statistical tests have been suggested. The first of these, called the Cohen d statistic, is the standardized difference in means. It is equal to $(\bar{Y}_t - \bar{Y}_c) / \sigma_t$ where \bar{Y}_t and \bar{Y}_c are the sample means for the treatment and comparison group, and σ_t is the estimated standard deviation from the treatment group. The balance test involves calculating d for each covariate and for the propensity score. A rule of thumb is that d should be less than 0.25; however some authors suggest 0.10. In the results presented in this study, we use $d < 0.10$.

Since the standardized difference in means is essentially focused on the first moment of the distribution only, a second test is to calculate the ratio of the estimated variances of the treatment and comparison group. This variable, $v = \sigma_t^2 / \sigma_c^2$, should be close to one. Again, in our case, v is close to one for virtually all variables, and in all cases $0.52 < v < 1.52$.

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 outcomes¹⁸ 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.

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. In this study, we did 1-to-1 matching with replacement.

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*. We applied a caliper of 0.005 in this study.

¹⁸ 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.

Estimation Procedures Used in This Study

Once we have arrived at matched treatment and comparison data sets that are well-balanced, several different estimators could be used to estimate the net impact of the treatment on labor market outcomes. In this study, the average treatment effect on the treated (ATET) is calculated straightforwardly by differencing the means of the outcome variables in the comparison group from the treatment group. The outcome variables are specified in terms of levels or difference-in-differences.

Table 2.1 summarizes our preferred estimator, by program. In general, the preferred estimator was the mean of the difference-in-differences means [(post-program outcomes for treatment cases minus pre-program levels) minus (outcomes for the comparison cases in the post-program period minus levels at the pre-program period)]. This difference-in-differences approach adjusts for individual-level *fixed (time-invariant)* unobservables. However, for programs where there was a clear disruption to the human capital/labor market experiences of participants, the preferred specification was differences in the post-program levels (post-program outcomes from treatment cases minus outcomes for the comparison cases in the post-program period). The table shows that various age ranges were for the comparison population. The age ranges were selected in order to preserve overlap with the workforce program.

Table 2.1 Preferred Estimation Technique

Workforce Program	Comparison Group Pool	Preferred Estimator
WIA Adults	Wagner-Peyser (age = [18,70])	Difference-in-differences
WIA Dislocated Workers	Wagner-Peyser (age = [18,70])	Levels
WIA Youth	Wagner-Peyser (age = [14,22])	Levels
CTC Workforce Education	Wagner-Peyser (age = [16,70])	Difference-in-differences
CTC Worker Retraining	Wagner-Peyser (age = [16,70])	Levels
CTC Basic Education for Adults	Wagner-Peyser (age = [18,55])	Difference-in-differences
CTC I-BEST	Wagner-Peyser (age = [18,55])	Difference-in-differences
Private Career Schools	Wagner-Peyser (age = [16,70])	Difference-in-differences
Registered Apprenticeships	Wagner-Peyser (age = [16,60])	Difference-in-differences
Aerospace Training	Wagner-Peyser (age = [16,70])	Difference-in-differences
Secondary Career and Technical Education	OSPI High School graduate data (not vocational completers)	Levels ^a
Vocational Rehabilitation	DVR administrative data (pre-plan exit from agency)	Levels ^a

^aAs described in the chapter below, the estimation is done with regression analyses in which the outcome levels are the dependent variables.

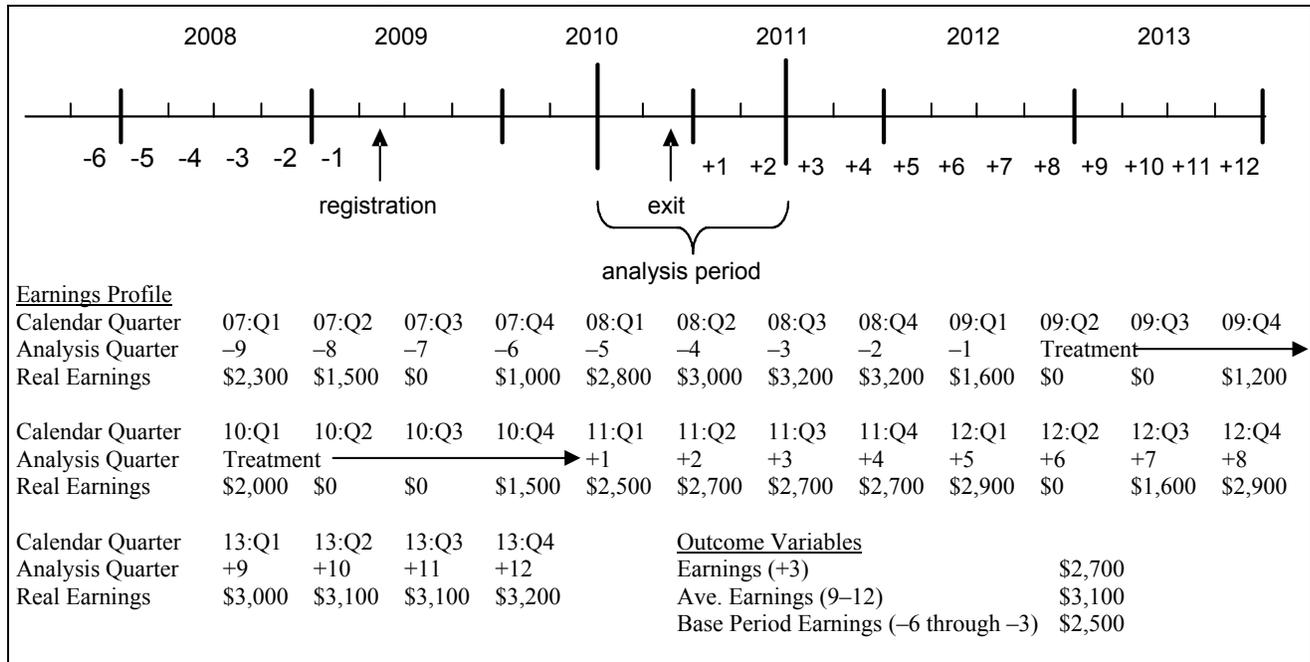
Choice of Outcome and Base Periods

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 2012/2013. *Longer-term* impacts were calculated by using individuals who exited in fiscal 2010/2011 as the treatment group. The comparison groups were drawn from administrative data for individuals who last received Wagner-Peyser program services 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 Wagner Peyser services with the Labor Exchange.)

The outcomes included the following:

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

Figure 2.1 Timeline and Earnings Profile for a Hypothetical WIA Adult Client



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 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 average of the outcomes three quarters after exiting from the program for both cohorts, and the second was the quarterly average during quarters 9–12 after exiting from the program. 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 Adult services in April, 2009 (Quarter 2 of 2009) and exited from services in November,

2010 (Quarter 4 of 2010). The earnings profile shows that this person had average quarterly earnings of \$2,500 (2014\$) in the base period (2007:Q4 to 2008:Q3), \$2,700 in the 3rd quarter after exit (2011:Q3); and \$3,100 average quarterly earnings in the 9th–12th post-exit quarters, which were 2013:Q1 to 2013:Q4. So in calculating the average treatment effect for earnings levels, this observation’s contributions to the treatment means would have been \$2,700 and \$3,100 for the short-term and longer-term outcomes. For the difference-in-differences calculations, this observation’s contributions to the means 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.

3 WORKFORCE INVESTMENT ACT (WIA) ADULT PROGRAM

The Workforce Investment Act (WIA) programs were the primary federally-funded job development programs for individuals during the time period of the cohorts being analyzed; services included core services, intensive services, and training. These levels of services were intended to be sequential. Core services, intended for all clients, included skill assessment, labor market information, consumer reports on training programs, and job search and placement assistance. Individuals who did not become employed after receiving core services were eligible for intensive services. These services were individualized—assessment, individual counseling, employment planning, and prevocational training. Adults who continued to have difficulty finding employment after core and intensive services were eligible for training. Training was provided through individual training accounts (ITAs), which are essentially vouchers that may be used at institutions on an approved list. For all services, highest priority was 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 (individuals who registered for WP services who were at least 18 but no more than 70 at the time). The first two columns of numbers compare the WIA clients who exited in 2010/2011 to individuals in the comparison group pool 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 2011/2012 to WP participants in the same year.

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

Characteristics	2010/2011		2012/2013	
	WIA Adult	Wagner-Peyser	WIA Adult	Wagner-Peyser
<u>Demographics</u>				
Female	56.7%	43.2%	53.7%	44.3%
Race:				
White	66.9%	64.9%	62.4% ^{††}	62.7% ^{††}
Black	11.1%	6.7%	11.8%	6.4%
Hispanic	10.1%	14.2%	10.4%	13.2%
Other race	9.4%	8.1%	11.8%	8.3%
Missing	2.6%	6.0%	3.7%	9.3%
Mean, age at registration	37.0	39.7	36.8	36.2
Employed at registration	17.6%	12.7%	18.7%	10.8%
Disability	6.7%	5.3%	4.6% ^{††}	5.1% ^{††}
Veteran	8.8%	9.9%	0.2%	8.6%
West WA	73.1%	60.4%	73.5%	60.9%
Urban county	35.6%	44.3%	46.0% ^{††}	46.0% ^{††}
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	58.2%	70.7%	55.0%	68.7%
Average quarterly earnings ^a	\$3,340	\$5,978	\$3,160	\$6,281
Mean, earnings trend ^b	-\$32.4	-\$5.5	-\$13.4	\$118.5
Mean, earnings variance ^b (in 10 ⁶ \$)	\$9.2	\$19.5	\$9.4	\$14.3
Job turnover	33.2%	19.3%	31.6%	12.9%
Percentage of quarters with multiple jobs	14.6% ^{††}	14.9% ^{††}	13.0%	11.8%
Had earnings dip	56.4% ^{††}	57.7% ^{††}	47.4%	28.1%
Mean, number of quarters since dip at registration ^a	2.1	2.4	1.7	0.9
Average earnings dip size in percentage ^a	46.5%	44.2%	39.9%	19.1%
Sample Size	3,294	331,268	2,757	178,493

NOTE: All differences in means (i.e., Wagner-Peyser mean minus program mean) are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$.

^a Averages include observations with values of zero.

^b Trend and variance calculations include quarters with zero earnings, if any.

^{††} Differences in means are not statistically significant at 0.05 level (t-test).

Note that there are two types of variables displayed in the table. The top panel of the table shows demographic 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 Wagner-Peyser). Percent of quarters with employment measures the percentage of calendar quarters prior to registration for which we had historical data (back to approximately 2007) that the individual had earnings of over \$100.¹⁹ The average quarterly earnings variable is the average for quarters in

¹⁹The numerator is the number of quarters with earnings that exceed \$100 (2014 \$) prior to registration; the denominator is potential number of quarters prior to registration that the individual could have had earnings. We

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 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). Job turnover is the percentage of quarters where the employer of record changed from one quarter to the next.

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.²⁰

The table shows that the populations are quite dissimilar both in terms of demographic characteristics and labor market histories. All but two of the variables have differences in the mean values that are statistically significant at the 0.05 level in the earlier cohort, and all but three variables in the later cohort have statistically significant differences in means. Among the demographic variables, much larger percentages of the WIA Adult exiters are females, were employed at the time of registration, and are from the Western side of the state in both cohorts. On the other hand, a much smaller percentage of WIA Adult exiters are from an urban county in the earlier cohort; however, this percentage was identical in the later cohort for the WIA exiters

started the “clock” for potential quarters in the earliest quarter in our data for which the individual had non-zero earnings.

²⁰ In previous studies, 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 available for the comparison groups, so those variables had to be dropped from the models.

and Wagner-Peyser participants. In the 2012/2013 cohort, only a handful of WIA exiters (0.2%) are veterans compared to almost 9 percent of the WP participants.

The average quarterly earnings for all WIA clients who had any earnings prior to registration was \$3,200 to \$3,300 ('14 \$), much smaller than the average quarterly earnings prior to registration for Wagner-Peyser program participants, which is \$6,000 in the 2010/2011 cohort and almost \$6,300 in the later cohort. This suggests that the human capital characteristics of the WIA Adults may be of significantly “lower quality” than of the WP participants. Indeed, there is a difference in the employment percentage of over 10 percentage points for both cohorts. Furthermore, the job turnover of WIA Adults is almost twice as large and, in the later cohort, a much higher percentage of WIA Adult exiters had an earnings dip—over 47 percent to 28 percent. There was no statistically significant difference in this percentage for the 2010/2011 cohort, however. In short, except for a few variables, there were significant differences in these two populations in each cohort. Thus the next step in the analyses was to estimate a model of participation in the WIA adult program and conduct a statistical match using the propensity score.

Participation Model

Table 3.2 provides the results from the logit estimation of participation in the WIA Adult program. More precisely, the adults (aged 18–70) who had registered for Wagner-Peyser services (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 WP group). The “model” is not theoretically derived, and so inferences about causality should be cautiously formulated. However, 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 Adult exiter.

Table 3.2 Coefficient Estimates from a Logit Model of Participation in WIA Adult Program

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.372***	0.040	0.135**	0.043
Race: (White is omitted category)				
Black	0.286***	0.061	0.443***	0.068
Hispanic	-0.233***	0.064	-0.074	0.072
Other	0.150*	0.063	0.381***	0.065
Missing	-0.859***	0.112	-0.970***	0.105
Age at registration	-0.000	0.002	0.029***	0.002
Employed at registration	0.424***	0.048	0.778***	0.053
Disability	0.171*	0.074	0.178	0.096
Veteran	0.029	0.068	-3.791***	0.411
West WA	0.814***	0.043	0.711***	0.050
Urban county	-0.604***	0.041	-0.303***	0.045
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.006***	0.001	-0.011***	0.001
Average quarterly earnings ^a (in 10 ² \$)	-0.001	0.001	-0.006***	0.001
Earnings trend ^b (in 10 ² \$)	-0.021***	0.004	-0.003	0.002
Earnings variance ^b (in 10 ⁸ \$)	-0.563***	0.127	0.073	0.062
Job turnover	0.041***	0.001	0.037***	0.001
Percentage of quarters with multiple jobs	-0.021***	0.001	-0.015***	0.001
Had earnings dip	0.343**	0.107	-0.699***	0.133
Number of quarters since dip at registration	-0.124***	0.011	0.023	0.013
Earnings dip size in percentage	0.180	0.105	1.368***	0.133
Constant	-6.124***	0.162	-6.259***	0.172
Observations	334,562		181,250	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

***, **, * indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

In the model, the following demographic 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: female, African American (white is the omitted category), employed at registration, and being from western Washington. The following demographic variables are negatively associated with being in the treatment group: being Hispanic or having the race variable missing (again, white is the omitted category) and residing in an urban county. Among the labor market variables, many are negatively related to participation in the WIA adult program: the percentage of quarters employed prior to registration, average quarterly earnings (not significant in the 2010 cohort), and the mean of the earnings trend (not significant in the 2012/2013 cohort). The only labor market variable that is positively associated with participation is job turnover. 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 Adult analyses. Note that there is a sizeable difference in the means between the WIA Adult and Wagner-Peyser 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 0.04 and 0.09, whereas they are about 0.01 for the comparison pool, for both cohorts. The 20th percentile indicators are approximately 57 percent for the earlier cohort and 73 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 (p-score) Model Quality for WIA Adult Analyses

Statistic	2010/2011	2012/2013
Mean p-score, WIA Adult	0.042	0.086
Mean p-score, Wagner-Peyser	0.010	0.014
Percentile Wagner-Peyser, at 20th percentile WIA Adult	56.7%	72.8%

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 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.

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

Statistic/Characteristic	2010/2011		2012/2013	
	WIA Adult	Wagner-Peyser	WIA Adult	Wagner-Peyser
Sample size	3,294	333,317	2,757	179,587
Sample size used in match	3,294	331,268	2,757	178,493
Matched sample size	3,271	3,271	2,718	2,718
Number of observations used once	--	2,949	--	2,298
Number of observations used multiple times	--	143	--	191
Maximum number of repeats	--	6	--	5
Demographics				
Female	56.6%	56.6%	53.8%	53.8%
Race:				
White	67.0%*	64.7%*	62.4%	60.3%
Black	10.9%*	12.4%*	11.7%**	13.6%**
Hispanic	10.1%	10.3%	10.4%	9.7%
Other race	9.3%	10.5%	11.7%	12.1%
Missing	2.6%	2.1%	3.7%	4.3%
Mean, age at registration	37.0	37.3	36.7	36.3
Employed at registration	17.5%	16.8%	18.5%	18.4%
Disability	6.7%	6.7%	4.6%	5.3%
Veteran	8.8%	8.3%	0.2%	0.3%
Urban county	35.7%	36.5%	46.0%*	48.4%*
West WA	72.9%	72.8%	73.4%	74.9%
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	58.4%***	53.0%***	55.5%***	49.6%***
Average quarterly earnings ^a	\$3,361***	\$2,937***	\$3,202***	\$2,676***
Mean, earnings trend ^b	-\$32.1	-\$39.2	-\$11.8	-\$12.8
Mean, earnings variance ^b (in 10 ⁶ \$)	\$9.2***	\$7.9***	\$9.5**	\$8.0**
Job turnover	32.7%***	30.8%***	30.7%**	29.4%**
Percentage of quarters with multiple jobs	14.7%***	13.1%***	13.1%	12.7%
Had earnings dip	56.5%***	51.0%***	47.2%	47.6%
Mean, number of quarters since dip at registration ^a	2.1***	1.9***	1.7	1.8
Average earnings dip size in percentage ^a	46.5%***	42.2%***	39.7%	40.4%
Sample Size	3,271	3,271	2,718	2,718

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***, * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). -- means not applicable.

^a Averages include observations with values of zero.

^b Trend and variance calculations include quarters with zero earnings, if any.

Balance

After the statistical match, there should be few 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

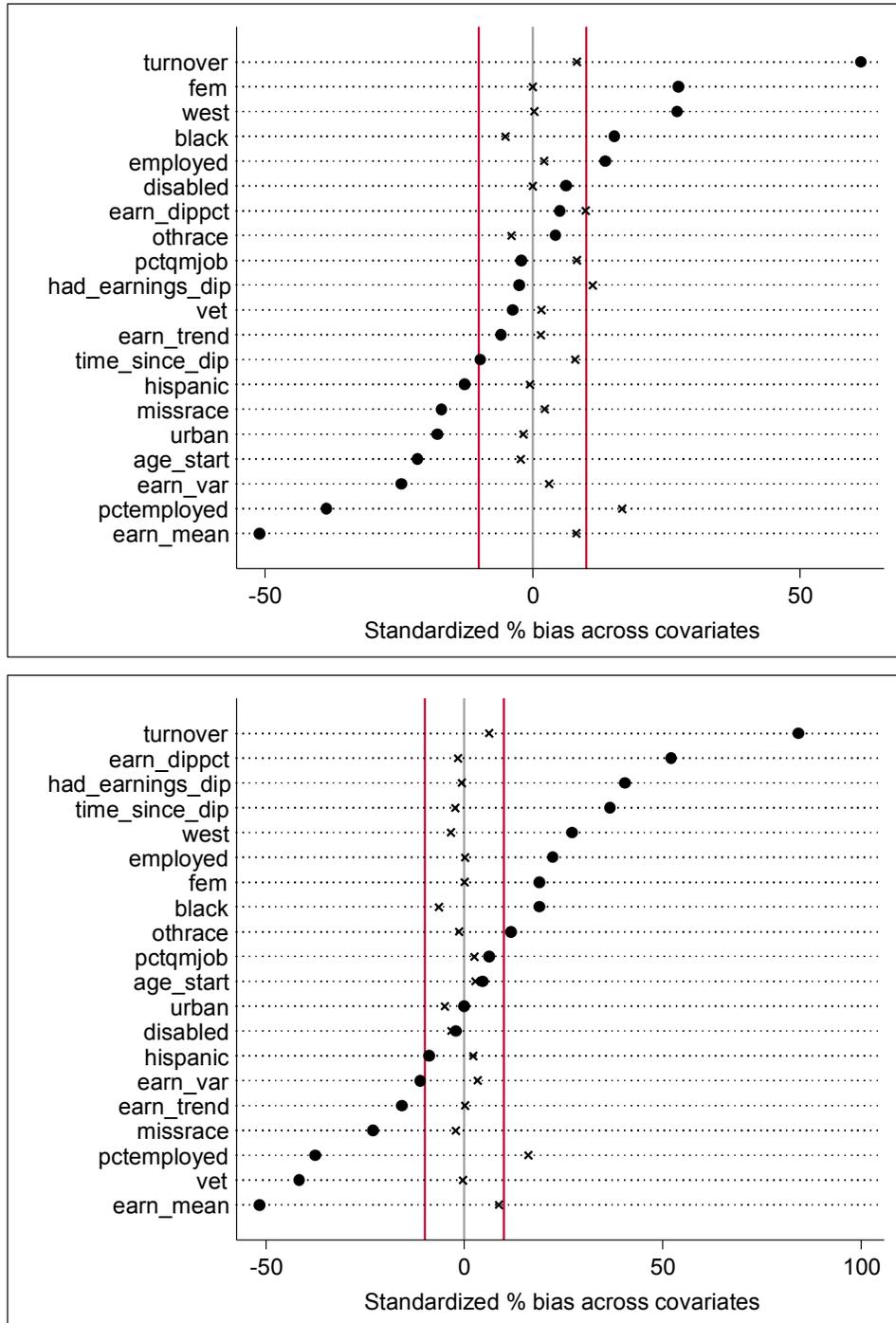
the differences between the first two rows of the table were for observations that had missing data for any of the variables used in the match. The difference in counts between the second and third row represents the number of observations that were deleted because they were not within the caliper radius. Notice that the resulting distributions are well-balanced. There is only one variable for which the difference in means is statistically significant. As noted in chapter 2, one way to test for balance between the treatment and matched comparison group is by examining the Cohen d statistics, or standardized difference in means. A well-balanced matching group will have $d < 0.25$. Figure 3.1 shows this test graphically for the WIA Adult sample. The top graph is for the 2010/2011 cohort and the bottom is for the 2012/2013 cohort. In the figures, the standardized difference in means for each variable used in the match using the entire matching pool sample (i.e., Wagner-Peyser data) and the treatment sample is shown with the heavy black dots. The same statistic using the matched sample is shown with “x’s.” The vertical lines are drawn at ± 0.10 . The figures show visually how the bias is reduced by matching, with only one variate—percent employed prior to program entry—barely outside of the 0.10 bound in both cohorts.

Net Impacts

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

- employment
- hourly wage
- quarterly hours of employment
- quarterly earnings
- receipt and amount of Unemployment Compensation benefits per quarter

Figure 3.1 Standardized Difference in Means, Pre- and Post-match, WIA Adults



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

Tables 3.5 and 3.6 provide estimated net impacts for the WIA Adult program. The first table displays the short-term (3 quarters after exit) and the longer-term (9–12 quarters after exit)

outcomes for the 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. The first column in each of the tables presents the net impact estimate, which is the average treatment effect. The impacts that are in “boxes” represent the final, “official” estimates. 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 2010/2011 cohort and Table 3.6 provides the results for the 2012/2013 cohort. Our general strategy is to rely on the earlier cohort of exiters to provide the longer-term net impacts, and to average the two cohorts of exiters to provide the short-term impacts.

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 is relevant. 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

Table 3.5 Net Impact Estimates for WIA Adult Program for 2010/2011 Cohort

Outcome	Matched Sample		Comparison Group Means			
	Estimator	Average Treatment Effect	Full Sample		Matched Sample	
			With 0	W/o 0	With 0	W/o 0
Employment (percentage points) ^a						
Short term	13.5***		54.2	--	46.7	--
Ever-employed, longer term	5.3***		64.9	--	58.6	--
Percent of quarters, longer term	7.3***		55.2	--	47.4	--
Percent of quarters, longer term, diff-in-diff	4.1**		-7.6	--	1.3	--
Hourly wage						
Short term (\$)	3.03***		9.93	18.08	7.26	15.20
Short term, diff-in-diff (\$)	2.93***		-3.79	-2.46	-0.71	-0.83
Longer term (4-quarter average) (\$)	2.77***		10.78	18.92	7.52	15.39
Longer term, diff-in-diff (\$)	2.67***		-2.94	-1.62	-0.45	-0.84
Quarterly hours						
Short term	81.4***		206.1	375.3	160.0	334.9
Short term, diff-in-diff	71.6***		-39.1	13.0	0.9	23.1
Longer term (4-quarter average)	46.3***		226.4	378.8	178.2	337.6
Longer term, diff-in-diff	36.4***		-18.9	19.9	19.1	30.4
Quarterly earnings						
Short term (\$)	1,712***		3,810	6,937	2,432	5,090
Short term, diff-in-diff (\$)	1,646***		-1,668	-774	-342	-127
Longer term (4-quarter average) (\$)	1,384***		4,491	7,437	2,864	5,384
Longer term, diff-in-diff (\$)	1,319***		-988	-246	91	180
Unemployment Insurance Benefits						
Percent receiving, short term	-8.2***		24.3	--	17.2	--
Benefits, short term (\$)	-291***		788	3,242	486	2,827
Ever-received, longer term	0.7		15.0	--	11.3	--
Benefits, longer term (4-quarter average) (\$)	27**		171	2,016	116	1,801

NOTE: Monetary data in 2014 \$. 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 row 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

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 (slightly over 4 percentage points), a higher average hourly wage (\$2.67 per hour), and a higher average of hours

Table 3.6 Net Impact Estimates for WIA Adult Program for 2012/2013 Cohort

Outcome	Matched Sample	Comparison Group Means			
	Estimator	Full Sample		Matched Sample	
	Average Treatment Effect	With 0	W/o 0	With 0	W/o 0
Employment ^a					
Short term	10.3***	60.7	--	55.4	--
Hourly wage					
Short term (\$)	2.01***	11.47	18.69	8.92	15.82
Short term, diff-in-diff (\$)	3.52***	-2.96	-1.52	0.31	-0.27
Quarterly hours					
Short term	67.4***	236.8	386.0	199.4	353.5
Short term, diff-in-diff	65.9***	-30.7	-0.1	43.9	71.6
Quarterly earnings					
Short term (\$)	1,249***	4,555	7,426	3,210	5,691
Short term, diff-in-diff (\$)	1,604***	-1,764	-973	339	811
Unemployment Insurance Benefits					
Percent receiving, short term	-0.5	9.7	--	7.7	--
Benefits, short term (\$)	-9	205	2,121	150	1,956

NOTE: Monetary data in 2014 \$. 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 row 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

of work per quarter (over 36 hours). These re-enforce each other so that the overall earnings impact is positive and significant. The longer-term earnings impact is approximately 25 percent (the estimated net impact is \$1,319 (2014 \$) per quarter and the unconditional mean level of earnings for the match comparison group is \$5,384). The longer-term estimates in the table suggest a slight (statistically insignificant) increase in the percent of individuals receiving UI benefits, and an increase in the level of those benefits. These point estimates are consistent with having higher levels of employment and earnings.

The estimated short-term net impacts on employment, wage rate, hours, and earnings displayed in Tables 3.5 and 3.6 are also positive, and in fact, are larger than the longer-term impacts. The estimated quarterly earnings impacts of over \$1,600 (2014 \$) per quarter is approximately 30 percent of average earnings for the matched comparison group. Although they are negative for the earlier cohort, the net impacts on the take-up of UI and benefits are

essentially 0 for the 2012/2013 cohort, which is not too surprising given that these impacts are measured just three quarters after exit.

As noted earlier, our preferred estimate for the short-term net impacts is the average of the short-run impacts from Tables 3.5 and 3.6. These are presented in Table 3.7. The results in this table suggest that in the short term, the WIA Adult program has large and significant positive effects on employment and earnings. The short-term net impact estimators from both cohorts are larger than the longer-term net impacts, so of course, their average is larger. In short, our estimates suggest that this program has large and significant labor market impacts that are still large, but somewhat attenuated, in the longer-term.

Table 3.7 Short-Term Net Impact Estimates for WIA Adult Program

	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	13.5***	10.3***	11.9***
Hourly wage			
Short term (\$)	3.03***	2.01***	2.52***
Short term, diff-in-diff (\$)	2.93***	3.52***	3.22***
Quarterly hours			
Short term	81.4***	67.4***	74.4***
Short term, diff-in-diff	71.6***	65.9***	68.7***
Quarterly earnings			
Short term (\$)	1,712***	1,249***	1,481***
Short term, diff-in-diff (\$)	1,646***	1,604***	1,625***
Unemployment Insurance Benefits			
Percent receiving, short term	-8.2***	-0.5	-4.4***
Benefits, short term (\$)	-291***	-9	-150***

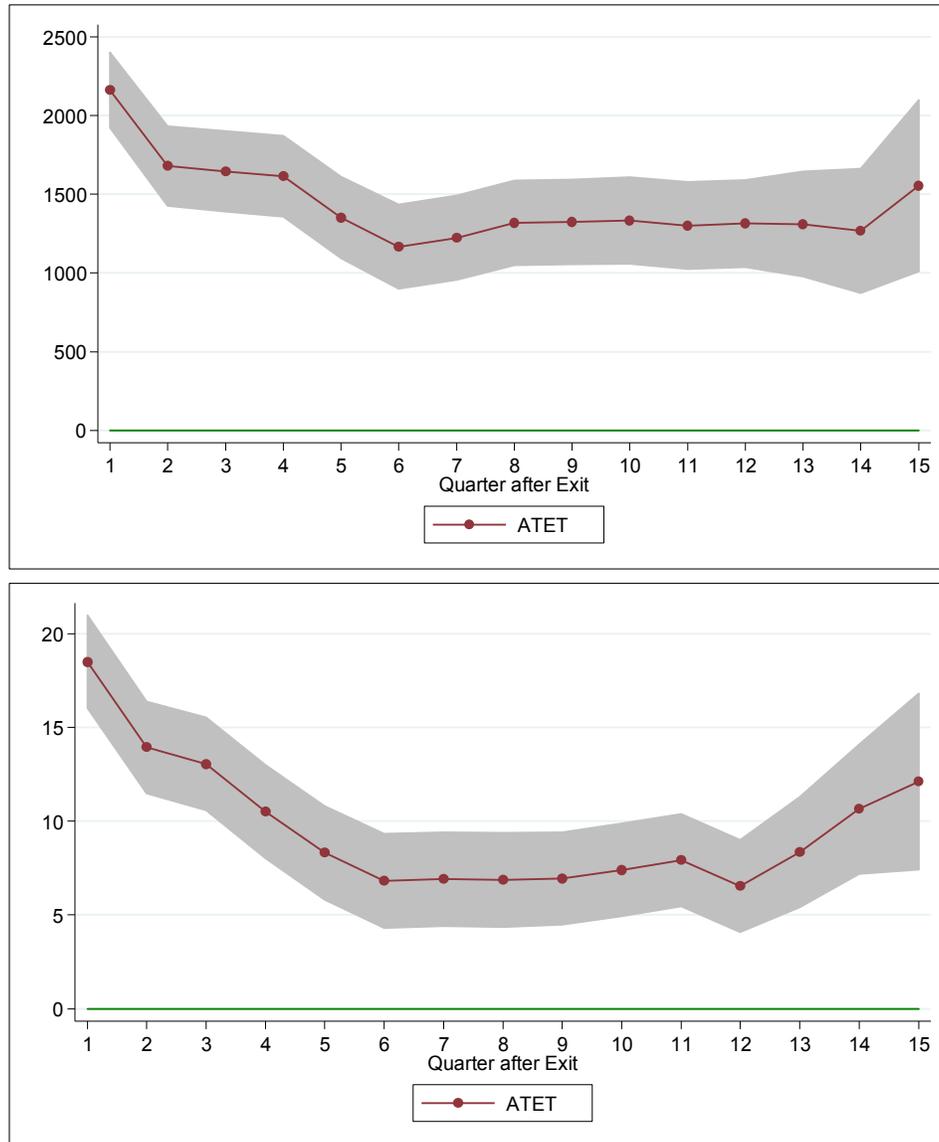
NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

Figures 3.2 and 3.3 present the net impacts on earnings and employment for each quarter after exit for 15 quarters for the 2010/2011 cohort and for 7 quarters for the 2012/2013 cohorts, respectively. The shaded portion of the graphs are the 95% confidence limits on the net impact estimates. With the exception of the employment impacts graph in the first figure, these figures provide the time series of the preferred estimates for earnings and employment “boxed” in the

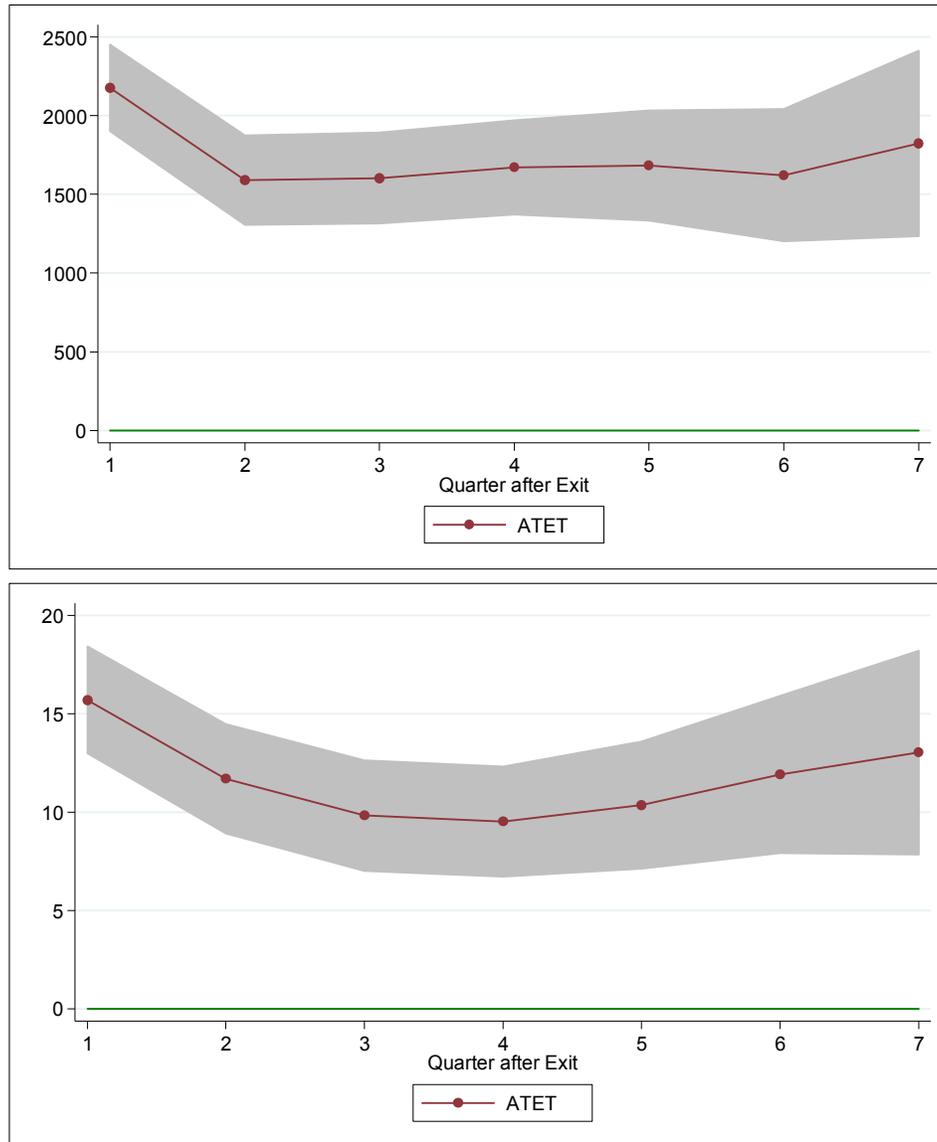
tables. The employment impacts in the first figure show “point-in-time” average treatment effects and are provided to give the reader a sense of the dynamic pattern of estimated net impacts.

Figure 3.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Adult Program, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 3.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Adult Program, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Subgroup Analyses

To test the effect of providing training to WIA 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 3.8 and 3.9 display the estimated net impacts for individuals who did and did not receive “training services,” as opposed to job search assistance or other “non-training” services only.

Table 3.8 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Adult Participants: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	1.3%	7.4%***	47.4%
Hourly Wage	\$0.66	\$3.98***	\$15.39
Hours Worked (quarterly)	9.5	54.0***	337.6
Earnings (quarterly)	\$251	\$2,016***	\$5,384
UI Receipt	2.7%**	-0.6%***	11.3%
UI Benefits (quarterly)	\$42**	\$17***	\$1,801
Subgroup Sample Size	1,292	1,979	—

NOTE: Outcomes shown in the table are the preferred outcomes that are “boxed” in table 3.5. Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). – means not applicable.

Table 3.9 Selected Short-Term Net Impact Estimates for Subgroups of WIA Adult Participants: 2010/2011 and 2012/2013 Cohorts Averaged

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	10.9%***	9.9%***	55.4%
Hourly Wage	\$3.11***	\$4.12***	\$15.82
Hours Worked (quarterly)	69.3***	69.2***	353.5
Earnings (quarterly)	\$1,246***	\$1,957***	\$5,691
UI Receipt	-0.3%***	-0.7%***	7.7%
UI Benefits (quarterly)	\$3***	-\$19	\$1,956
Subgroup Sample Size	1,197	1,521	—

NOTE: Outcomes shown in the table are the preferred outcomes that are “boxed” in table 3.6. Monetary data in 2014 \$. * 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 for individuals who received training are substantially better than the impacts for those individuals who did not receive training services. The employment rate is a little over six percentage points higher. The longer-term hourly wage net impact is just under \$4.00 per hour for individuals who received training versus less than \$0.70 for non-trainees. 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 longer-term net earnings impact for individuals who had been trained is over \$2,000 compared to about \$250 for individuals who exited, but didn't receive training. Trainee exiters were less likely to receive UI benefits, but if they did receive benefits, the average level was higher.

In the short term, the net quarterly earnings impact estimates for the 2012/2013 cohort of individuals who participated in training do not dominate non-trainees as they do for the 2010/2011 cohort. In fact, the net impacts for the employment rate and for quarterly hours for non-trainees are slightly higher than for trainees. However, the net impact on trainees' hourly wage rate is about \$1.00 less than for trainees, and the quarterly earnings net impact is about \$700 less.

4 WIA DISLOCATED WORKER PROGRAM

Over the period of analysis in this study, the Workforce Investment Act (WIA) 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 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 were 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 2010/2011 to individuals who registered for Wagner-Peyser services 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 2012/2013 to WP participants in the

same year. The data for the comparison group pool for the WIA Dislocated Workers are identical to the pool for the WIA Adults.

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

Characteristics	2010/2011		2012/2013	
	WIA Dislocated Workers	Wagner-Peyser	WIA Dislocated Workers	Wagner-Peyser
<u>Demographics</u>				
Female	43.7% ^{††}	43.2% ^{††}	40.9%	44.3%
Race:				
White	77.3%	64.9%	76.4%	62.7%
Black	4.1%	6.7%	6.1% ^{††}	6.4% ^{††}
Hispanic	6.6%	14.2%	7.0%	13.2%
Other race	9.1%	8.1%	7.9% ^{††}	8.3% ^{††}
Missing	2.8%	6.0%	2.5%	9.3%
Mean, age at registration	44.3	39.7	44.7	36.2
Employed at registration	5.7%	12.7%	5.4%	10.8%
Disability	3.9%	5.3%	3.9%	5.1%
Veteran	11.1%	9.9%	0.5%	8.6%
West WA	76.4%	60.4%	76.3%	60.9%
Urban county	51.0%	44.3%	50.5%	46.0%
<u>UI Benefits (prior to registration)</u>				
Quarter 1	\$2,857	\$1,180	\$2,973	\$125
Quarter 2	\$1,906	\$1,172	\$2,141	\$88
Quarter 3	\$1,117	\$962	\$1,637	\$76
Quarter 4	\$809	\$763	\$1,333	\$68
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	82.6%	70.7%	79.7%	68.7%
Average quarterly earnings ^a	\$9,516	\$5,978	\$8,915	\$6,281
Mean, earnings trend ^b	-\$4.3 ^{††}	-\$5.5 ^{††}	\$12.7	\$118.5
Mean, earnings variance ^b (in 10 ⁶ \$)	\$29.9	\$19.5	\$29.6	\$14.3
Job turnover	18.6%	19.3%	19.3%	12.9%
Percentage of quarters with multiple jobs	11.4%	14.9%	11.2%	11.8%
Had earnings dip	65.7%	57.7%	64.9%	28.1%
Mean, number of quarters since dip at registration ^a	1.9	2.4	2.0	0.9
Average earnings dip size in percentage ^a	52.1%	44.2%	52.1%	19.1%
Sample Size	3,760	331,268	3,057	178,493

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

The populations are different in their demographic characteristics. Not surprisingly, the dislocated workers are older than the Wagner-Peyser registrants, averaging about 44 years old compared to about 40 and 36 in the 2010/2011 and 2012/2013 cohorts respectively. They are less likely to be a minority, less likely to have a (self-reported) disability, are more likely to be a

veteran, and more likely to reside in West Washington and in an urban county. In terms of their labor market histories, the dislocated workers have higher levels of prior employment and average quarterly earnings. They are much more likely to have experienced a dip in earnings, and the size of their earnings dip is significantly greater. On the other hand, their average earnings trend is lower and variance in prior earnings is higher.

Participation Model

Table 4.2 provides the results from the logit estimation of participation. More precisely, the individuals who had registered for Wagner-Peyser services (but who had not received employment and training services in the Washington workforce development system) were pooled with the WIA 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 Adult program participation as described in the preceding chapter with one exception. Unemployment Insurance benefits amounts in the four quarters prior to enrollment were added after the original predicted propensity score failed to find good matches. The table provides the logit coefficient estimates and standard errors.

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 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.

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

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.259***	0.038	-0.097*	0.047
Race: (White is omitted category)				
Black	-0.381***	0.085	-0.007	0.090
Hispanic	-0.368***	0.071	-0.137	0.082
Other	-0.054	0.059	-0.192*	0.078
Missing	-0.504***	0.100	-0.904***	0.127
Age at registration	0.010***	0.002	0.034***	0.002
Employed at registration	-0.680***	0.071	-0.572***	0.089
Disability	-0.301***	0.087	0.044	0.105
Veteran	0.086	0.057	-3.621***	0.269
West WA	0.555***	0.043	0.733***	0.053
Urban county	-0.243***	0.038	-0.284***	0.047
<u>UI Benefits (prior to registration)</u>				
Quarter 1 (in 10 ³ \$)	0.355***	0.011	0.590***	0.014
Quarter 2 (in 10 ³ \$)	-0.082***	0.013	-0.071***	0.020
Quarter 3 (in 10 ³ \$)	-0.111***	0.015	0.056*	0.022
Quarter 4 (in 10 ³ \$)	-0.042**	0.014	0.174***	0.019
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	0.009***	0.001	-0.003*	0.001
Average quarterly earnings ^a (in 10 ² \$)	0.001*	0.000	-0.002***	0.000
Earnings trend ^b (in 10 ² \$)	-0.010*	0.004	0.006**	0.002
Earnings variance ^b (in 10 ⁸ \$)	-0.121***	0.036	-0.060	0.044
Job turnover	0.027***	0.002	0.030***	0.001
Percentage of quarters with multiple jobs	-0.017***	0.002	-0.015***	0.002
Had earnings dip	0.684***	0.088	0.848***	0.106
Number of quarters since dip at registration	-0.137***	0.012	-0.062***	0.015
Earnings dip size in percentage	-0.935***	0.098	-0.623***	0.120
Constant	-6.920***	0.187	-7.385***	0.240
Observations	335,028		181,550	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^a Average includes quarters with values of zero, if any.

^b Trend and variance calculations include quarters with zero earnings, if any.

***, **, * indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

In the model, the following demographic variables are positively associated with being in the treatment group at a statistically significant level (i.e., a WIA Dislocated Worker exiter) in both years of data: age and being from western Washington. The following demographic variables are negatively associated with being in the treatment group: being Hispanic or Black, having the race variable missing (white is the omitted category), and residing in an urban county. Among the labor market variables, the following are negatively related to participation in the WIA Dislocated Worker program: the percentage of quarters with multiple jobs, the mean of the earnings variance, average number of quarters since experiencing an earnings dip, and the

average size of the earnings dip. The only labor market variables that are positively associated with dislocated worker program participation are job turnover and having experienced an earnings dip. 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 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 Dislocated Worker analyses. There is a large difference in the means, although the difference for the 2010/2011 cohort is not as great as expected. The mean propensity scores for the treatment groups are between 0.039 and 0.224, whereas they are 0.011 and 0.013 for the comparison pool in 2010/2011 and 2012/2013, respectively. The 20th percentile indicators are reasonably large, achieving the 80 percent threshold in the 2012/2013 cohort.

Table 4.3 Indicators of Propensity Score (p-score) Model Quality for WIA Dislocated Worker Analyses

Statistic	2010/2011	2012/2013
Mean p-score, WIA Dislocated Worker	0.039	0.224
Mean p-score, Wagner-Peyser	0.011	0.013
Percentile Wagner-Peyser, at 20th percentile WIA Dislocated Worker	63.4%	86.9%

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 a relatively small percentage of the matches with multiple copies of the comparison group record—only 95 in the 2010/2011 analysis and about 400 in the 2012/2013 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 few variables had a difference in means that is significant.

Balance

As noted in chapter 2, one way to test for balance between the treatment and matched comparison group is by examining the Cohen d statistics, or standardized difference in means. A well-balanced matching group will have $d < 0.25$. Figure 4.1 shows this test graphically for the WIA dislocated worker sample. The top graph is for the 2010/2011 cohort and the bottom is for the 2012/2013 cohort. In the figures, the standardized difference in means for each variable used in the match using the entire matching pool sample (i.e., Wagner-Peyser data) and the treatment sample is shown with the heavy black dots. The same statistic using the matched sample is

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

Statistic/Characteristic	2010/2011		2012/2013	
	WIA Dislocated Workers	Wagner-Peyser	WIA Dislocated Workers	Wagner-Peyser
Sample size	3,760	333,317	3,057	179,587
Sample size used in match	3,760	331,268	3,057	178,493
Matched sample size	3,751	3,751	3,042	3,042
Number of observations used once	---	3,558	---	2,069
Number of observations used multiple times	---	95	---	395
Maximum number of repeats	---	3	---	7
Demographics				
Female	43.7%	43.7%	40.7%	40.7%
Race:				
White	77.3%*	78.9%*	76.5%	77.7%
Black	4.1%	3.6%	6.0%	5.7%
Hispanic	6.6%	6.4%	7.0%	6.5%
Other race	9.1%	8.4%	8.0%	7.9%
Missing	2.9%	2.7%	2.5%	2.2%
Mean, age at registration	44.3**	44.9**	44.7***	45.6***
Employed at registration	5.8%	6.1%	5.4%	5.6%
Disability	3.9%	3.4%	3.9%	4.4%
Veteran	11.1%	11.1%	0.5%	0.4%
West WA	76.4%	77.2%	76.1%	75.0%
Urban county	50.9%	50.8%	50.3%**	47.8%**
UI Benefits (prior to registration)				
Quarter 1	\$2,845	\$2,863	\$2,948	\$2,758
Quarter 2	\$1,908	\$1,979	\$2,112**	\$1,881**
Quarter 3	\$1,120	\$1,164	\$1,606***	\$1,468***
Quarter 4	\$811	&875	\$1,306**	\$1,243**
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	82.6%**	81.4%**	79.8%***	77.8%***
Average quarterly earnings ^a	\$9,495	\$9,323	\$8,908***	\$8,401***
Mean, earnings trend ^b	\$0.3	-\$4.4	\$13.6	\$5.1
Mean, earnings variance ^b (in 10 ⁶ \$)	\$29.7	\$28.8	\$29.5	\$27.9
Job turnover	18.6%	18.2%	19.3%***	21.0%***
Percentage of quarters with multiple jobs	11.5%	11.1%	11.2%	11.5%
Had earnings dip	65.7%	64.8%	64.8%	66.0%
Mean, number of quarters since dip at registration ^a	1.9	1.8	2.0	2.0
Average earnings dip size in percentage ^a	52.1%	51.4%	51.9%	52.3%
Sample Size	3,751	3,751	3,042	3,042

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***, * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^a Averages include observations with values of zero.

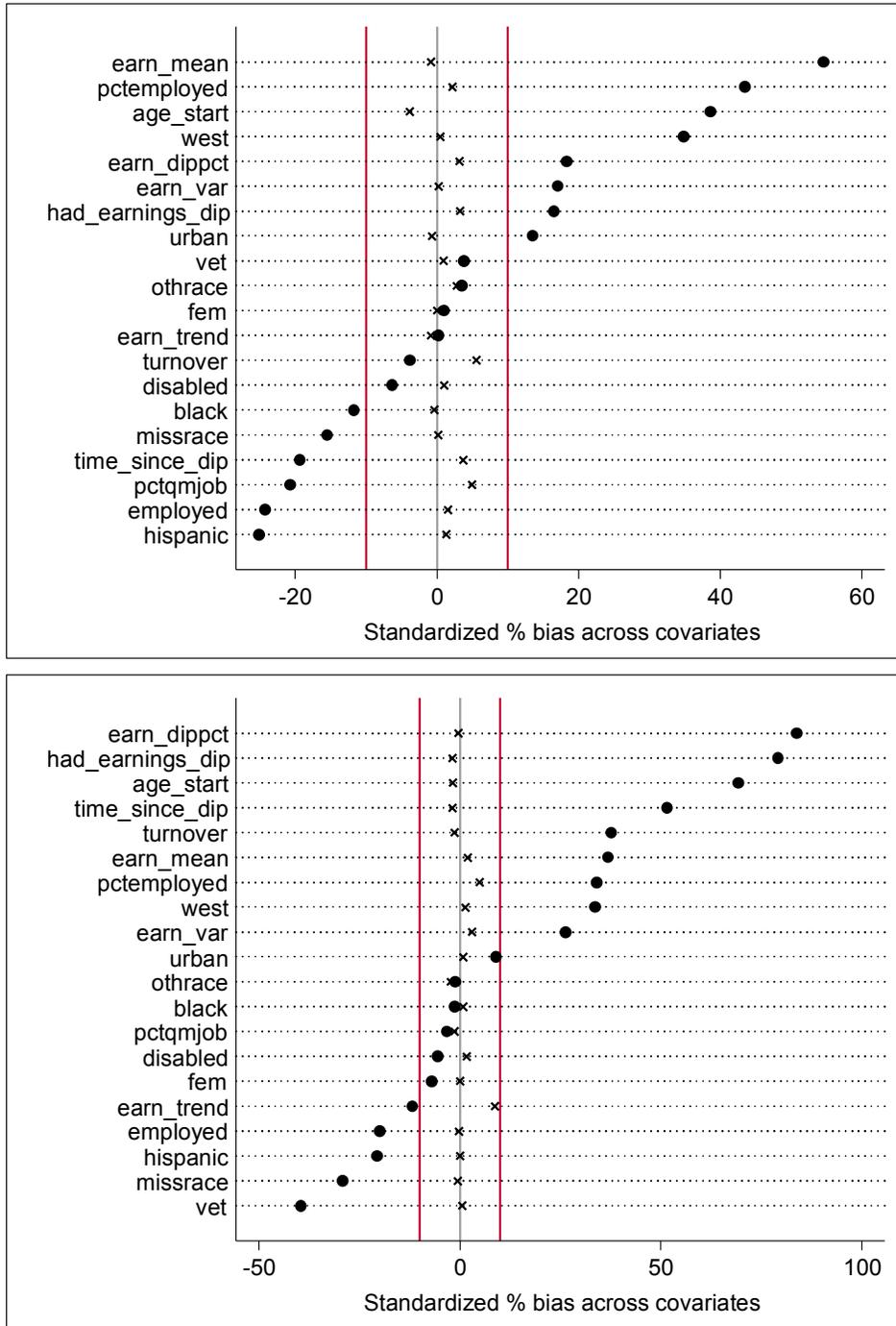
^b Trend and variance calculations include quarters with zero earnings, if any.

shown with “x’s.” The vertical lines are drawn at ± 0.10 . The figures show visually how the bias is reduced by matching. No variates are outside of the 0.10 bound in both cohorts.

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

Figure 4.1 Standardized Difference in Means, Pre- and Post-match, WIA Dislocated Workers



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

WIA Dislocated Workers for the two cohorts. The first table displays the short-term (3 quarters after exit) and the longer-term (9-12 quarters after exit) outcomes for the 2010/2011

Table 4.5 Net Impact Estimates for WIA Dislocated Worker Program for 2010/2011 Cohort

Outcome	Matched	Comparison Group Means			
	Sample	Full Sample		Matched Sample	
	Estimator	With 0	W/O 0	With 0	W/O 0
	Average Treatment Effect				
Employment (percentage points) ^a					
Short term	13.0***	54.2	--	55.2	--
Ever-employed, longer term	5.4***	64.9	--	66.4	--
Percent of quarters, longer term	7.4***	55.2	--	57.9	--
Percent of quarters, longer term, diff-in-diff	5.2***	-7.6	--	-20.6	--
Hourly wage					
Short term (\$)	3.35***	9.93	18.08	11.72	21.04
Short term, diff-in-diff (\$)	3.86***	-3.79	-2.46	-9.82	-4.93
Longer term (4-quarter average) (\$)	2.30***	10.78	18.92	13.13	22.10
Longer term, diff-in-diff (\$)	2.82***	-2.94	-1.62	-8.41	-4.44
Quarterly hours					
Short term	84.2***	206.1	375.3	218.6	392.4
Short term, diff-in-diff	52.0***	-39.1	13.0	-121.9	-18.0
Longer term (4-quarter average)	54.7***	226.4	378.8	248.3	402.6
Longer term, diff-in-diff	22.5***	-18.9	19.9	-92.1	-7.4
Quarterly earnings					
Short term (\$)	1,881***	3,810	6,937	4,760	8,547
Short term, diff-in-diff (\$)	1,683***	-1,668	-774	-4,688	-2,302
Longer term (4-quarter average) (\$)	1,455***	4,491	7,437	5,714	9,187
Longer term, diff-in-diff (\$)	1,256***	-988	-246	-3,734	-1,921
Unemployment Insurance Benefits					
Percent receiving, short term	-20.1***	24.3	--	34.2	--
Benefits, short term (\$)	-921***	788	3,242	1,369	3,994
Ever-received, longer term	-1.4	15.0	--	16.7	--
Benefits, longer term (4-quarter average) (\$)	40**	171	2,016	225	2,308

NOTE: Monetary data in 2014 \$. 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 row 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.

^a Short term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. The first column in each of the tables presents the net impact estimate, which is the average treatment effect. 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 4.6 Net Impact Estimates for WIA Dislocated Worker Program for 2012/2013 Cohort

Outcome	Matched Sample Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
		With 0	W/O 0	With 0	W/O 0
Employment ^a					
Short term	10.0***	60.7	--	60.0	--
Hourly wage					
Short term (\$)	1.99***	11.47	18.69	12.84	21.19
Short term, diff-in-diff (\$)	2.97***	-2.96	-1.52	-7.16	-5.07
Quarterly hours					
Short term	73.5***	236.8	386.0	234.3	386.7
Short term, diff-in-diff	46.4***	-30.7	-0.1	-68.1	9.7
Quarterly earnings					
Short term (\$)	1,453***	4,555	7,426	5,053	8,340
Short term, diff-in-diff (\$)	1,218***	-1,764	-973	-3,207	-1,901
Unemployment Insurance Benefits					
Percent receiving, short term	-3.7***	9.7	--	14.5	--
Benefits, short term (\$)	-76**	205	2,121	373	2,577

NOTE: Monetary data in 2014 \$. 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 row 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.

^a Short term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The longer-term impacts displayed in Table 4.5 show that the Dislocated Worker program engenders quite substantial net impacts on average. Employment is up by over 7 percentage points, hourly wages are up by \$2.30, and average hours worked per quarter is up by almost 55 hours. Since employment, wage rates, and hours are increased, average quarterly earnings are also increased by almost \$1,500 (2014\$). The receipt of unemployment insurance is decreased, although the net impact on benefit levels is positive.

The results in Tables 4.5 and 4.6 show that for exiters 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 almost \$1,900 for the 2010/2011 cohort and over \$1,450 for the 2012/2013 cohort, which represents impacts of about 22 and 17 percent, respectively. In both cohorts, the short-term net impact estimators show a decrease in the take-up of unemployment insurance benefits. In the earlier cohort, this decrease is especially large.

As noted earlier, our preferred estimate for the short-term net impacts is the average of the short-run impacts from Tables 4.5 and 4.6. These are presented in Table 4.7. The results in this table suggest that in the short term, the WIA Dislocated Worker program have large and significant positive effects on employment and earnings. The short-term net impact estimators from both cohorts are larger than the longer-term net impacts, so of course, their average is larger. In short, our estimates suggest that this program has large and significant labor market impacts that are still large, but somewhat attenuated, in the longer-term.

Table 4.7 Short-Term Net Impact Estimates for WIA Dislocated Worker Program

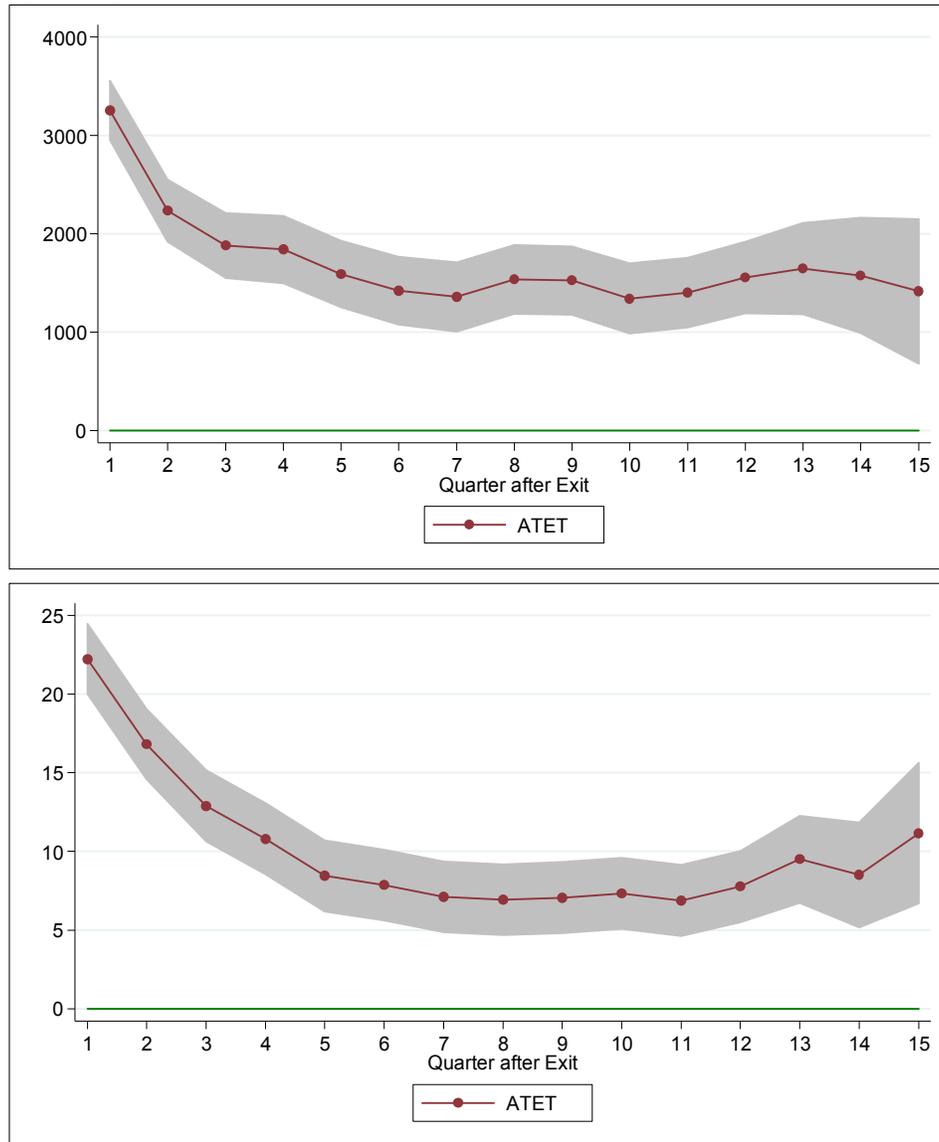
	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	13.0***	10.0***	11.5***
Hourly wage			
Short term (\$)	3.35***	1.99***	2.67***
Short term, diff-in-diff (\$)	3.86***	2.97***	3.42***
Quarterly hours			
Short term	84.2***	73.5***	78.9***
Short term, diff-in-diff	52.0***	46.4***	49.2***
Quarterly earnings			
Short term (\$)	1,881***	1,453***	1,667***
Short term, diff-in-diff (\$)	1,683***	1,218***	1,450***
Unemployment Insurance Benefits			
Percent receiving, short term	-20.1***	-3.7***	-11.9***
Benefits, short term (\$)	-921***	-76**	-499***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

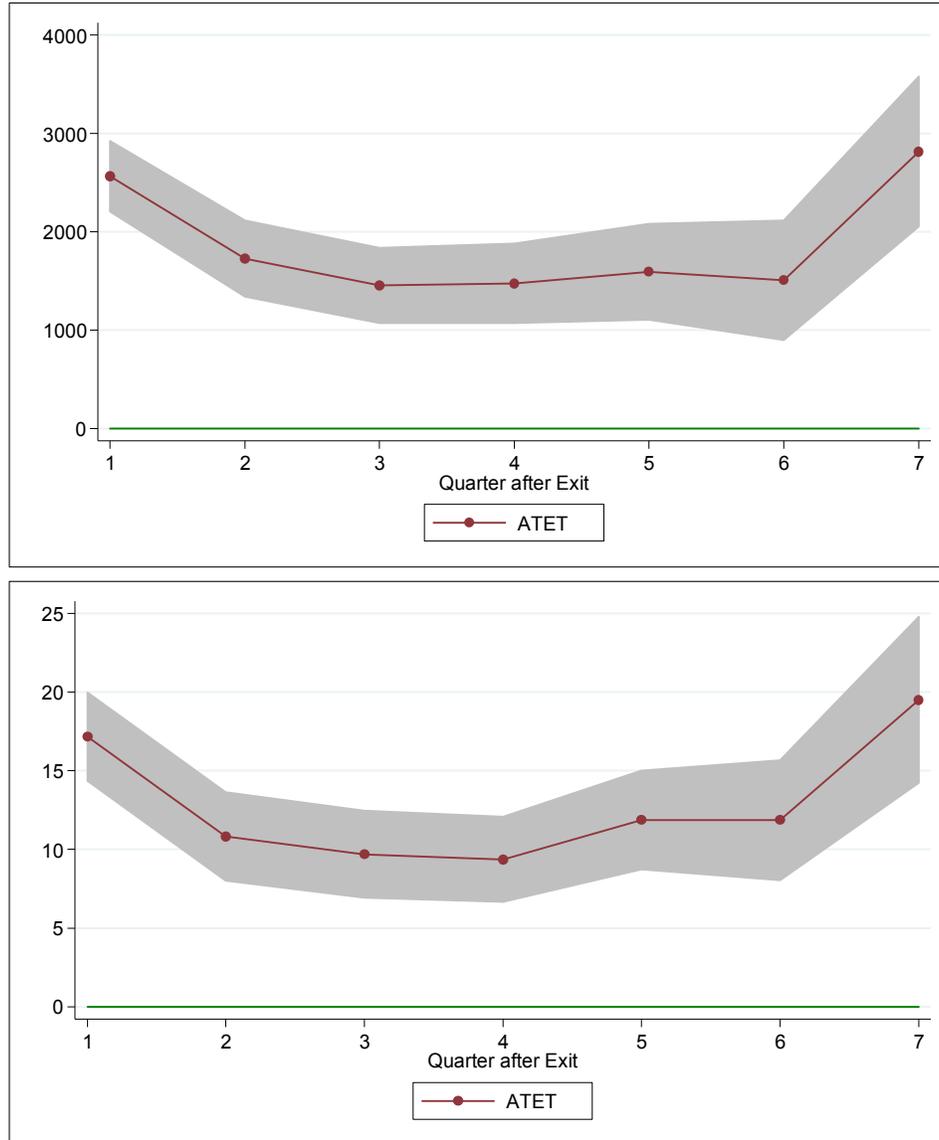
Figures 4.2 and 4.3 present the net impacts on earnings and employment for each quarter after exit for 15 quarters for the 2010/2011 cohort and for 7 quarters for the 2012/2013 cohorts, respectively. The shaded portion of the graphs are the 95 percent confidence limits on the net impact estimates. Again, note that the employment impacts graphed in Figure 4.2 do not track precisely with the estimates in Table 4.5.

Figure 4.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Dislocated Worker Program, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 4.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Dislocated Worker Program, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Subgroup Analyses

About 70 percent of the WIA dislocated worker participants are coded in the administrative data as having received training. Tables 4.8 and 4.9 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 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.

Table 4.8 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Dislocated Worker Participants: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	6.3%**	7.8%**	57.9%
Hourly Wage	\$2.97***	\$2.08***	\$13.13
Hours Worked (quarterly)	47.8**	57.0***	248.3
Earnings (quarterly)	\$1,721***	\$1,367***	\$5,714
UI Receipt	-1.1%***	-1.6%***	16.7%
UI Benefits (quarterly)	\$14***	\$49***	225
Subgroup Sample Size	932	2,819	—

NOTE: Outcomes shown in the table are the preferred outcomes that are “boxed” in table 4.5. Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). – means not applicable.

Table 4.9 Selected Short-Term Net Impact Estimates for Subgroups of WIA Dislocated Worker Participants: 2012/2013 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	7.7%***	11.0%***	60.0%
Hourly Wage	\$2.56***	\$1.73***	\$12.84
Hours Worked (quarterly)	50.7***	83.6***	234.3
Earnings (quarterly)	\$1,438***	\$1,460***	\$5,053
UI Receipt	-1.4%***	-4.7%***	14.5%
UI Benefits (quarterly)	\$37***	-\$127***	\$373
Subgroup Sample Size	936	2,106	—

NOTE: Outcomes shown in the table are the preferred outcomes that are “boxed” in table 4.6. Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). – means not applicable.

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.

5 WIA YOUTH PROGRAM

The Workforce Investment Act (WIA) youth program prepared low-income youth ages 14 to 21 for academic and employment success. Youth were assessed to determine academic, skill level, and support service needs. Staff members of the local workforce investment area worked with each young person to develop a plan that may have encompassed counseling, tutoring, job training, mentoring, or work experience. Other strategies included summer employment, study skills training, or basic skills instruction in preparation for obtaining a GED. Youth ages 18 to 21 may have been co-enrolled in WIA Adult programs. At least 30 percent of the funding was to 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 2010/2011 to individuals under 22 who registered for Wagner-Peyser (WP) services 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 2012/2013 to WP exiters in the same year.

The populations are dissimilar. In particular, the WIA Youth are younger (from one to two years on average), are more likely to be female, and are more likely to be from an urban county and from western Washington than the WP registrants. The WIA youth have less

employment and earnings prior to registration: lower prior employment rates, lower average quarterly earnings, a lower trend in prior earnings, and more turnover. The WIA Youth exiters have \$1,000 less in average quarterly earnings prior to registration than the WP registrants (who are also youthful). In short, compared to the entire Wagner-Peyser group of individuals, the WIA Youth seem to have much less human capital in the form of prior employment.

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

Characteristics	2010/2011		2012/2013	
	WIA Youth	Wagner-Peyser	WIA Youth	Wagner-Peyser
<u>Demographics</u>				
Female	53.0%	47.7%	52.0%	45.1%
Race:				
White	51.4% ^{††}	51.8% ^{††}	49.8%	53.2%
Black	13.3%	6.4%	12.5%	6.4%
Hispanic	22.1% ^{††}	23.6% ^{††}	22.4% ^{††}	21.1% ^{††}
Other race	12.3%	6.5%	12.7%	6.5%
Missing	0.8%	11.8%	2.6%	12.9%
Mean, age at registration	18.3	20.1	18.5	19.6
Employed at registration	5.7%	11.7%	5.3%	10.4%
Disability	13.5%	2.7%	10.5%	2.9%
Veteran	0.2%	2.0%	0.0%	2.8%
West WA	61.6%	50.2%	61.3%	48.9%
Urban county	46.1%	30.9%	47.0%	32.0%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	27.0%	48.8%	20.6%	50.3%
Average quarterly earnings ^a	\$404	\$1,376	\$324	\$1,515
Mean, earnings trend ^b	-\$30.2	\$46.5	-\$15.0	\$126.3
Mean, earnings variance ^b (in 10 ⁶ \$)	\$0.5	\$2.7	\$0.5	\$2.4
Job turnover	32.8%	17.6%	27.7%	15.2%
Percentage of quarters with multiple jobs	4.5%	12.4%	3.4%	11.5%
Had earnings dip	32.3%	46.7%	23.4%	29.1%
Mean, number of quarters since dip at registration ^a	1.1	2.0	0.8	1.0
Average earnings dip size in percentage ^a	28.9%	37.2%	21.0%	23.2%
Sample Size	1,871	35,101	1,994	41,525

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}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 registered for Wagner-Peyser

services (but who had not received employment and training services in Washington) and the WIA 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 Program

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.136*	0.058	0.145**	0.052
Race: (White is omitted category)				
Black	0.246**	0.095	0.226**	0.086
Hispanic	-0.090	0.077	0.137*	0.070
Other	0.422***	0.095	0.452***	0.084
Missing	-2.859***	0.274	-1.610***	0.148
Age at the start of the program	-0.725***	0.021	-0.277***	0.016
Employed at registration	-0.149	0.118	-0.552***	0.112
Disability	1.520***	0.098	1.072***	0.091
West WA	0.337***	0.068	0.407***	0.060
Urban county	0.673***	0.067	0.652***	0.060
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.016***	0.002	-0.025***	0.002
Average quarterly earnings ^a (in 10 ² \$)	0.012**	0.004	0.005	0.004
Earnings trend ^b (in 10 ² \$)	-0.053***	0.014	-0.051***	0.009
Earnings variance ^b (in 10 ⁸ \$)	-16.154***	2.755	-12.586***	2.171
Job turnover	0.056***	0.002	0.052***	0.001
Percentage of quarters with multiple jobs	-0.032***	0.003	-0.034***	0.003
Had earnings dip	0.015	0.273	-0.229	0.286
Number of quarters since dip at registration	-0.208***	0.024	-0.084**	0.027
Earnings dip size in percentage	0.015	0.266	-0.213	0.281
Constant	10.051***	0.421	2.031***	0.330
Observations	36,972		43,519	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^a Average includes quarters with values of zero, if any.

^b Trend and variance calculations include quarters with zero earnings, if any.

***, ** indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

The following demographic variables are significantly correlated with being in the treatment group (i.e., a WIA participant) in both years of data: being female, being a nonHispanic minority, having a disability, residing in an urban county, and being from western Washington. Among the demographic variables, the only covariate that is negatively associated

with participation is age. Among the prior labor force variables, the two variables that are positively related to participation are job turnover and prior earnings (the latter is not significant in the 2012/2013 cohort). Most of the prior labor force variables are negatively related to participation: prior employment percentage, prior earnings trend and variance, and number of quarters since 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. The mean p-score for the treatment group is 0.336 in 2010/2011, which is over several times larger than the mean for the comparison pool—0.035. For the 2012/2013 data, the difference is also substantial, 0.229 to 0.037. 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 Youth analyses. These indicators are right around 80 percent suggesting that the model satisfactorily discriminates.

Table 5.3 Indicators of Propensity Score (p-score) Model Quality for WIA Youth Analyses

Statistic	2010/2011	2012/2013
Mean p-score, WIA Youth	0.336	0.229
Mean p-score, Wagner-Peyser	0.035	0.037
Percentile Wagner-Peyser, at 20th percentile WIA Youth	84.3%	77.5%

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 the 2010/2011 and 2012/2013 matches, over 25 percent of the records used in the match had multiple observations.

Balance

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 2010/2011 analysis, three characteristics displayed in the data have means that are statistically different from each other, and in the 2012/2013 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. Figure 5.1 shows the standardized difference in means, and unlike the equivalent figures in the prior two chapters, here a number of variates are outside of the ± 0.10 limits.

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

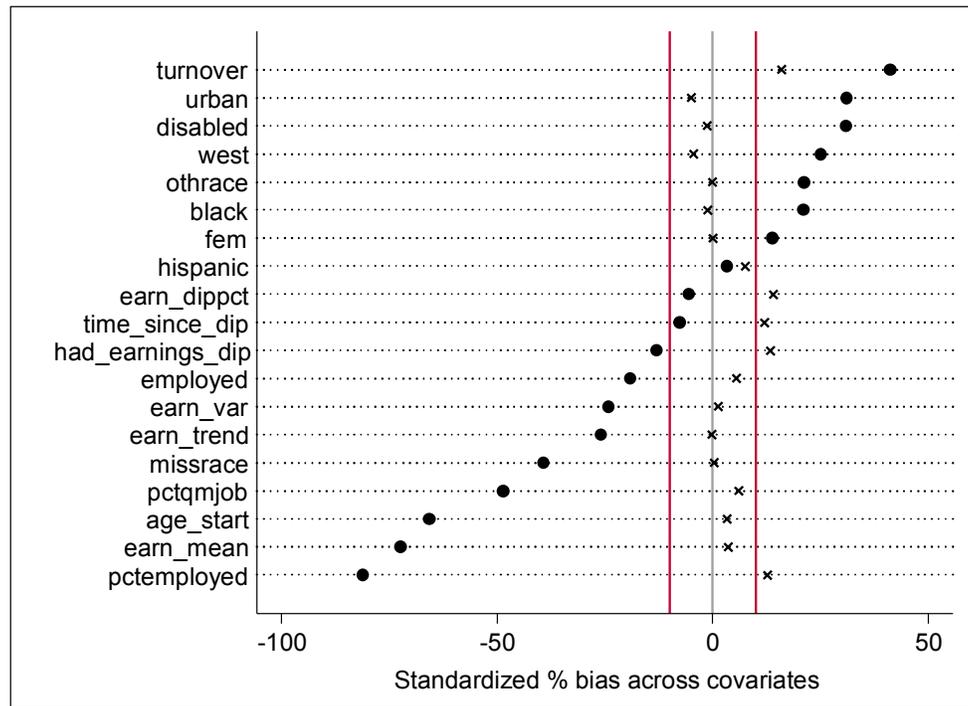
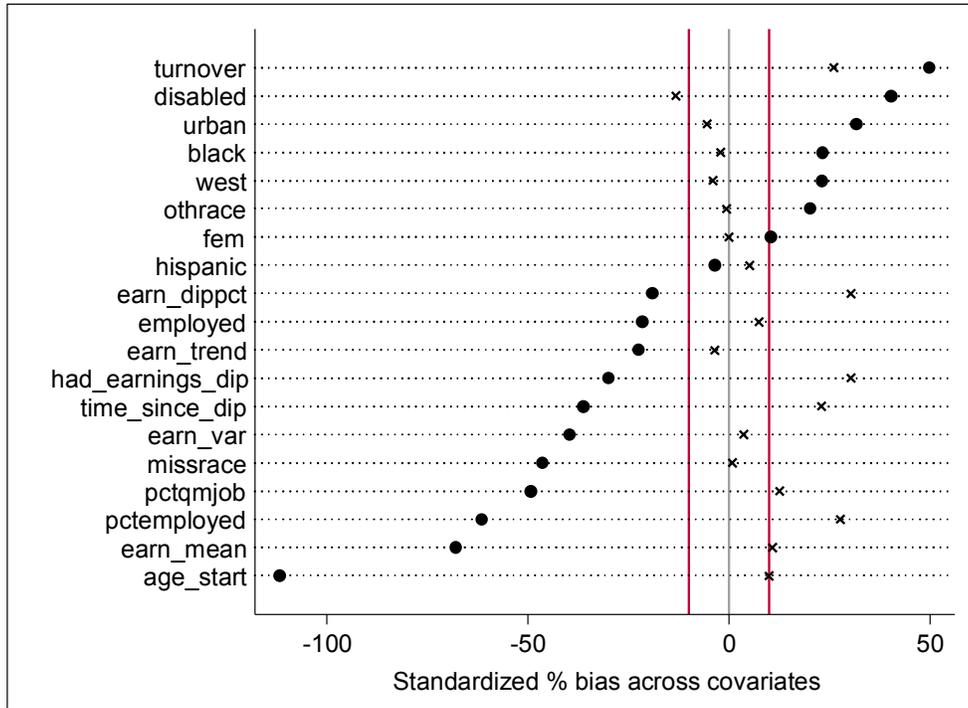
Statistic/Characteristic	2010/2011		2012/2013	
	Training Program	Wagner-Peyser	Training Program	Wagner-Peyser
Sample size	1,871	35,538	1,994	42,000
Sample size used in match	1,871	35,101	1,994	41,525
Matched sample size	1,583	1,583	1,790	1,790
Number of observations used once	---	508	---	588
Number of observations used multiple times	---	213	---	213
Maximum number of repeats	---	29	---	38
<u>Demographics</u>				
Female	53.1%	53.1%	52.0%	52.0%
Race:				
White	51.5%	53.0%	50.7%	53.5%
Black	12.8%	13.5%	12.3%	12.6%
Hispanic	22.7%	20.6%	22.2%**	19.2%**
Other race	12.0%	12.2%	11.8%	11.9%
Missing	0.9%	0.8%	2.9%	2.8%
Mean, age at registration	18.4***	18.2***	18.5	18.4
Employed at registration	6.2%***	4.1%***	5.3%**	3.8%**
Disability	11.7%***	15.3%***	10.1%	10.4%
Veteran	0.2%*	0.6%*	0.0%***	1.7%***
Urban county	45.7%	48.4%	46.7%	49.1%
West WA	60.7%	62.7%	60.6%	62.8%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	25.0%***	15.2%***	19.8%***	15.2%***
Average quarterly earnings ^a	\$407***	\$252***	\$337**	\$279**
Mean, earnings trend ^b	-\$15.0	-\$2.6	\$0.6	\$2.4
Mean, earnings variance ^b (in 10 ⁶ \$)	\$0.5***	\$0.3***	\$0.5*	\$0.4*
Job turnover	22.2%***	14.2%***	19.7%***	14.8%***
Percentage of quarters with multiple jobs	4.9%***	2.8%***	3.8%***	2.8%***
Had earnings dip	28.4%***	13.8%***	19.6%***	13.7%***
Mean, number of quarters since dip at registration ^a	1.0***	0.5***	0.7***	0.4***
Average earnings dip size in percentage ^a	24.7%***	11.6%***	17.1%***	11.6%***
Sample Size	1,583	1,583	1,790	1,790

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^a Averages include observations with values of zero.

^b Trend and variance calculations include quarters with zero earnings, if any.

Figure 5.1 Standardized Difference in Means, Pre- and Post-match, WIA Youth



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

Net Impacts

Tables 5.5 and 5.6 provide the estimated net impacts of the WIA Youth programs on clients for the two cohorts. As with comparable tables in the prior chapters, the first table displays the short-term (3 quarters after exit) and the longer-term (9 to 12 quarters after exit) outcomes for the 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. As with the WIA Dislocated Workers, we use the levels of the outcome variables as the dependent variable for which we are estimating the net impact. The final four columns of data in the table provide the means of the dependent variables

Table 5.5 Net Impact Estimates for WIA Youth Program for 2010/2011 Cohort

Outcome	Matched Sample Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
		With 0	W/O 0	With 0	W/O 0
Employment (percentage points) ^a					
Short term	13.5***	52.9	---	30.9	---
Ever-employed, longer term	7.2**	69.9	---	58.2	---
Percent of quarters, longer term	6.7**	56.4	---	43.4	---
Percent of quarters, longer term, diff-in-diff	-6.6**	15.4	---	37.5	---
Hourly wage					
Short term (\$)	1.40***	6.58	12.20	3.58	11.22
Short term, diff-in-diff (\$)	0.59	1.35	0.47	2.28	0.91
Longer term (4-quarter average) (\$)	0.82**	7.74	13.24	5.39	11.86
Longer term, diff-in-diff (\$)	0.01	2.50	1.82	4.10	1.52
Quarterly hours					
Short term	32.7**	175.6	325.3	100.9	316.4
Short term, diff-in-diff	16.5	54.9	80.9	79.9	149.6
Longer term (4-quarter average)	24.3	207.7	330.9	141.0	284.3
Longer term, diff-in-diff	8.2	87.1	96.6	120.0	151.5
Quarterly earnings					
Short term (\$)	363**	2,133	3,951	1,034	3,242
Short term, diff-in-diff (\$)	232	645	1,133	796	1,915
Longer term (4-quarter average) (\$)	250	2,882	4,530	1,778	3,515
Longer term, diff-in-diff (\$)	118	1,394	1,927	1,540	2,348

NOTE: Monetary impacts in 2014 \$. 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 row 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

for the particular outcomes, so that percentage impacts can be calculated. Note that we do not have UI benefits as an outcome variable for WIA Youth.

In our prior studies, we have usually found negative net impact estimates for WIA Youth. However, the longer-term and short term net impact estimates shown in Table 5.5 are positive for employment, hourly wages, hours worked, and earnings (the longer-term estimates for the latter two are not statistically significant). The short-term net impact results displayed in Table 5.6 for the 2012/2013 cohort are opposite, however, and are more in conformance with the findings from prior studies. The net impacts shown there are quite negative and statistically significant. Given the prior negative findings for this population, it may be the case that the 2010/2011 cohort is idiosyncratic.

Table 5.6 Net Impact Estimates for WIA Youth Program for 2012/2013 Cohort

Outcome	Matched Sample	Comparison Group Means			
	Estimator	Full Sample		Matched Sample	
	Average Treatment Effect	With 0	W/O 0	With 0	W/O 0
Employment ^a					
Short term	-10.6**	62.5		59.4	
Hourly wage					
Short term (\$)	-2.24***	8.84	13.92	7.73	12.93
Short term, diff-in-diff (\$)	-1.70***	3.45	2.62	5.86	2.84
Quarterly hours					
Short term	-57.8***	223.2	351.4	198.7	332.4
Short term, diff-in-diff	-51.8**	98.6	113.7	166.2	192.0
Quarterly earnings					
Short term (\$)	-1,154***	3,191	5,025	2,697	4,512
Short term, diff-in-diff (\$)	-921***	1,619	2,381	2,214	3,078

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

As noted earlier, our preferred estimate for the short-term net impacts is the average of the short-run impacts from Tables 5.5 and 5.6. These are presented in Table 5.7. With exception of employment, the more negative estimates for the 2012/2013 cohort are larger in absolute value than the short-term estimates for the 2010/2011 cohort, so the average that is shown in the

final column of the table is negative. In short, our (averaged) estimates suggest that this program has does not provide positive labor market outcomes for youth.

Table 5.7 Short-Term Net Impact Estimates for WIA Youth Program

	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	13.5***	-10.6**	1.5
Hourly wage			
Short term (\$)	1.40***	-2.24***	-0.42
Short term, diff-in-diff (\$)	0.59	-1.70***	-1.14***
Quarterly hours			
Short term	32.7**	-57.8***	-12.6
Short term, diff-in-diff	16.5	-51.8**	-17.6*
Quarterly earnings			
Short term (\$)	363**	-1,154***	-395***
Short term, diff-in-diff (\$)	232	-921***	-344**

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

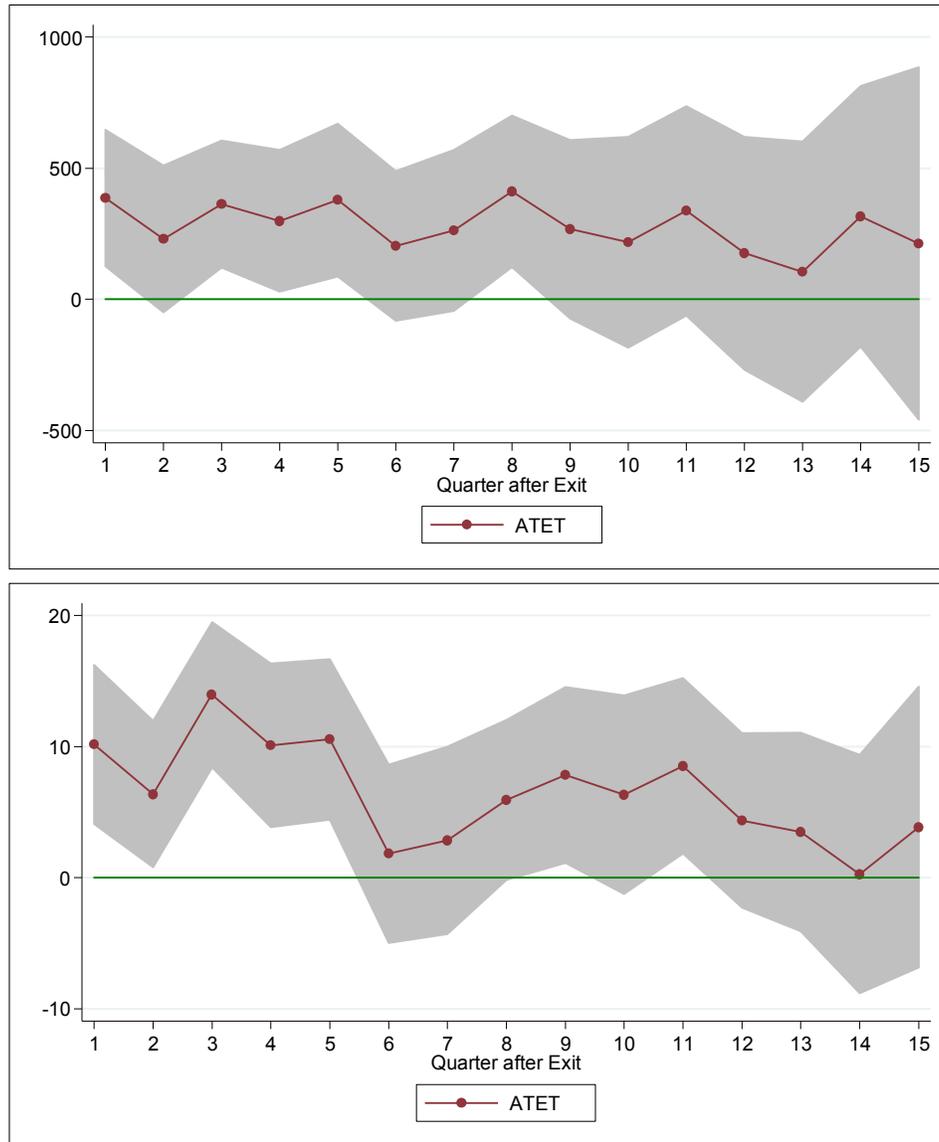
^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

Figures 5.2 and 5.3 present the estimated net impacts on earnings and employment for each quarter after exit for 15 quarters for the 2010/2011 cohort and for 7 quarters for the 2012/2013 cohorts, respectively. The shaded portion of the graphs are the 95% confidence limits on the net impact estimates.

Subgroup Analyses

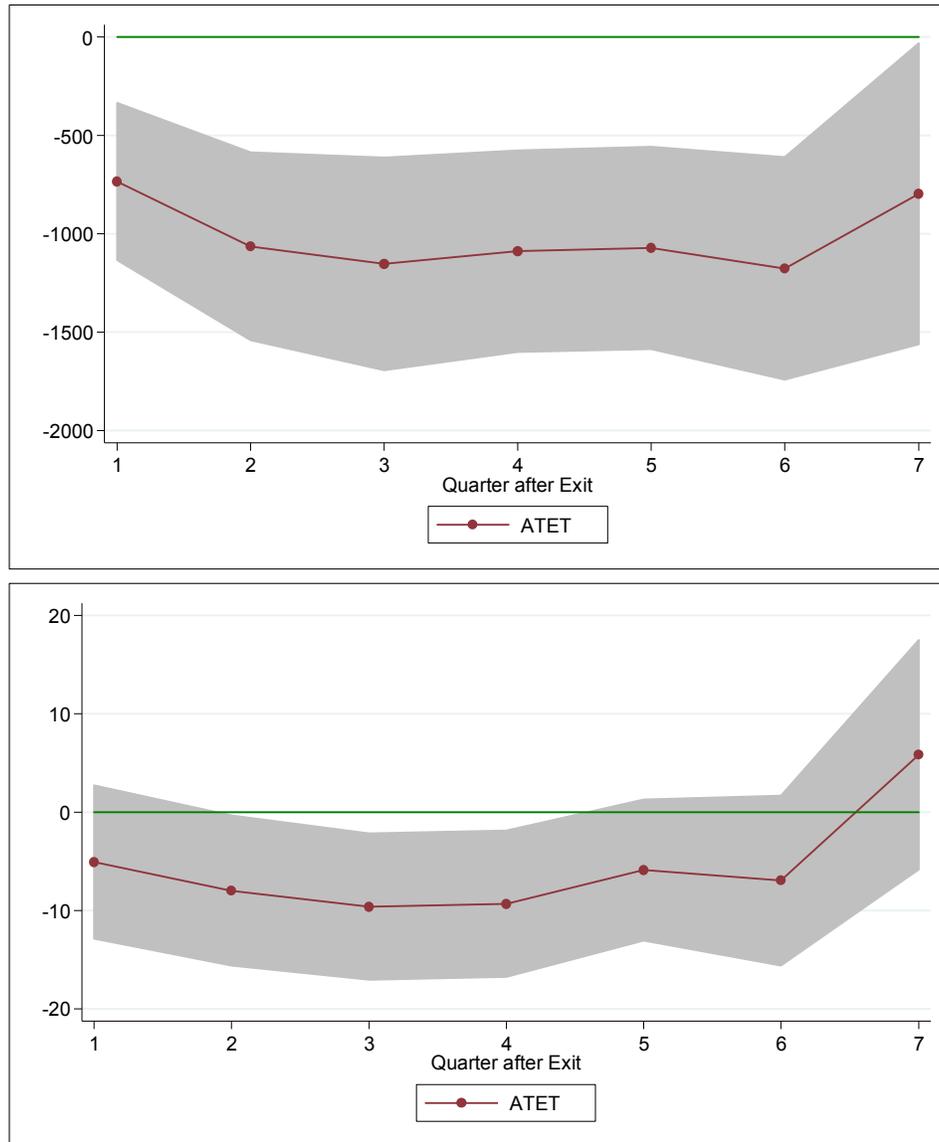
According to the administrative data, training is not as prevalent for WIA Youth as it is for Adults or Dislocated Workers, but we still find that around 25 percent of exiters are reported to have received training services. Tables 5.8 and 5.9 display the net impact estimates for that subgroup along 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 (less negative) than the net impacts for participants who did not get training. In the longer-term (2010/2011 cohort), the employment and earnings outcomes for the participants with training are two to three times greater than for all other participants. In the short-term, they are 30 to 0

Figure 5.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Youth Program, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 5.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of WIA Youth Program, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

percent less negative. All in all, the results suggest that there is a substantial payoff to training for WIA Youth.

Table 5.8 Selected Longer-Term Net Impact Estimates for Subgroups of WIA Youth Participants: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	5.6%**	10.2%**	43.4%
Hourly Wage	\$0.52**	\$1.86***	\$5.39
Hours Worked (quarterly)	18.6**	43.7**	141.0
Earnings (quarterly)	\$141**	\$620**	\$1,778
Subgroup Sample Size	1,225	358	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

Table 5.9 Selected Short-Term Net Impact Estimates for Subgroups of WIA Youth Participants: 2012/2013 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Participants who did not receive training	Participants with training	
Employment	-11.8%***	-7.4%**	59.4%
Hourly Wage	-\$2.46***	-\$1.67***	\$7.73
Hours Worked (quarterly)	-69.4***	-27.9**	198.7
Earnings (quarterly)	-\$1,366***	-\$611***	\$2,697
Subgroup Sample Size	1,288	502	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

6 COMMUNITY AND TECHNICAL COLLEGE WORKFORCE EDUCATION

Workforce education programs represent the applied (non-transfer) training mission of community and technical colleges (CTCs). Programs prepare individuals to enter a variety of 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 on 34 community and technical college 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 Wagner-Peyser (WP) clients who were 16 to 70 at the time of registration. The individuals who had participated in other workforce development programs were removed from the data. The first two columns of numbers compare the community and technical college students in Workforce Education programs who exited in 2010/2011²¹ to individuals in the comparison group. The final two columns compare the community and technical college students in 2012/2013 to WP registrants in the same year.

The populations are dissimilar. The community and technical college students are considerably younger. The average age of the students when they entered the community and technical college system is about 31, whereas the average age of the WP registrants when they registered is 36 to

²¹ In this and the succeeding three chapters that analyze CTC programs, exiters include students who complete a credential as well as those who exit the system without a credential.

40. Also, there is a much larger percentage of females and much higher percentage of individuals with other (nonwhite, nonblack, nonHispanic) racial background in the community and technical college exiter population than in Wagner-Peyser registrants. Geographically, the table shows that CTC Workforce Education students are disproportionately from western Washington and from urban counties.

Table 6.1 Descriptive Statistics for CTC Workforce Education Treatment Group and Comparison Group Universe

Characteristics	2010/2011		2012/2013	
	Workforce Education	Wagner-Peyser	Workforce Education	Wagner-Peyser
<u>Demographics</u>				
Female	56.5%	43.2%	55.7%	44.4%
Race				
White	65.5%	64.7%	62.9% ^{††}	62.4% ^{††}
Black	6.8% ^{††}	6.7% ^{††}	6.8%	6.4%
Hispanic	8.1%	14.4%	8.9%	13.8%
Other race	19.4%	8.1%	21.0%	8.2%
Missing	0.3%	6.1%	0.4%	9.2%
Mean, age at registration	31.0	39.5	30.7	35.7
Disability	6.6%	5.2%	7.3%	5.1%
West WA	81.5%	60.3%	81.3%	60.3%
Urban county	62.8%	44.1%	63.1%	45.5%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	59.0%	70.4%	57.2%	67.6%
Average quarterly earnings ^a	\$3,335	\$5,944	\$3,096	\$6,152
Mean, earnings trend ^b	\$36.6	-\$5.5	\$42.1	\$115.7
Mean, earnings variance ^b (in 10 ⁶ \$)	\$8.8	\$19.4	\$8.4	\$14.0
Job turnover	31.4%	19.2%	31.2%	12.7%
Percentage of quarters with multiple jobs	12.8%	14.9%	12.3%	11.6%
Had earnings dip	40.5%	57.5%	37.0%	27.9%
Mean, number of quarters since dip at registration ^a	1.6	2.4	1.4	0.9
Average earnings dip size in percentage ^a	32.0%	44.1%	29.0%	19.0%
Sample Size	34,522	333,316	31,182	182,399

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

The bottom panel of the table shows that the prior employment and earnings experiences of the two populations are quite different as well. In particular, the community and technical college participants had lower percentages of quarters with prior employment, much lower average earnings prior to registration, and more job turnover. The pre-registration average

quarterly earnings levels of Wagner-Peyser registrants are over \$2,500 greater than the student earnings levels prior to their registration in community and technical colleges.

Participation Model

Table 6.2 provides the results from the logit estimation of participation in a Community and Technical College Workforce Education program. The dependent variable in this econometric model, which was estimated with a sample that pooled the individuals who had registered for Wagner-Peyser services (but who had not participated in other workforce development programs in Washington) with the Community and Technical College Workforce Education students who had exited, is a dummy variable equal to 1 for the students (and 0 for the WP clients). The table provides the logit coefficient estimates and standard errors.

Table 6.2 Coefficient Estimates from a Logit Model of Participation in CTC Workforce Education

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
Demographics				
Female	0.294***	0.013	0.335***	0.015
Race: (White and missing are omitted categories)				
Black	-0.473***	0.025	-0.283***	0.029
Hispanic	-0.204***	0.023	0.012	0.025
Other	0.758***	0.017	0.918***	0.019
Age at registration	-0.047***	0.001	-0.018***	0.001
Disability	0.405***	0.026	0.463***	0.028
West WA	0.900***	0.017	0.898***	0.019
Urban county	0.602***	0.014	0.472***	0.016
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	-0.002***	0.000	-0.008***	0.000
Average quarterly earnings ^a (in 10 ² \$)	-0.001***	0.000	-0.005***	0.000
Earnings trend ^b (in 10 ² \$)	-0.006***	0.001	-0.008***	0.001
Earnings variance ^b (in 10 ⁸ \$)	-0.233***	0.033	0.084***	0.021
Job turnover	0.037***	0.000	0.035***	0.000
Percentage of quarters with multiple jobs	-0.023***	0.000	-0.016***	0.000
Had earnings dip	0.005	0.038	-0.392***	0.044
Number of quarters since dip at registration	-0.095***	0.004	0.055***	0.005
Earnings dip size in percentage	-0.431***	0.038	0.314***	0.045
Constant	-2.280***	0.058	-2.743***	0.061
Observations	367,838		213,581	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^a Average includes quarters with values of zero, if any.

^b Trend and variance calculations include quarters with zero earnings, if any.

***, **, * indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

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 Workforce Education exiter.

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 Workforce Education student) in both years of data: Female, having a disability, being from Western Washington, residing in an urban county, and job turnover. The following variables are significantly correlated with being a Wagner-Peyser registrant: age at registration, African American, percent of quarters in the labor market prior to enrollment with employment, average earnings prior to registration, and trend and variance in earnings prior to registration. The results are consistent with the notion that the Community and Technical College Workforce Education programs seem to attract 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 and Technical College Workforce Education analyses. The mean propensity scores for the treatment groups are roughly

0.26 and 0.34 for the 2010/2011 and 2012/2013 cohorts of exiters, respectively, whereas they are just under 0.08 and just over 0.11 for the comparison groups. The 20th percentile indicators are about 66 percent, which suggests that the participation model does not discriminate particularly well between students and non-students.

Table 6.3 Indicators of Propensity Score (p-score) Model Quality for CTC Workforce Education Analyses

Statistic	2010/2011	2012/2013
Mean p-score, CTC Workforce Education	0.258	0.341
Mean p-score, Wagner-Peyser	0.077	0.113
Percentile Wagner-Peyser at 20th percentile Workforce Education	66.2%	68.3%

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.

Balance

As would be expected, the differences between the treatment group and the matched 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 differences in means are significant. For example, almost all of the employment and earnings variables (prior to registration) still have significantly different averages in both the 2010/2011 match and 2012/2013 match.

Furthermore, the differences in means between most of the demographic variables are also significant. In all likelihood, it would have made sense to add interaction terms or higher order polynomial terms to the participation equation.

Table 6.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for CTC Workforce Education Analyses

Statistic/Characteristic	2010/2011		2012/2013	
	Workforce Education	Wagner-Peysers	Workforce Education	Wagner-Peysers
Sample size	34,522	335,449	31,182	183,505
Sample size used in match	34,522	333,316	31,182	182,399
Matched sample size	34,103	34,103	30,779	30,779
Number of observations used once	—	18,962	—	13,844
Number of observations used multiple times	—	4,427	—	5,045
Maximum number of repeats	—	85	—	112
<u>Demographics</u>				
Female	56.8%	56.8%	55.8%	55.8%
Race				
White	65.7%***	57.2%***	63.2%***	54.1%***
Black	6.8%	6.6%	6.8%	7.0%
Hispanic	8.1%	7.9%	9.0%***	7.7%***
Other race	19.0%***	20.8%***	20.5%***	22.3%***
Missing	0.3%***	7.5%***	0.4%***	8.9%***
Mean, age at registration	31.1***	31.5***	30.8***	30.3***
Disability	6.6%***	7.4%***	7.2%	7.3%
West WA	81.3%***	82.3%***	81.0%***	82.9%***
Urban county	62.5%**	63.4%**	62.8%***	65.1%***
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	59.2%***	52.2%***	57.6%***	52.4%***
Average quarterly earnings ^a	\$3,368***	\$3,000***	\$3,132***	\$2,787***
Mean, earnings trend ^b	\$38.2**	\$29.7**	\$43.7***	\$14.5***
Mean, earnings variance ^b (in 10 ⁶ \$)	\$8.9***	\$8.3***	\$8.5	\$8.5
Job turnover	30.6%***	28.3%***	30.3%***	28.1%***
Percentage of quarters with multiple jobs	12.9%***	12.0%***	12.4%***	11.7%***
Had earnings dip	40.8%***	35.1%***	37.0%***	35.7%***
Mean, number of quarters since dip at registration ^a	1.6***	1.4***	1.4	1.4
Average earnings dip size in percentage ^a	32.1%***	27.6%***	28.9%**	28.0%**
Sample Size	34,103	34,103	30,779	30,779

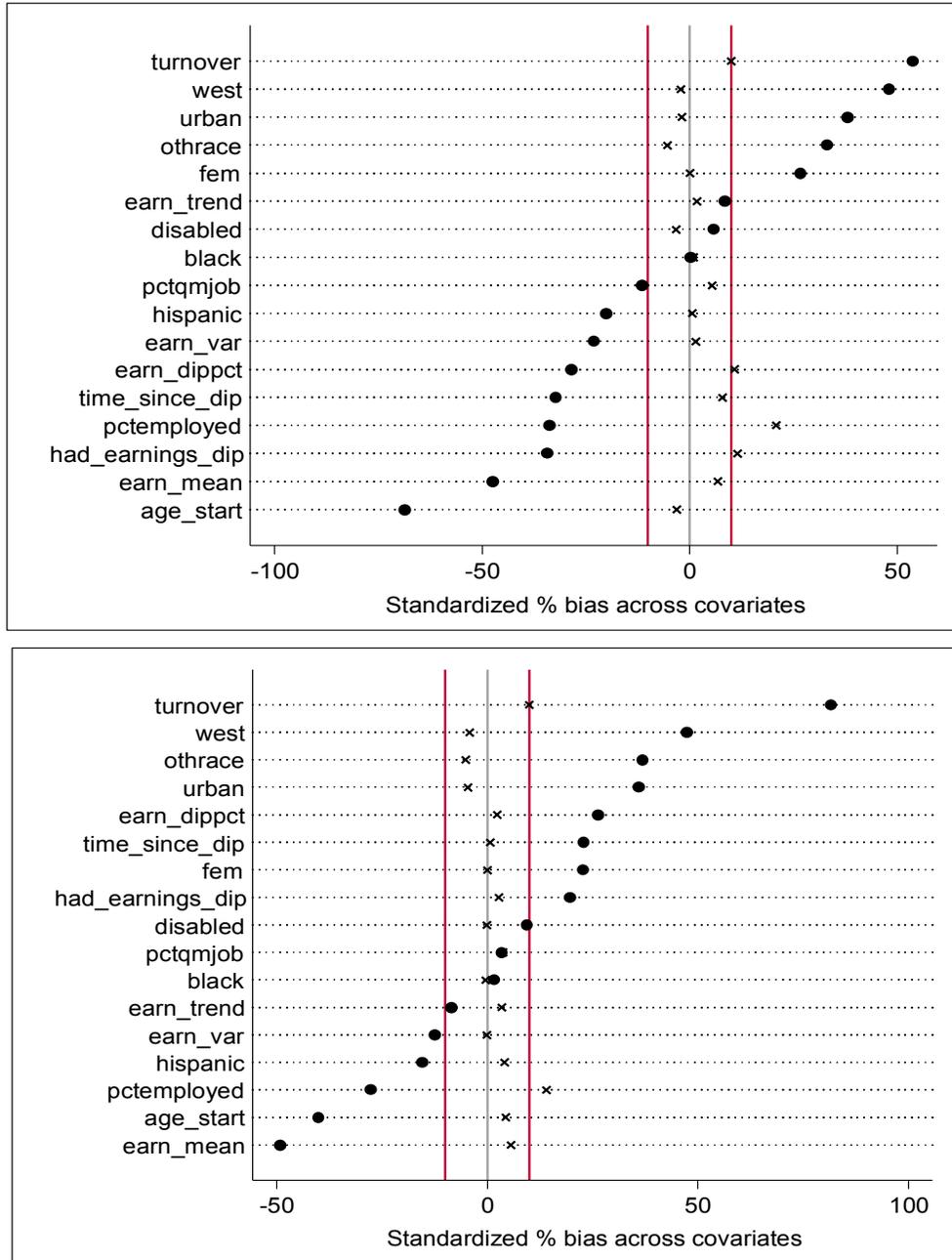
NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). — means not applicable.

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

Although many statistically significant differences in means remain after the matches, the balance test—standardized means of post-match variates within +/- 0.10—shown in Figure 6.1 seem to show that balance was achieved.

Figure 6.1 Standardized Difference in Means, Pre- and Post-match, CTC Workforce Education



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

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 and Technical College Workforce Education 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 2010/2011 cohort of program exiters.

Table 6.5 Net Impact Estimates for CTC Workforce Education Programs for 2010/2011 Cohort

Outcome	Matched Sample				
	Estimator	Comparison Group Means			
		Average	Full Sample		Matched Sample
Treatment Effect	With 0	W/O 0	With 0	W/O 0	
Employment (percentage points) ^a					
Short term	9.1***	54.1	---	48.6	---
Ever-employed, longer term	2.8***	64.9	---	62.4	---
Percent of quarters, longer term	5.9***	55.2	---	51.2	---
Percent of quarters, longer term, diff-in-diff	1.1**	-7.3	---	6.1	---
Hourly wage					
Short term (\$)	3.07***	9.89	18.05	7.65	15.45
Short term, diff-in-diff (\$)	2.45***	-3.75	-2.46	-0.63	-1.04
Longer term (4-quarter average) (\$)	2.88***	10.75	18.87	8.80	16.48
Longer term, diff-in-diff (\$)	2.27***	-2.89	-1.62	0.52	0.11
Quarterly hours					
Short term	54.2***	205.4	374.7	174.2	351.9
Short term, diff-in-diff	41.4***	-38.5	13.1	8.8	33.2
Longer term (4-quarter average)	40.6***	226.0	378.1	198.5	351.9
Longer term, diff-in-diff	27.9***	-17.9	20.1	33.2	36.6
Quarterly earnings					
Short term (\$)	1,603***	3,792	6,920	2,782	5,622
Short term, diff-in-diff (\$)	1,454***	-1,654	-771	-313	82
Longer term (4-quarter average) (\$)	1,521***	4,475	7,409	3,500	6,096
Longer term, diff-in-diff (\$)	1,372***	-972	-242	405	617
Unemployment Insurance Benefits					
Percent receiving, short term	-11.3***	24.1	---	15.8	---
Benefits, short term (\$)	-348***	783	3242	475	3002
Ever-received, longer term	-3.9***	14.9	---	10.6	---
Benefits, longer term (4-quarter average) (\$)	-33***	170	2,016	107	1,861

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

The second table is limited to the short-term net impacts for the 2012/2013 cohort. The longer-term coefficient estimates that are in “boxes” are the preferred net impact estimates using a difference-in-differences specification. Table 6.7 below shows the preferred short-term net impact estimates. The final columns of the tables provide the means of the comparison group,

Table 6.6 Net Impact Estimates for CTC Workforce Education Programs for 2012/2013 Cohort

Outcome	Matched Sample				
	Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
	With 0	W/O 0	With 0	W/O 0	
Employment ^a					
Short term	3.9***	60.7	---	58.3	---
Hourly wage					
Short term (\$)	1.67***	11.39	18.57	9.78	16.57
Short term, diff-in-diff (\$)	2.07***	-2.77	-1.50	1.02	0.94
Quarterly hours					
Short term	32.1***	235.9	384.8	215.0	364.4
Short term, diff-in-diff	32.3***	-26.5	1.3	42.1	64.9
Quarterly earnings					
Short term (\$)	984***	4,513	7,361	3,690	6,253
Short term, diff-in-diff (\$)	1,115***	-1,679	-945	534	1,190
Unemployment Insurance Benefits					
Percent receiving, short term	-5.4***	9.6	---	8.4	---
Benefits, short term (\$)	-90***	202	2,110	153	1,824

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

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 longer-term earnings impacts for the CTC Workforce Education exiters are quite positive. The students earn, on average, almost \$1,400 per quarter more than their comparison group counterparts. This arises because of an employment net impact of 1.1 percentage points, an average hourly wage impact of \$2.27, and an average hours of employment impact of almost 30 hours. The estimates also show a reduction in reciprocity and benefits for UI as longer-term outcomes.

The estimated short-term and longer-term impacts for the Community and Technical College Workforce Education students that are displayed in both tables are also quite positive. In Table 6.6, average quarterly earnings increase by over \$1,000, or about 15 percent. These earnings gains come from increased employment impacts of 3.9 percentage points, average hourly wage increases of \$2.07, and increased average hours per quarter of about 32 hours.

As we have done in prior chapters, we average the short-term net impact estimates from Table 6.5 and 6.6 to derive our preferred estimate for the short term. These averages are presented in Table 6.7. The results in this table suggest that in the short term, the Workforce Education programs offered at community and technical colleges have large and significant positive effects on employment and earnings. The estimated impact on quarterly earnings is almost \$1,300 (2014 \$), which occurs because of a positive employment impact of about 6.5 percentage points, an increase in the average hourly wage of \$2.26, and an estimated increase in hours of employment of 36.9 hours. Besides the positive employment and earnings, these students are estimated to have lower UI benefit take-up and benefits.

Table 6.7 Short-Term Net Impact Estimates for CTC Workforce Education

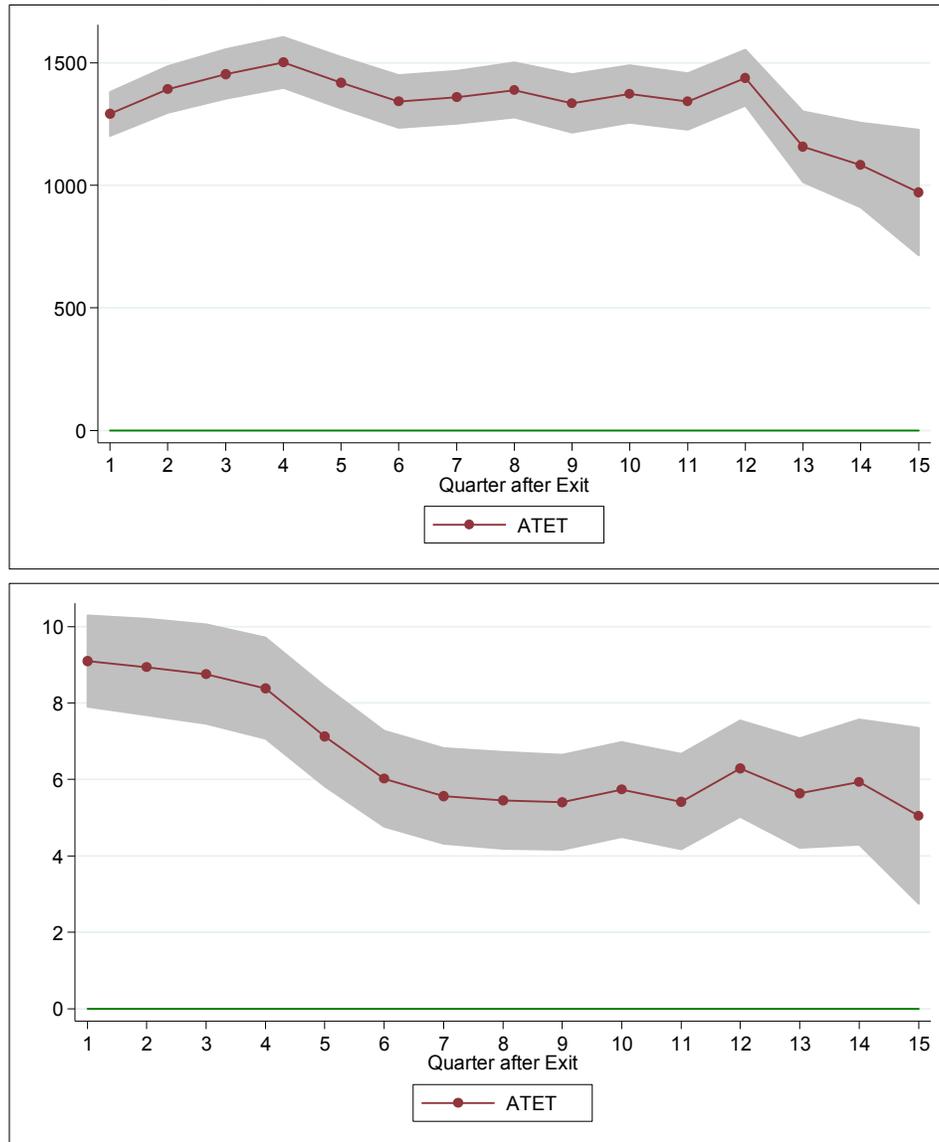
	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	9.1***	3.9***	6.5***
Hourly wage			
Short term (\$)	3.07***	1.67***	2.37***
Short term, diff-in-diff (\$)	2.45***	2.07***	2.26***
Quarterly hours			
Short term	54.2***	32.1***	43.1***
Short term, diff-in-diff	41.4***	32.3***	36.8***
Quarterly earnings			
Short term (\$)	1,603***	984***	1,294***
Short term, diff-in-diff (\$)	1,454***	1,115***	1,285***
Unemployment Insurance Benefits			
Percent receiving, short term	-11.3***	-5.4***	-8.3***
Benefits, short term (\$)	-348***	-90***	-219***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

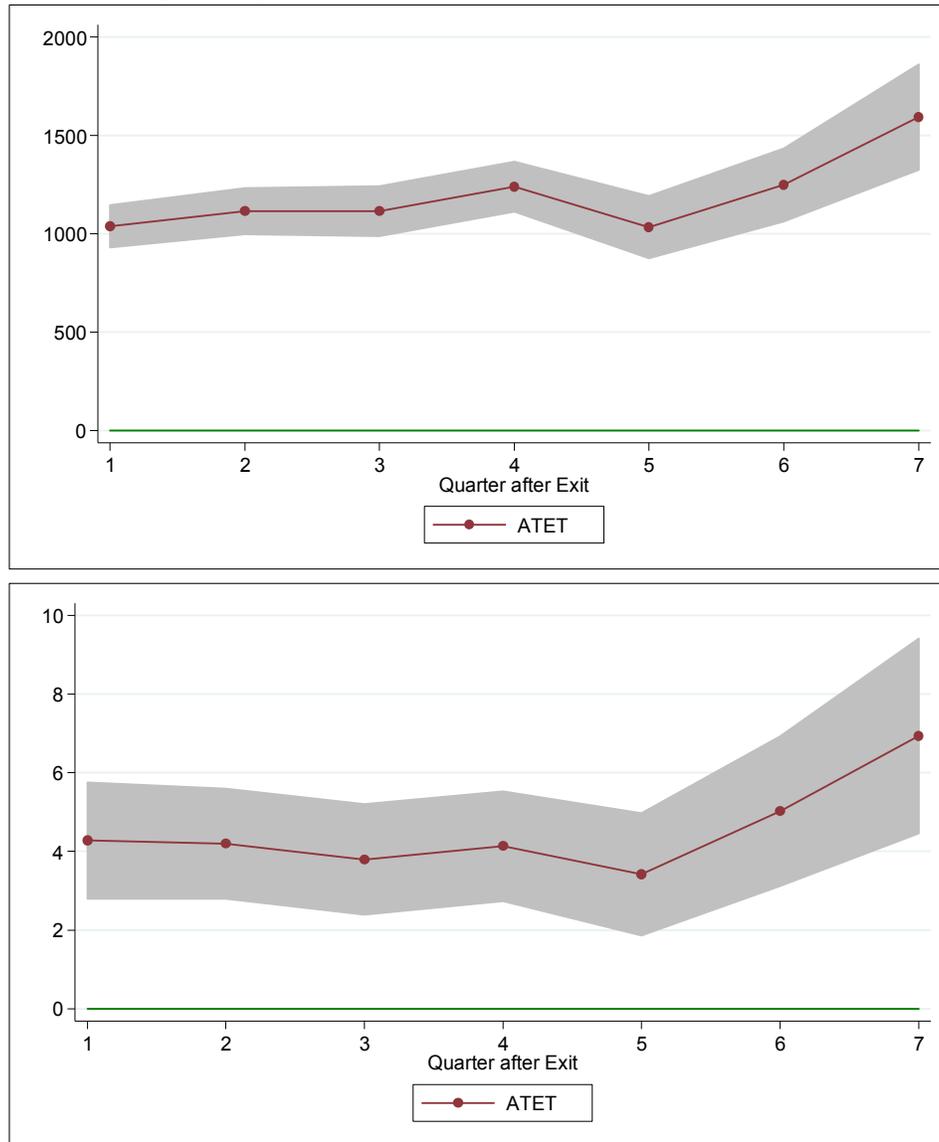
Figures 6.2 and 6.3 present the estimated net impacts on earnings and employment for each quarter after exit for 15 quarters for the 2010/2011 cohort and for 7 quarters for the 2012/2013 cohorts, respectively. The shaded portion of the graphs are the 95% confidence limits on the net impact estimates.

Figure 6.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Workforce Education Programs, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 6.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Workforce Education Programs, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Subgroup Analyses

For Community and Technical College Workforce Education 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 6.8 and 6.9, a

little more than 60 percent of the Workforce Education treatment group actually completed their schooling, defined as receiving a certificate or degree.²² 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 net impacts are all much higher for the completers than for the noncompleters. For example, the estimated long-term net impact for quarterly earnings is just over \$2,300 for completers and under \$650 for noncompleters.

Table 6.8 Selected Longer-Term Net Impact Estimates for CTC Workplace Education Completers and Noncompleters: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-4.0***	4.5***	51.2
Hourly Wage	\$0.80***	\$4.14***	\$8.80
Hours Worked (quarterly)	7.0**	54.5***	198.5
Earnings (quarterly)	\$643***	2,305***	\$3,500
UI Receipt	-3.7***	-4.2***	10.6
UI Benefits (quarterly)	-\$32***	-\$33***	\$107
Subgroup Sample Size	19,133	15,623	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

Table 6.9 Selected Short-Term Net Impact Estimates for CTC Workplace Education Completers and Noncompleters: 2012/2013 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-1.5**	9.8***	58.3
Hourly Wage	\$0.88***	\$3.70***	\$9.78
Hours Worked (quarterly)	10.5***	63.0***	215.0
Earnings (quarterly)	\$480***	\$1,910***	\$3,690
UI Receipt	-5.6***	-5.1***	8.4
UI Benefits (quarterly)	-\$99***	-\$79***	\$153
Subgroup Sample Size	16,020	14,759	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

²² The definition is slightly broader. The exact specification was $\text{GradDrop} > 0$, 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.).

Similarly, the employment rate, hourly wage, and quarterly hours impacts are much larger for the completers than for the noncompleters. The differences in net impacts between completers and noncompleters are just as large for the short-term and for the longer-term estimates. The hourly wage impact of almost \$4.00 per hour for completers, the hours worked impact of almost 55 hours, and the earnings impact of over \$2,300 are all more than four times larger than the net impacts for noncompleters.

7 COMMUNITY AND TECHNICAL COLLEGE WORKER RETRAINING PROGRAM

The Worker Retraining (WR) program provides financial support to unemployed and dislocated workers, connecting them to workforce education programs at community and technical colleges, or basic skills and literacy training as necessary.²³ WR programs also support transitioning military members and veterans and a small number of workers vulnerable to layoffs. 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 (now WIOA) Dislocated Worker program and can often benefit from participation in both programs.

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 Wagner-Peyser (WP) registrants who were 16 to 70 at the time of registration and received services in 2010/2011 or 2012/2013. 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 2010/2011 to individuals in the comparison group. The final two columns compare the community and technical college worker retraining exiters in 2012/2013 to WP registrants in the same year.

²³A 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.

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

Characteristics	2010/2011		2012/2013	
	Worker Retraining	Wagner-Peyser	Worker Retraining	Wagner-Peyser
Demographics				
Female	50.2%	43.2%	51.4%	44.4%
Race:				
White	67.5%	64.7%	65.1%	62.4%
Black	7.4% ^{††}	6.7% ^{††}	8.3%	6.4%
Hispanic	7.2%	14.4%	8.2%	13.8%
Other race	17.7%	8.1%	17.9%	8.2%
Missing	0.3%	6.1%	0.4%	9.2%
Mean, age at registration	40.7	39.5	39.9	35.7
Disability	8.1%	5.2%	9.7%	5.1%
West WA	86.1%	60.3%	79.8%	60.3%
Urban county	64.2%	44.1%	63.7%	45.5%
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	78.1%	70.4%	74.7%	67.6%
Average quarterly earnings ^a	\$7,423	\$5,944	\$6,509	\$6,152
Mean, earnings trend ^b	-\$19.2	-\$5.5	-\$35.7	\$115.7
Mean, earnings variance ^b (in 10 ⁶ \$)	\$21.4	\$19.4	\$20.6	\$14.0
Job turnover	22.8%	19.2%	24.4%	12.7%
Percentage of quarters with multiple jobs	13.8%	14.9%	14.0%	11.6%
Had earnings dip	75.3%	57.5%	68.5%	27.9%
Mean, number of quarters since dip at registration ^a	2.2	2.4	2.2	0.9
Average earnings dip size in percentage ^a	63.4%	44.1%	58.4%	19.0%
Sample Size	6,816	333,316	6,600	182,399

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend 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 older than the WP registrants. As in the CTC Workforce Education programs, the CTC Worker Retraining exiters have larger shares of females, minorities (except Hispanic), disabled workers, and residents of urban counties and western Washington.

The Worker Retraining exiters' work histories show more employment and higher average quarterly earnings (percentage of quarters worked are about 75 to 78 percent versus about 68 to 70 percent for the Worker Retraining and Wagner-Peyser clients, respectively). The

average quarterly earnings difference was about \$1,500 in the 2010/2011 data, and about \$500 in the 2012/2013 data.

Participation Model

Table 7.2 provides the results from the logit estimation of participation. The individuals who had registered for Wagner-Peyser services 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 CTC Workforce Education programs 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

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

	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
Demographics				
Female	0.384***	0.027	0.322***	0.029
Race: (White and missing are omitted categories)				
Black	-0.049	0.050	0.111*	0.052
Hispanic	-0.086	0.051	0.125*	0.051
Other	0.678***	0.034	0.783***	0.037
Age	-0.003*	0.001	0.025***	0.001
Disability	0.495***	0.047	0.538***	0.047
West WA	1.141***	0.039	0.702***	0.036
Urban county	0.270***	0.029	0.334***	0.031
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	0.006***	0.001	0.005***	0.001
Average quarterly earnings ^a (in 10 ² \$)	0.003***	0.000	-0.002***	0.000
Earnings trend ^b (in 10 ² \$)	-0.009**	0.003	0.004***	0.001
Earnings variance ^b (in 10 ⁸ \$)	-0.324***	0.040	0.052*	0.025
Job turnover	0.032***	0.001	0.030***	0.001
Percentage of quarters with multiple jobs	-0.015***	0.001	-0.010***	0.001
Had earnings dip	0.777***	0.068	-0.643***	0.076
Number of quarters since dip at registration	-0.279***	0.007	-0.001	0.008
Earnings dip size in percentage	0.937***	0.065	2.722***	0.076
Constant	-7.080***	0.143	-7.830***	0.151
Observations	340,132		188,999	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^a Average includes observations with values of zero, if any.

^b Trend and variance calculations include quarters with zero earnings, if any.

***, **, * indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

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.

The estimation results show that the following demographic variables are significantly correlated with being in the treatment group (i.e., a Community and Technical College Worker Retraining exiter) in both years of data: Female, “Other” racial category, having a disability, being from Western Washington, and residing in an urban county. The following prior labor market variables are also significantly correlated with being in worker retraining: percentage of quarters with employment, job turnover, and average size/depth of 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 and technical college worker retraining analyses. The mean propensity scores for the treatment groups are roughly 0.06 and 0.15, whereas they are approximately 0.02 and 0.03 for the comparison group for 2010/2011 and 2012/2013 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 (p-score) Model Quality for CTC Worker Retraining Analyses

Statistic	2001/2002	2003/2004
Mean p-score, Worker Retraining	0.056	0.148
Mean p-score, Wagner-Peyser	0.019	0.031
Percentile Wagner-Peyser, at 20th percentile Worker Retraining	61.3%	75.0%

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 5 percent of the matched comparison group records in the earlier cohort and 10 percent for the 2012/2013 cohort have multiple copies, and most 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 workforce education, 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.

Balance

The fact that only a few of the variables in Table 7.4 show significantly different means suggests that the matched populations are well-balanced. This suggestion is buttressed by figure 7.1, which shows the standardized differences in means before and after the match.

Net Impacts

Tables 7.5 and 7.6 provide the estimated net impacts for Worker Retraining for the 2010/2011 and 2012/2013 cohorts, respectively. 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 2010/2011 cohort of program exiters. The second table is limited to

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

<u>Statistic/Characteristic</u>	2010/2011		2012/2013	
	Worker Retraining	Wagner-Peyser	Worker Retraining	Wagner-Peyser
Sample size	6,816	335,449	6,600	183,505
Sample size used in match	6,816	333,316	6,600	182,399
Matched sample size	6,804	6,804	6,575	6,575
Number of observations used once	---	6,156	---	5,065
Number of observations used multiple times	---	309	---	686
Maximum number of repeats	---	6	---	5
<u>Demographics</u>				
Female	50.1%	50.1%	51.4%	51.4%
Race:				
White	67.6%***	63.3%***	65.3%***	58.7%***
Black	7.4%*	6.6%*	8.3%	9.1%
Hispanic	7.2%	6.7%	8.2%	8.0%
Other race	17.6%	18.4%	17.8%	18.0%
Missing	0.3%***	5.0%***	0.4%***	6.3%***
Mean, age at registration	40.7	40.7	39.9	39.8
Disability	8.1%	8.6%	9.6%	8.9%
Urban county	64.1%	64.8%	63.6%	64.0%
West WA	86.1%	86.9%	79.7%	80.2%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	78.1%***	76.4%***	74.8%***	71.6%***
Average quarterly earnings ^a (in 10 ² \$)	\$7,432	\$7,297	\$6,527***	\$6,085***
Mean, earnings trend ^b (in 10 ² \$)	-\$19.3	-\$22.4	-\$34.8	-\$65.8
Mean, earnings variance ^b (in 10 ⁶ \$)	\$21.4	\$21.1	\$20.6	\$21.5
Job turnover	22.7%*	22.1%*	24.2%	24.5%
Percentage of quarters with multiple jobs	13.8%*	13.4%*	14.0%	14.2%
Had earnings dip	75.3%	74.5%	68.4%	69.5%
Mean, number of quarters since dip at registration	2.2***	2.0***	2.2	2.2
Average earnings dip size in percentage	63.4%	63.4%	58.2%*	59.7%*
Sample Size	6,804	6,804	6,575	6,575

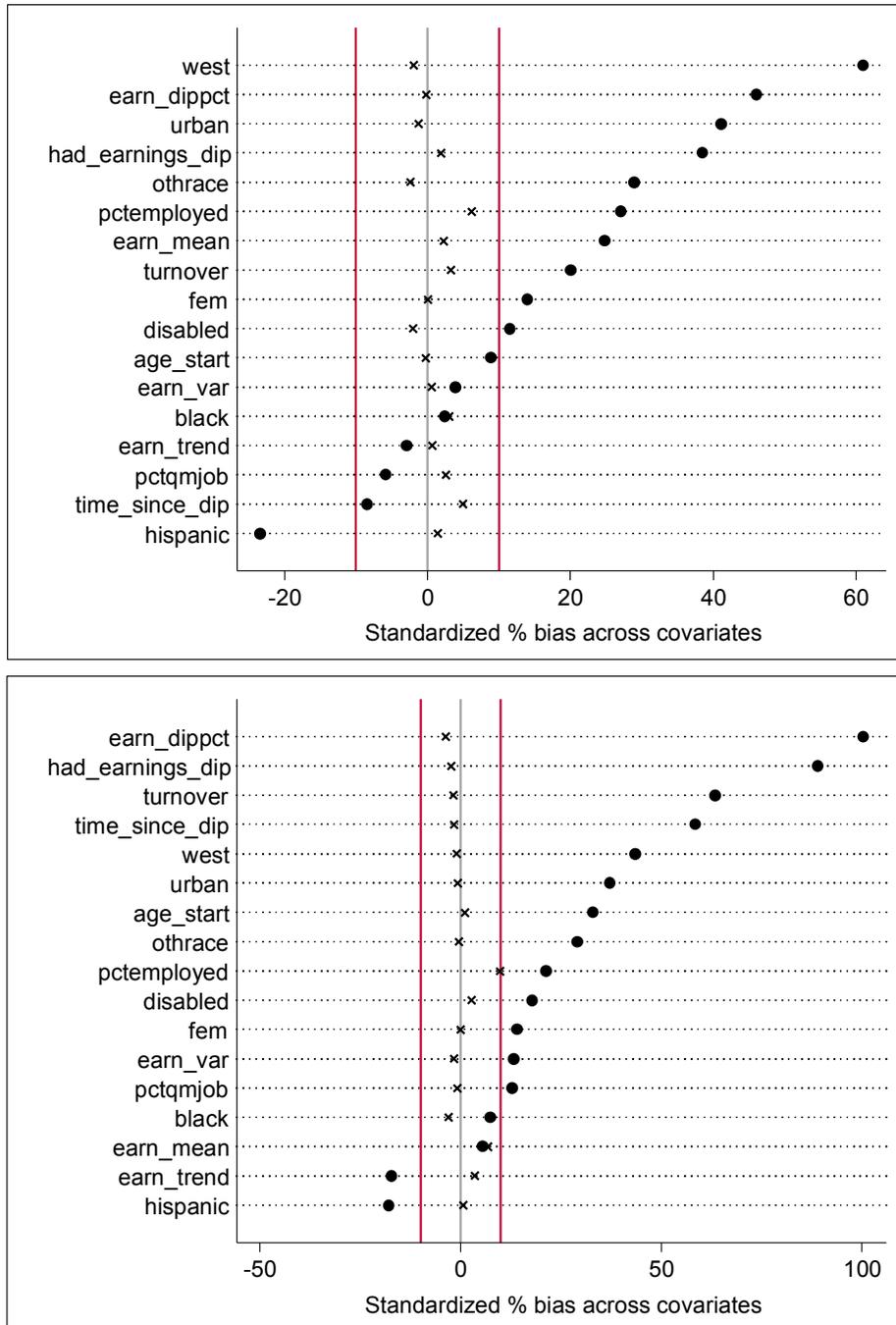
NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

the short-term net impacts for the 2012/2013 cohort. For this program, we use the levels of the outcome variables as the dependent variable. 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.

Figure 7.1 Standardized Difference in Means, Pre- and Post-match, CTC Worker Retraining



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

The longer-term earnings and employment impacts are large and statistically significant. The estimated longer-term employment rate impact is 8.0 percentage points; hourly wage impact is \$1.91; quarterly hours is 49.5; and the quarterly earnings impact is about \$1,130. On the other hand, the longer-term estimates of the net impact on receipt of and levels of Unemployment Insurance benefits are not significantly different from 0.

Table 7.5 Net Impact Estimates for CTC Worker Retraining Program for 2010/2011 Cohort

Outcome	Matched Sample		Comparison Group Means			
	Estimator		Full Sample		Matched Sample	
	Average Treatment Effect		With 0	W/O 0	With 0	W/O 0
Employment (percentage points)^a						
Short term	9.1***		54.1	---	52.5	---
Ever-employed, longer term	6.0***		64.9	---	65.4	---
Percent of quarters, longer term	8.0***		55.2	---	55.8	---
Percent of quarters, longer term, diff-in-diff	6.7***		-7.3	---	-17.2	---
Hourly wage						
Short term (\$)	1.44***		9.89	18.05	10.36	19.50
Short term, diff-in-diff (\$)	2.18***		-3.75	-2.46	-7.45	-3.74
Longer term (4-quarter average) (\$)	1.91***		10.75	18.87	11.59	20.13
Longer term, diff-in-diff (\$)	2.66***		-2.89	-1.62	-6.21	-3.06
Quarterly hours						
Short term	48.5***		205.4	374.7	200.4	377.3
Short term, diff-in-diff	21.8***		-38.5	13.1	-95.2	-1.7
Longer term (4-quarter average)	49.5***		226.0	378.1	230.4	382.5
Longer term, diff-in-diff	22.8***		-17.9	20.1	-65.2	0.3
Quarterly earnings						
Short term (\$)	770***		3,792	6,920	4,067	7,654
Short term, diff-in-diff (\$)	719***		-1,654	-771	-3,299	-1,501
Longer term (4-quarter average) (\$)	1,132***		4,475	7,409	4,877	7,995
Longer term, diff-in-diff (\$)	1,081***		-972	-242	-2,488	-1,213
Unemployment Insurance Benefits						
Percent receiving, short term	-11.8***		24.1	---	28.9	---
Benefits, short term (\$)	-437***		783	3,242	1,029	3,564
Ever-received, longer term	-0.6		14.9	---	14.9	---
Benefits, longer term (4-quarter average) (\$)	8		170	2,016	180	2,126

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

The short-term impacts for the Worker Retraining participants, shown in the two tables, reflect a very strong, positive employment rate gain of 7 – 9 percentage points; positive net impacts in hourly wage rates: \$1.44 -- \$1.63 per hour; and positive net impacts in quarterly hours: 43.7 – 48.5 hours. All together, the estimated impacts on quarterly earnings are in the \$800 to \$900 range. In the short run, the worker retraining participants had a small statistically significant decrease in UI reciprocity and benefits.

As noted earlier, our preferred estimate for the short-term net impacts is the average of the short-run impacts from Tables 7.5 and 7.6. These are presented in Table 7.7. The results in this table suggest that in the short term, the CTC Worker Retraining program have large and significant positive effects on employment and earnings. The short-term employment and earnings net impact estimators shown in Table 7.7 are very similar to, but just slightly smaller than, the longer-term net impacts suggesting that the positive impacts from the CTC Worker Retraining programs do not depreciate quickly. However the short-term reductions in UI

Table 7.6 Net Impact Estimates for CTC Worker Retraining Program for 2012/2013 Cohort

Outcome	Matched Sample				
	Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
	With 0	W/O 0	With 0	W/O 0	
Employment ^a					
Short term	7.0***	60.7	---	56.5	---
Hourly wage					
Short term (\$)	1.63***	11.39	18.57	10.73	18.79
Short term, diff-in-diff (\$)	2.62***	-2.77	-1.50	-4.77	-1.86
Quarterly hours					
Short term	43.7***	235.9	384.8	212.4	371.9
Short term, diff-in-diff	32.3***	-26.5	1.3	-49.1	25.4
Quarterly earnings					
Short term (\$)	930***	4,513	7,361	4,103	7,182
Short term, diff-in-diff (\$)	1,110***	-1,679	-945	-2,057	-581
Unemployment Insurance Benefits					
Percent receiving, short term	-2.7***	9.6	---	10.8	---
Benefits, short term (\$)	-42**	202	2,110	239	2,208

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

reciprocity and benefits that are statistically significant do increase to close to 0 in the longer term.

Table 7.7 Short-Term Net Impact Estimates for CTC Worker Retraining Program

	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	9.1***	7.0***	8.1***
Hourly wage			
Short term (\$)	1.44***	1.63***	1.54***
Short term, diff-in-diff (\$)	2.18***	2.62***	2.40***
Quarterly hours			
Short term	48.5***	43.7***	46.1***
Short term, diff-in-diff	21.8***	32.3***	27.1***
Quarterly earnings			
Short term (\$)	770***	930***	850***
Short term, diff-in-diff (\$)	719***	1,110***	914***
Unemployment Insurance Benefits			
Percent receiving, short term	-11.8***	-2.7***	-7.2***
Benefits, short term (\$)	-437***	-42**	-239***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

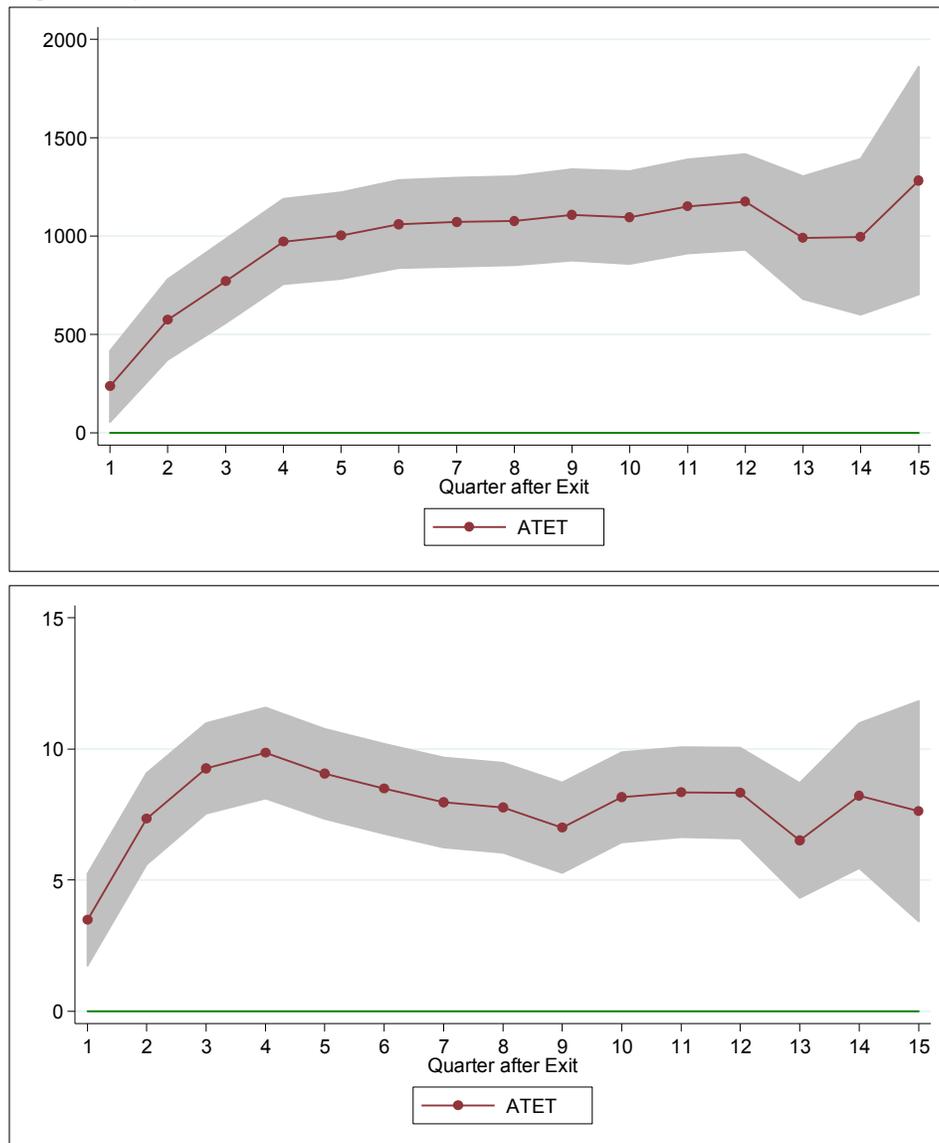
Figures 7.2 and 7.3 present the estimated net impacts on earnings and employment for each quarter after exit for 15 quarters for the 2010/2011 cohort and for 7 quarters for the 2012/2013 cohorts, respectively. The shaded portion of the graphs are the 95% confidence limits on the net impact estimates.

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 completers and noncompleters are provided in Tables 7.8 and 7.9. As with the Workforce Education exiters 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 the 2010/2011 cohort of

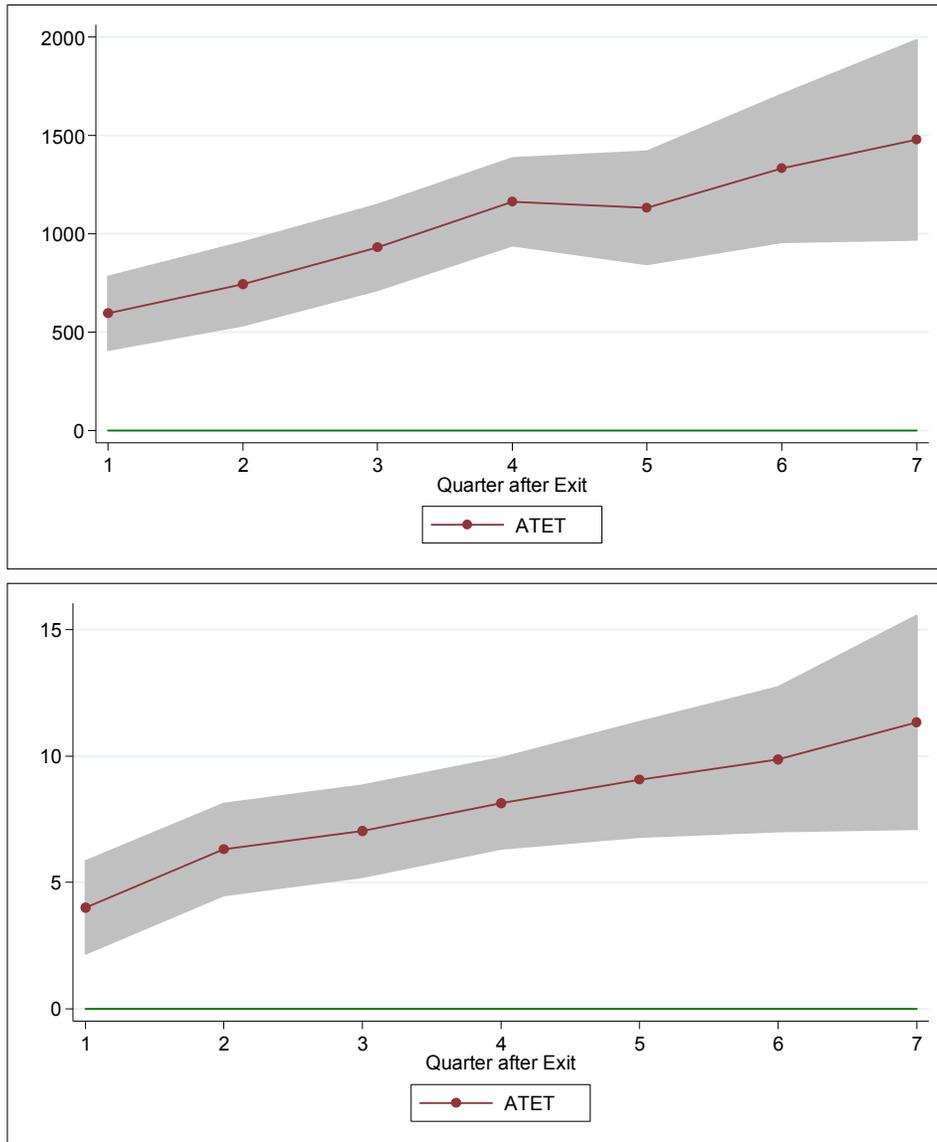
completers than noncompleters, and over \$500 for the more recent cohort. Similarly, the average hourly wage rates impacts is almost \$2.50 more for completers than noncompleters in the longer-term and about \$1.00 an hour more for the 2012/2013 cohort. The UI impacts tend to be negative (i.e., reductions in take-up) for completers as compared to positive (although not statistically significant) impacts for the noncompleters.

Figure 7.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Worker Retraining Programs, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 7.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Worker Retraining Programs, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Table 7.8 Selected Longer-Term Net Impact Estimates for CTC Worker Retraining Completers and Noncompleters: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	1.8***	13.5***	55.8
Hourly Wage	\$0.64**	\$3.04***	\$11.59
Hours Worked (quarterly)	15.8**	79.2***	230.4
Earnings (quarterly)	\$456**	1,728***	\$4,877
UI Receipt	0.2**	-1.4***	14.9
UI Benefits (quarterly)	\$20**	-\$2***	\$180
Subgroup Sample Size	3,190	3,614	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

Table 7.9 Selected Short-Term Net Impact Estimates for CTC Worker Retraining Completers and Noncompleters: 2012/2013 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	3.2**	12.1***	56.5
Hourly Wage	\$1.18***	\$2.24***	\$10.73
Hours Worked (quarterly)	25.6***	68.0***	212.4
Earnings (quarterly)	\$711***	\$1,224***	\$4,103
UI Receipt	-0.5***	-5.7***	10.8
UI Benefits (quarterly)	\$3***	-\$101***	\$239
Subgroup Sample Size	3,765	2,810	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

8 BASIC EDUCATION FOR ADULTS ON COMMUNITY AND TECHNICAL COLLEGE CAMPUSES

Adults with deficits in basic academic and literacy skills are supported in Basic Education for Adults (BEaA) across the state. The purposes of the instruction are to:

- provide academic instruction and education services below the postsecondary level that increase an individual's ability to—
 - (A) read, write, and speak English and perform mathematics or other activities necessary for the attainment of a secondary school diploma or its recognized equivalent;
 - (B) transition to postsecondary education and training; or
 - (C) obtain employment;
- assist adults to become literate and obtain the knowledge and skills necessary for employment and self-sufficiency; and
- assist adults who are parents to obtain the educational skills necessary to become full partners in the educational development of their children.

The types of programs include adult literacy, basic skills education, high school diploma or equivalency preparation, integrated education and workforce training, employability skills development, English language acquisition, integrated English literacy and civics instruction, and family literacy. A substantial share of the instruction is for individuals with limited English proficiency who participate in English acquisition 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. The age range for including observations in the comparison

group pool was somewhat different from what was used for the other community and technical college programs: the comparison group consists of Wagner-Peyser (WP) registrants who were 18 to 55 at the time of registering for WP service, 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 and Technical College BEdA participants who exited in 2010/2011 to individuals in the comparison group. The final two columns compare the exiters in 2012/2013 to WP registrants in the same year.

Table 8.1 Descriptive Statistics for CTC Basic Education for Adults Treatment Group and Comparison Group Universe

Characteristics	2010/2011		2012/2013	
	BEdA	Wagner-Peyser	BEdA	Wagner-Peyser
<u>Demographics</u>				
Female	58.3%	43.5%	58.9%	44.1%
Race:				
White	40.8%	63.0%	38.8%	61.2%
Black	17.0%	7.2%	16.7%	6.7%
Hispanic	21.1%	15.2%	20.5%	14.1%
Other race	21.2%	8.3%	14.6%	8.4%
Missing	0.0%	6.3%	9.3% ^{††}	9.6% ^{††}
Mean, age at registration	32.0	36.1	31.3	33.3
Disability	4.8% ^{††}	4.8% ^{††}	5.6%	4.8%
West WA	72.3%	59.9%	71.4%	60.1%
Urban county	54.4%	43.7%	54.6%	45.4%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	50.7%	69.4%	50.1%	67.4%
Average quarterly earnings ^a	\$2,332	\$5,489	\$2,246	\$5,741
Mean, earnings trend ^b	\$9.2 ^{††}	\$5.8 ^{††}	\$32.8	\$125.4
Mean, earnings variance ^b (in 10 ⁶ \$)	\$4.9	\$15.4	\$4.5	\$10.6
Job turnover	36.3%	20.2%	35.7%	13.6%
Percentage of quarters with multiple jobs	13.1%	15.5%	12.7%	12.2%
Had earnings dip	47.0%	57.1%	38.8%	28.0%
Mean, number of quarters since dip at registration ^a	2.1	2.4	1.6	0.9
Average earnings dip size in percentage ^a	38.4%	43.7%	30.8%	19.3%
Sample Size	17,697	283,661	12,669	160,013

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

The populations are quite different. The BEdA participants are younger—averaging about 31 as compared to 33—36 for the Wagner-Peyser 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 Wagner-Peyser registrants are female. Similarly, in both cohorts, about 60 percent of the community and technical college BEdA clients are nonwhite as compared to only about 35 percent of the WP population. As with many of the programs analyzed in this study, the BEdA participants are much more likely to reside in an urban county and in western Washington than were WP registrants.

The pre-program registration labor market experiences of the BEdA students are also quite different from their Wagner-Peyser counterparts. Their percentage of quarters with employment is about 50 percent, whereas the comparison group pool was almost 70 percent. The average quarterly earnings are also significantly lower. The average quarterly earnings for the BEdA population is only about \$2,300; whereas it is about \$5,500 for the WP registrants.

Participation Model

Table 8.2 provides the results from the logit estimation of participation in BEdA. 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 BEdA exiter.

The following variables are significantly correlated with being in the treatment group (i.e., BEdA participant) in both years of data: female, minority, having a disability, being from western Washington, residing in an urban county, and job turnover. Not surprisingly, most of the prior employment and earnings variables are significantly correlated with being in the

Table 8.2 Coefficient Estimates from a Logit Model of Participation in CTC Basic Education for Adults

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.427***	0.018	0.543***	0.022
Race: (White or missing are omitted categories)				
Black	0.975***	0.026	1.065***	0.033
Hispanic	1.052***	0.024	1.026***	0.031
Other	1.366***	0.024	0.924***	0.033
Age	-0.018***	0.001	0.014***	0.001
Disability	0.106**	0.041	0.272***	0.047
West WA	0.643***	0.022	0.568***	0.026
Urban county	0.322***	0.020	0.237***	0.024
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.006***	0.000	-0.010***	0.000
Average quarterly earnings ^a (in 10 ² \$)	0.001	0.000	-0.007***	0.000
Earnings trend ^b (in 10 ² \$)	-0.003	0.003	-0.008***	0.002
Earnings variance ^b (in 10 ⁸ \$)	-3.147***	0.132	-0.832***	0.117
Job turnover	0.041***	0.000	0.039***	0.001
Percentage of quarters with multiple jobs	-0.027***	0.001	-0.019***	0.001
Had earnings dip	-0.238***	0.055	-0.309***	0.067
Number of quarters since dip at registration	-0.001	0.005	0.095***	0.007
Earnings dip size in percentage	-0.102	0.053	0.041	0.067
Constant	-3.600***	0.064	-4.084***	0.073
Observations	301,358		172,682	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

***, ** indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

comparison group (WP registrants): employment percentage, earnings trend and variance, and having experienced an earnings dip. All of these results are consistent with the theory that relatively skilled individuals with inconsistent earnings and employment histories tend to register for Wagner-Peyser services at Work Source offices, whereas BEdA participants are low-skilled individuals seeking to upgrade their employment opportunities.

Propensity Score Statistics

Table 8.3 provides the mean propensity scores and 20th percentile indicator for the community and technical college BEdA analyses. The mean propensity scores for the treatment groups are roughly 0.21 and 0.26, whereas they are 0.05 and 0.06 for the comparison group for the 2010/2011 and 2012/2013 cohorts, respectively. The 20th percentile indicator is approximately 69 percent for both cohorts. These modest percentages suggest that the propensity

Table 8.3 Indicators of Propensity Score (p-score) Model Quality for CTC Basic Education for Adults Analyses

Statistic	2010/2011	2012/2013
Mean p-score, BEdA	0.207	0.259
Mean p-score, Wagner-Peyser	0.049	0.059
Percentile Wagner-Peyser, at 20th percentile BEdA	68.6%	69.1%

score model was only modestly successful in discriminating between the BEdA and Wagner-Peyser participants. This is borne out in Table 8.4 below.

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. The match “struggled.” Almost all of the differences in means are still significant suggesting that the populations are relatively imbalanced. The top panel of statistics in the table shows that less than 10 percent of the observations from the 2010/2011 comparison group pool were used multiple times; however, about 16 percent of the comparison group pool observations were used in the 2012/2013 match. Furthermore, the maximum number of repeats is 250 and 40 in the two 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 matched comparison group derived from the WP file is much smaller in 2012/2013 and because most of the matching variables are discrete.

Balance

The fact that only most of the variables in Table 8.4 show significantly different means suggests that the matched populations are not well-balanced. However, Figure 8.1, which shows the standardized differences in means before and after the match, indicates that all of the variates in the match satisfy the ± 0.10 criterion for balance.

Table 8.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for CTC Basic Education for Adults Analyses

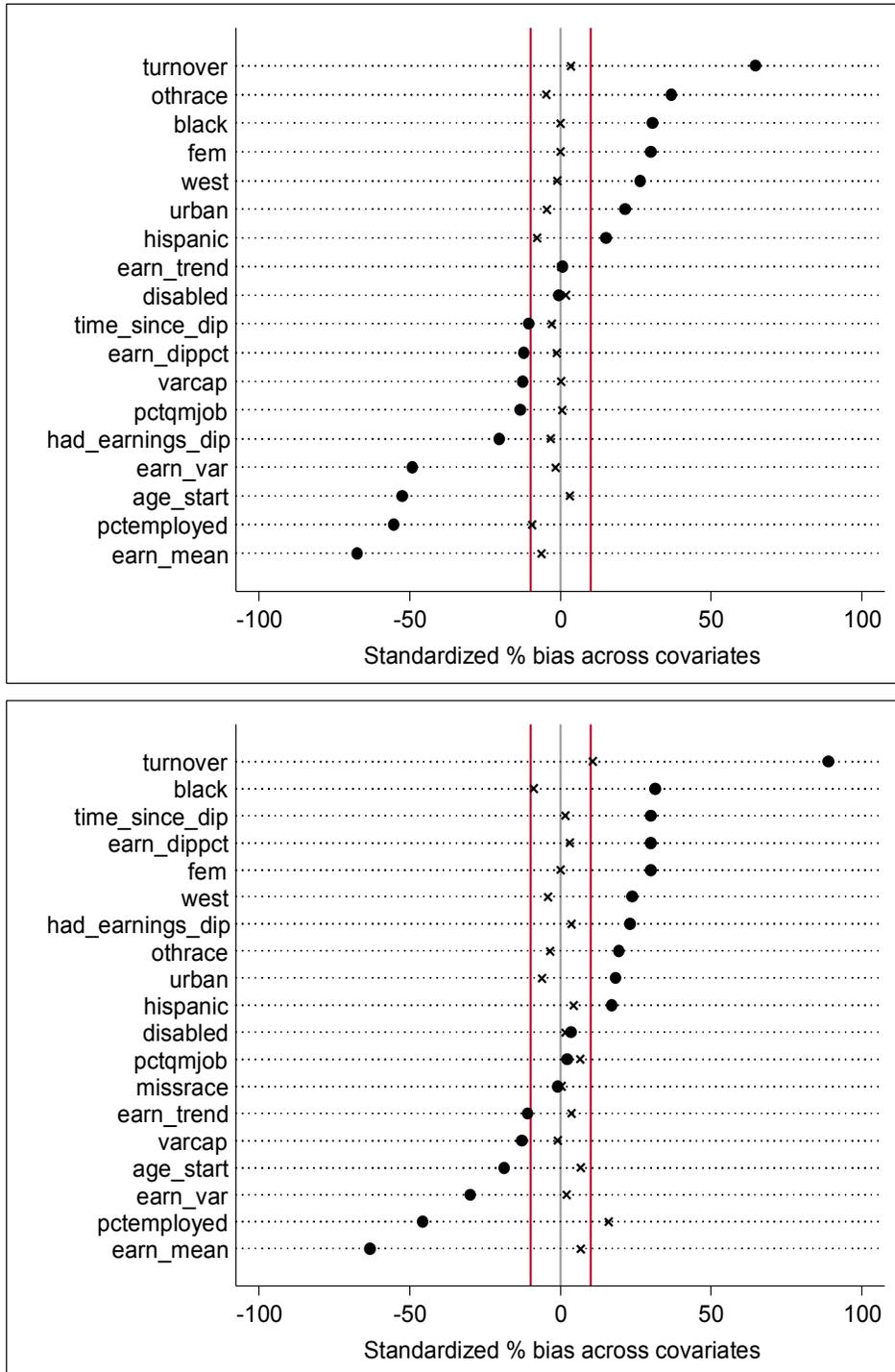
Statistic/Characteristic	2010/2011		2012/2013	
	BEdA	Wagner-Peyser	BEdA	Wagner-Peyser
Sample size	17,697	285,498	12,669	161,024
Sample size used in match	17,697	283,661	12,669	160,013
Matched sample size	17,360	17,360	12,432	12,432
Number of observations used once	---	10,465	---	6,700
Number of observations used multiple times	---	1,574	---	1,724
Maximum number of repeats	---	250	---	40
<u>Demographics</u>				
Female	58.3%	58.3%	59.0%	59.0%
Race:				
White	41.5%***	33.9%***	39.3%***	37.1%***
Black	16.7%	16.7%	16.3%***	19.1%***
Hispanic	21.2%***	24.2%***	20.6%***	19.0%***
Other race	20.6%***	22.3%***	14.4%**	15.5%**
Missing	0.0%***	2.9%***	9.3%	9.3%
Mean, age at registration	32.0***	31.7***	31.4***	30.6***
Disability	4.7%*	4.4%*	5.5%	5.2%
West WA	71.9%	72.5%	71.0%***	72.9%***
Urban county	54.1%***	56.4%***	54.1%***	57.2%***
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	51.1%***	54.3%***	50.7%***	44.7%***
Average quarterly earnings ^a	\$2,369***	\$2,664***	\$2,285***	\$1,914***
Mean, earnings trend ^b	\$10.8	\$10.5	\$34.2***	\$4.0***
Mean, earnings variance ^b (in 10 ⁶ \$)	\$4.9***	\$5.3***	\$4.6***	\$4.2***
Job turnover	35.0%***	34.2%***	34.5%***	31.9%***
Percentage of quarters with multiple jobs	13.3%	13.2%	12.9%***	11.6%***
Had earnings dip	47.2%***	48.9%***	38.8%***	37.1%***
Mean, number of quarters since dip at registration ^a	2.1***	2.2***	1.6	1.5
Average earnings dip size in percentage ^a	38.6%	39.2%	30.7%**	29.5%**
Sample Size	17,360	17,360	12,432	12,432

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

Figure 8.1 Standardized Difference in Means, Pre- and Post-match, CTC Basic Education for Adults



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

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 BEdA 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 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. Our preferred specification for the estimates is the average treatment effect for

Table 8.5 Net Impact Estimates for CTC Basic Education for Adults for 2010/2011 Cohort

Outcome	Matched Sample				
	Estimator	Comparison Group Means			
		Average Treatment Effect	Full Sample With 0	W/O 0	Matched Sample With 0
Employment (percentage points) ^a					
Short term	-0.3	56.1	---	46.3	---
Ever-employed, longer term	-3.1**	67.8	---	66.7	---
Percent of quarters, longer term	-0.8	57.8	---	52.3	---
Percent of quarters, longer term, diff-in-diff	2.9**	-3.9	---	8.5	---
Hourly wage					
Short term (\$)	-0.79**	10.11	17.79	6.81	14.34
Short term, diff-in-diff (\$)	0.38	-2.89	-2.17	-0.31	-0.55
Longer term (4-quarter average) (\$)	-1.15***	11.18	18.75	8.36	15.01
Longer term, diff-in-diff (\$)	0.03	-1.81	-1.20	1.25	0.25
Quarterly hours					
Short term	-0.5	214.8	378.3	163.3	344.3
Short term, diff-in-diff	6.0	-24.7	18.8	14.2	49.4
Longer term (4-quarter average)	-2.3	238.8	382.3	201.4	331.1
Longer term, diff-in-diff	4.2	-0.7	26.7	52.3	43.2
Quarterly earnings					
Short term (\$)	-279**	3,915	6,893	2,416	5,092
Short term, diff-in-diff (\$)	130	-1,237	-538	-58	504
Longer term (4-quarter average) (\$)	-493***	4,708	7,454	3,313	5,352
Longer term, diff-in-diff (\$)	-85	-445	65	838	853
Unemployment Insurance Benefits					
Percent receiving, short term	-5.7**	22.7	---	16.6	---
Benefits, short term (\$)	-169**	712	3133	457	2758
Ever-received, longer term	-1.1	15.1	---	12.1	---
Benefits, longer term (4-quarter average) (\$)	-23	169	1,987	121	1,719

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

difference-in-differences. 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 longer-term net impacts for the community and technical college Basic Education for Adults participants are shown in Table 8.5. The employment rate rose by 2.9 percentage points, but very small increases in the hourly wage and average hours of work per quarter were not statistically significant. Combined, these impacts actually resulted in small, and not statistically significant, decrease in average quarterly earnings of about \$85. Being a BEdA exiter is also estimated to reduce the participants' reliance on unemployment insurance benefits, although these are not statistically significant.

Table 8.6 Net Impact Estimates for CTC Basic Education for Adults for 2012/2013 Cohort

Outcome	Matched Sample		Comparison Group Means		
	Estimator				
	Average Treatment Effect	Full Sample With 0	W/O 0	Matched Sample With 0	W/O 0
Employment ^a					
Short term	-4.1***	62.6	---	56.2	---
Hourly wage					
Short term (\$)	-1.54***	11.67	18.46	8.43	14.74
Short term, diff-in-diff (\$)	-0.93***	-1.80	-1.08	2.14	0.68
Quarterly hours					
Short term	-18.7***	245.7	388.7	205.2	358.6
Short term, diff-in-diff	-41.9***	-12.1	8.1	78.3	95.2
Quarterly earnings					
Short term (\$)	-655***	4,672	7,392	3,143	5,493
Short term, diff-in-diff (\$)	-712***	-1,154	-607	1,128	1,633
Unemployment Insurance Benefits					
Percent receiving, short term	-2.6***	9.4	---	8.1	---
Benefits, short term (\$)	-35***	196	2,087	142	1,743

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The short-term net impacts, shown in Tables 8.5 and 8.6, are either statistically insignificantly different from 0 or quite negative for the BEdA exiters. In Table 8.6, the employment rate goes down by over 4 percentage points, the average hourly wage drops by

nearly \$1.00 per hour, and hours of work per quarter decreases by almost 42 hours. All together, these declines lead to a drop in quarterly earnings of over \$700 (about a 15 percent decline). The reduced usage of unemployment insurance benefits estimated in the longer-term is also in the short-term results.

As we have done in prior chapters, we average the short-term net impact estimates from Table 8.5 and 8.6 to derive our preferred estimate for the short term. These averages are presented in Table 8.7, with the preferred estimates in “boxes.” The results in this table suggest that in the short term, the Basic Education for Adults offered at community and technical colleges do not overcome the labor markets barriers that students face. The estimated net impacts on labor market outcomes for the short term are negative. However, it should be noted that the longer-term outcomes are either positive or less negative.

Table 8.7 Short-Term Net Impact Estimates for CTC Basic Education for Adults

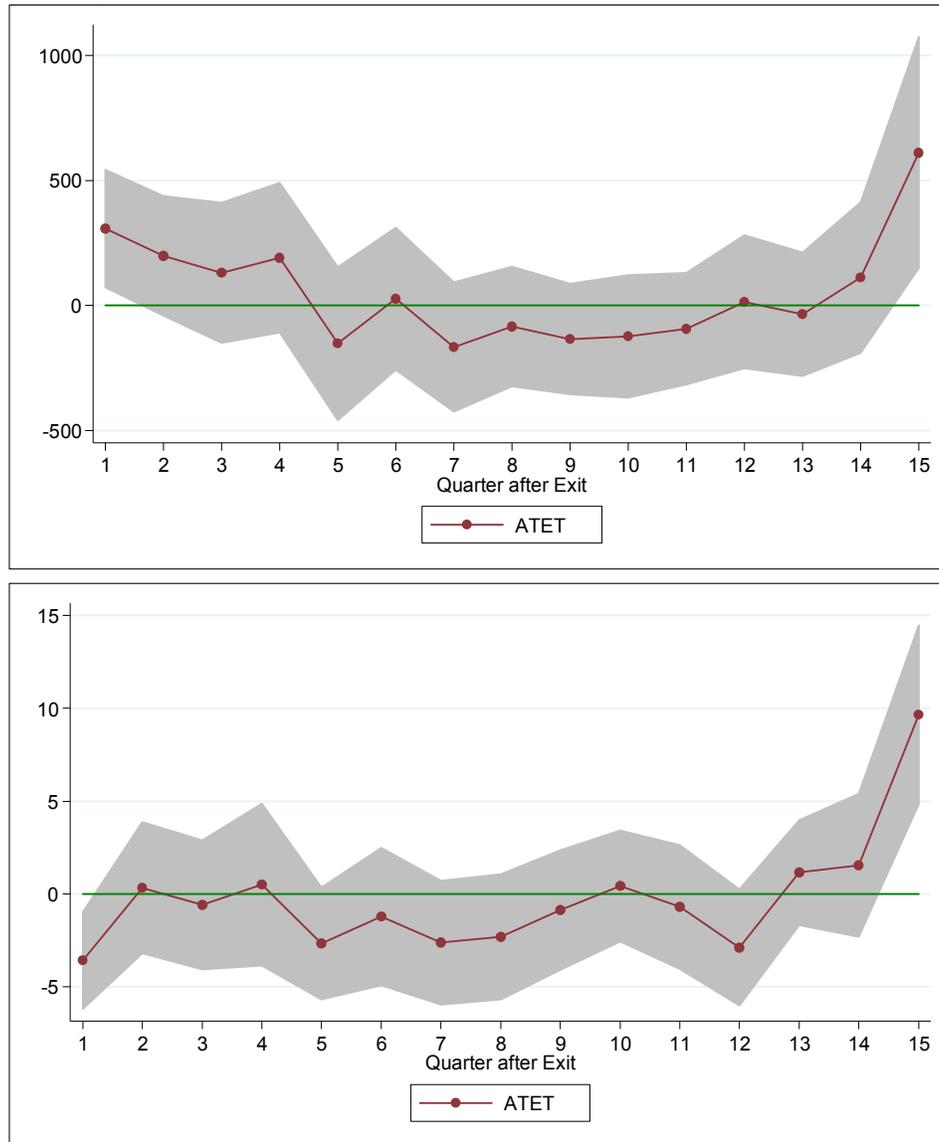
	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	-0.3	-4.1***	-2.2**
Hourly wage			
Short term (\$)	-0.79**	-1.54***	-1.17***
Short term, diff-in-diff (\$)	0.38	-0.93***	-0.28
Quarterly hours			
Short term	-0.5	-18.7***	-9.6
Short term, diff-in-diff	6.0	-41.9***	-18.0***
Quarterly earnings			
Short term (\$)	-279**	-655***	-467***
Short term, diff-in-diff (\$)	130	-712***	-291***
Unemployment Insurance Benefits			
Percent receiving, short term	-5.7**	-2.6***	-4.2***
Benefits, short term (\$)	-169**	-35***	-102***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

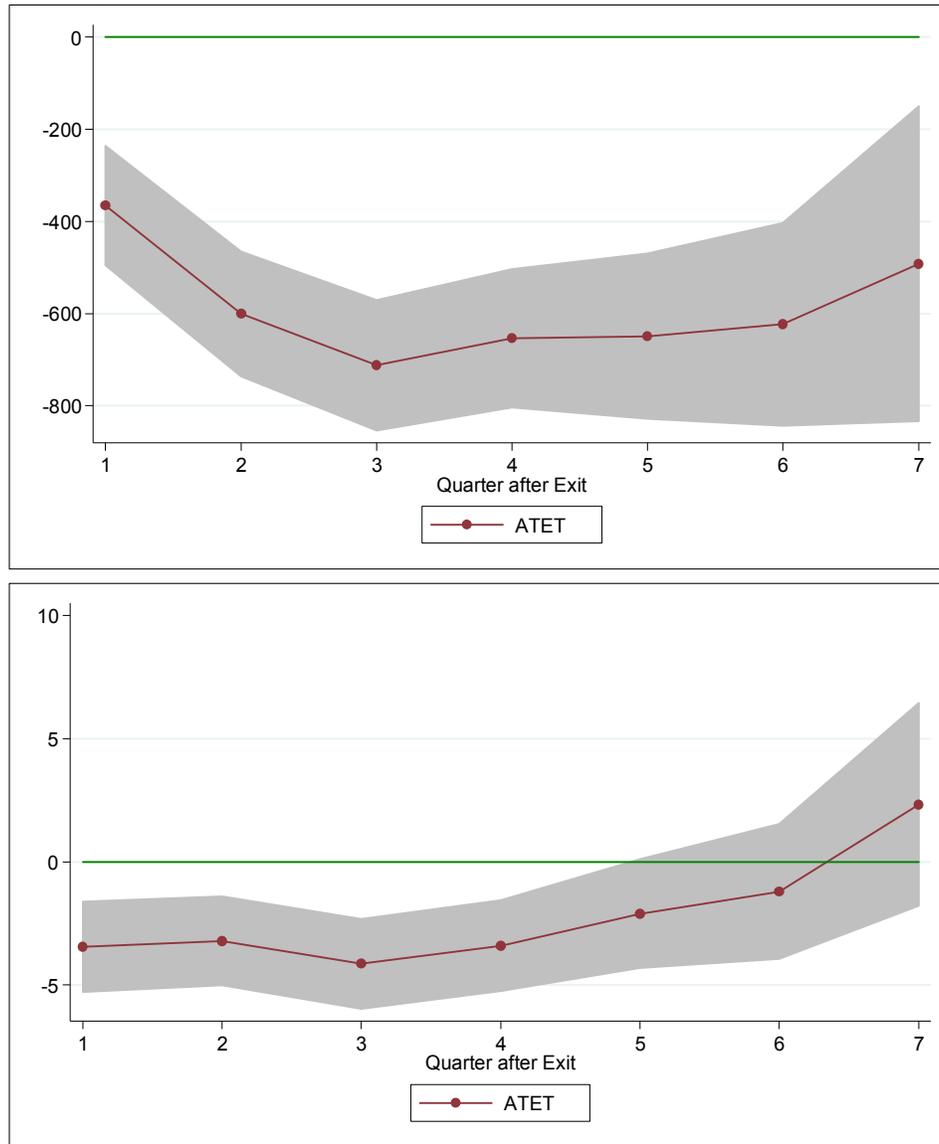
Figures 8.2 and 8.3 display graphically the net impacts over the first 15 and first 7 quarters after exiting the program for the 2010/2011 and 2012/2013 cohorts, respectively.

Figure 8.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Basic Education for Adults, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 8.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC Basic Education for Adults, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

9 COMMUNITY AND TECHNICAL COLLEGES INTEGRATED BASIC EDUCATION AND SKILLS TRAINING (I-BEST) PROGRAM

Pioneered by Washington’s community and technical colleges, the Integrated Basic Education and Skills Training Program (I-BEST) uses a team-teaching approach. Students work with two teachers in the classroom: one provides job training and the other teaches basic skills in reading, math, or English language. Students get the help they need while studying in the career field of their choice; they learn by doing. Widely emulated in other states, the intent of I-BEST is to quickly impart to adult students literacy, work, and college-readiness skills so they can move through school and into living wage jobs faster.

Participant Characteristics

Table 9.1 provides descriptive data that compare the individuals in the treatment group, i.e., individuals who exited from I-BEST in 2010/2011 or 2012/2013, to those in the comparison group pool, registrants for Wagner-Peyser services. The age range for including observations in the comparison group pool was somewhat different from what was used for the other community and technical college programs: the comparison group consists of Wagner-Peyser (WP) registrants who were 18 to 55 at the time of registering for WP service, 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. As noted in the previous chapter, we used the same age range for the BEdA program.

The first two columns of numbers in the table compare the IBEST exiters in 2010/2011 to WP registrants in that year, whereas the final two columns compare the exiters in 2012/2013 to WP registrants in the same year.

Table 9.1 Descriptive Statistics for CTC I-BEST Treatment Group and Comparison Group Universe

Characteristics	2010/2011		2012/2013	
	I-BEST	Wagner-Peyser	I-BEST	Wagner-Peyser
<u>Demographics</u>				
Female	69.3%	43.5%	67.3%	44.1%
Race:				
White	48.3%	62.9%	49.1%	61.2%
Black	12.2%	7.2%	11.6%	6.7%
Hispanic	9.7%	15.2%	8.1%	14.1%
Other race	28.8%	8.3%	30.2%	8.4%
Missing	1.0%	6.3%	0.1% ^{††}	9.6% ^{††}
Mean, age at registration	33.0	36.1	31.8	33.3
West WA	82.6%	59.8%	83.7%	60.1%
Urban county	53.3%	43.7%	53.6%	45.4%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	57.0%	69.4%	55.4%	67.4%
Average quarterly earnings ^a	\$2,779	\$5,470	\$2,435	\$5,745
Mean, earnings trend ^b	-\$8.1 ^{††}	\$6.0 ^{††}	\$14.3	\$125.5
Mean, earnings variance ^b (in 10 ⁶ \$)	\$5.7	\$17.4	\$5.3	\$12.8
Job turnover	20.4% ^{††}	20.2% ^{††}	19.7%	13.6%
Percentage of quarters with multiple jobs	14.6% ^{††}	15.6% ^{††}	13.1% ^{††}	12.2% ^{††}
Had earnings dip	48.8%	57.0%	45.6%	28.0%
Mean, number of quarters since dip at registration ^a	1.9	2.4	1.6	0.9
Average earnings dip size in percentage ^a	40.4%	43.6%	37.7%	19.3%
Sample Size	1,296	282,152	1,316	159,773

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

The populations are quite different. The I-BEST participants are younger—averaging about 31 as compared to 33 to 36 for the Wagner-Peyser population—and are more likely to be female and to be African American or other (nonwhite, nonHispanic) race. In both cohorts, almost 70 percent of the treatment group members are female, whereas just under 45 percent of the Wagner-Peyser registrants are female. Similarly, in both cohorts, about 50 percent of the Community and Technical College I-BEST clients are nonwhite as compared to only about 35 percent of the WP population. As with many of the programs analyzed in this study, the I-BEST participants are much more likely to reside in an urban county and in western Washington than are WP registrants.

The pre-program registration labor market experiences of the I-BEST exiters are also quite different from their Wagner-Peyser counterparts. Their percentage of quarters with employment prior to being in an I-BEST program was about 55 percent, whereas the comparison group pool was over 65 percent. The average quarterly earnings prior to program participation are also significantly lower. The average quarterly earnings for the I-BEST population was only about \$2,400 to \$2,800; whereas it was about \$5,500 for the WP registrants.

Participation Model

Table 9.2 provides the results from the logit estimation of participation in I-BEST. 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 I-BEST exiter.

The following variables are significantly correlated with being in the treatment group (i.e., I-BEST participant) in both years of data: female, African American, other race, being from western Washington, and size of an earnings dip in percentage terms. Not surprisingly, most of the prior employment and earnings variables are significantly correlated with being in the comparison group (WP registrants): employment percentage, earnings trend and variance, and having experienced an earnings dip. All of these results are consistent with the theory that relatively skilled individuals with inconsistent earnings and employment histories tend to register for Wagner-Peyser services at Work Source offices, whereas I-BEST participants, like

Table 9.2 Coefficient Estimates from a Logit Model of Participation in CTC I-BEST Program

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.676***	0.064	0.707***	0.063
Race: (White is omitted category)				
Black	0.432***	0.094	0.512***	0.096
Hispanic	0.077	0.105	-0.098	0.115
Other	1.377***	0.068	1.446***	0.068
Missing	-1.786***	0.281	-2.170***	0.292
Age	-0.013***	0.003	0.011***	0.003
West WA	1.215***	0.082	1.304***	0.083
Urban county	-0.043	0.063	-0.222***	0.063
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.003	0.001	-0.005***	0.001
Average quarterly earnings ^a (in 10 ² \$)	0.012***	0.002	-0.019***	0.002
Earnings trend ^b (in 10 ² \$)	-0.027***	0.010	-0.000	0.000
Earnings variance ^b (in 10 ⁸ \$)	-2.190***	0.441	-0.002	0.246
Job turnover	-0.006***	0.002	0.003	0.002
Percentage of quarters with multiple jobs	0.001	0.002	-0.002	0.002
Had earnings dip	-0.143	0.181	-0.341*	0.180
Number of quarters since dip at registration	-0.090***	0.018	0.014	0.019
Earnings dip size in percentage	0.362**	0.179	0.954***	0.182
Constant	-5.220***	0.232	-5.235***	0.222
Observations	283,448		161,089	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

BEa participants, are low-skilled individuals seeking to upgrade their employment opportunities.

Propensity Score Statistics

Table 9.3 provides the mean propensity scores and 20th percentile indicator for the community and technical college I-BEST analyses. The mean propensity scores for the treatment groups are roughly 0.02 and 0.04 for the 2010/2011 and 2012/2013 cohorts, respectively, whereas they are less than 0.01 for the comparison group for both cohorts. The 20th percentile indicator is approximately 67 percent and 75 percent for the two cohorts. These modest percentages suggest that the propensity score model may have been only modestly successful in

discriminating between the I-BEST and Wagner-Peyser participants. However, as noted in the following section, the statistical match ended up nicely balanced.

Table 9.3 Indicators of Propensity Score (p-score) Model Quality for CTC I-BEST Analyses

Statistic	2010/2011	2012/2013
Mean p-score, I-BEST	0.017	0.037
Mean p-score, Wagner-Peyser	0.005	0.008
Percentile Wagner-Peyser, at 20th percentile I-BEST	66.7%	75.0%

Statistical Match

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. Only three of the differences in means are still significant suggesting that the match produced reasonably close “matches.” The top panel of statistics in the table shows that less than 5 percent of the observations from the 2010/2011 and 2012/2013 comparison group pools were used multiple times; a relatively small percentage. Furthermore, the maximum number of repeats is only 4 and 6 in the two matches. All in all, the match was quite successful in achieving balanced distributions in the treatment and comparison groups.

Balance

The fact that balance was achieved is shown in Figure 9.1, which shows the standardized differences in means before and after the match. The figure shows that all of the variates in the match satisfy the ± 0.10 criterion for balance.

Table 9.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for CTC I-BEST Analyses

Statistic/Characteristic	2010/2011		2012/2013	
	I-BEST	Wagner-Peyser	I-BEST	Wagner-Peyser
Sample size	1,296	285,046	1,316	160,783
Sample size used in match	1,296	282,152	1,316	159,773
Matched sample size	1,296	1,296	1,314	1,314
Number of observations used once	---	1,208	---	1,173
Number of observations used multiple times	---	38	---	60
Maximum number of repeats	---	4	---	6
Demographics				
Female	69.4%	69.4%	67.3%	67.3%
Race:				
White	48.3%	46.8%	49.2%	50.1%
Black	12.2%	11.9%	11.6%	11.1%
Hispanic	9.7%	9.6%	8.1%	6.8%
Other race	28.8%	30.3%	30.1%	31.4%
Missing	0.1%	0.1%	0.1%	0.1%
Mean, age at registration	33.0	33.3	31.8	31.6
West WA	82.6%	83.3%	83.6%	85.4%
Urban county	53.3%	55.8%	53.6%	55.0%
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	57.0%	55.0%	55.4%	53.3%
Average quarterly earnings ^a	\$2,778	\$2,838	\$2,438	\$2,365
Mean, earnings trend ^b	-\$8.1	-\$8.0	\$14.4	\$30.9
Mean, earnings variance ^b (in 10 ⁶ \$)	\$5.7	\$5.8	\$5.4	\$5.7
Job turnover	20.4%**	18.7%**	19.6%	19.1%
Percentage of quarters with multiple jobs	14.6%	13.5%	13.1%	12.7%
Had earnings dip	48.8%*	45.3%*	45.5%	46.0%
Mean, number of quarters since dip at registration ^a	1.9*	1.7*	1.6	1.7
Average earnings dip size in percentage ^a	40.5%	37.8%	37.7%	37.1%
Sample Size	1,296	1,296	1,314	1,314

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

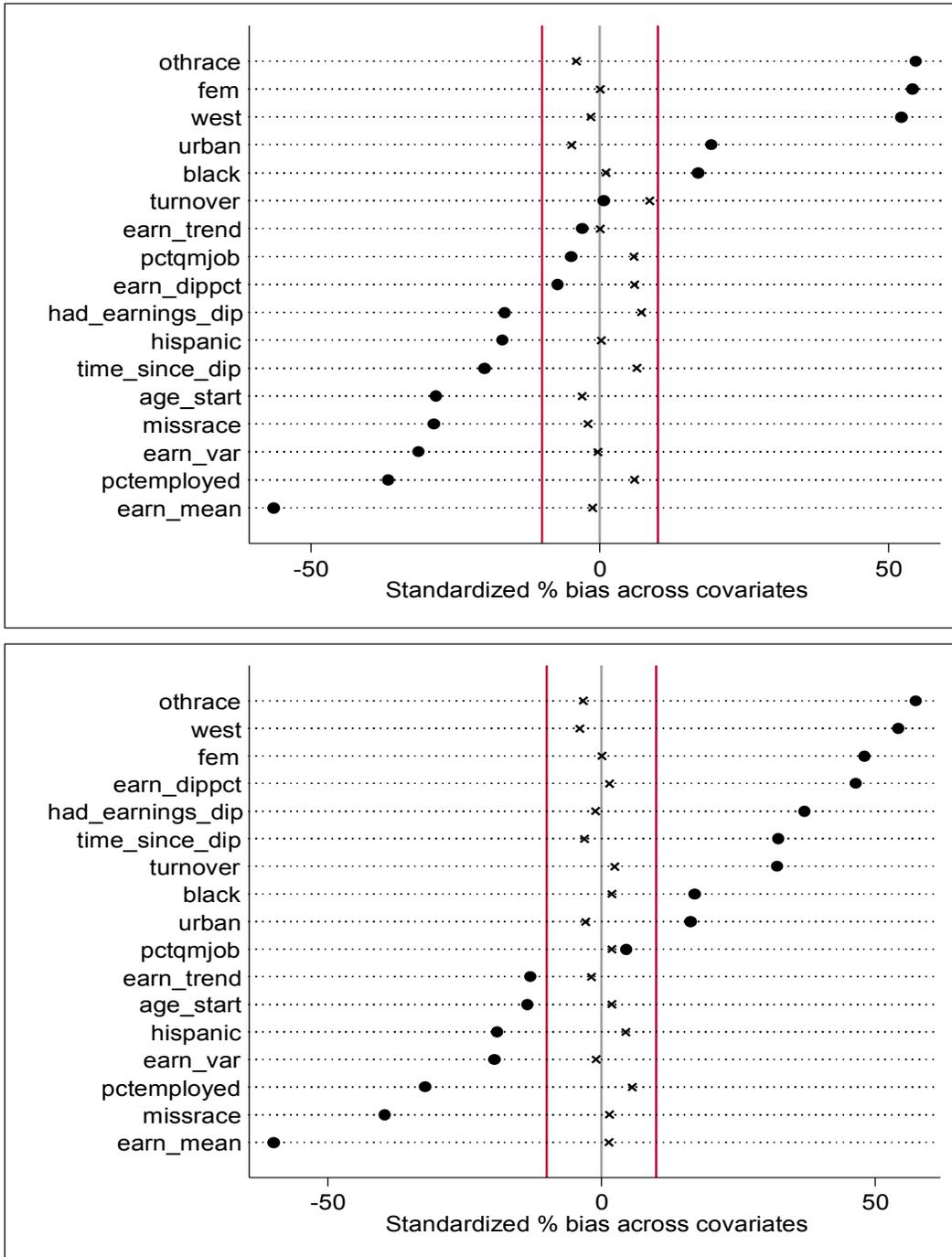
^aAverages include observations with values of zero.

^bTrend 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, and Tables 9.5 and 9.6 provide the estimated net impacts for I-BEST 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 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. Our preferred specification for the estimates is the average treatment

Figure 9.1 Standardized Difference in Means, Pre- and Post-match, CTC I-BEST



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

Table 9.5 Net Impact Estimates for CTC I-BEST Program for 2010/2011 Cohort

Outcome	Matched Sample				
	Estimator	Comparison Group Means			
		Average	Full Sample		Matched Sample
Treatment Effect	With 0	W/O 0	With 0	With/O 0	
Employment (percentage points) ^a					
Short term	7.1***	56.1	---	50.3	---
Ever-employed, longer term	6.6***	67.7	---	61.9	---
Percent of quarters, longer term	7.5***	57.7	---	51.2	---
Percent of quarters, longer term, diff-in-diff	12.3***	-3.9	---	1.5	---
Average hourly wage					
Short term (\$)	0.37	10.09	17.78	7.32	14.42
Short term, diff-in-diff (\$)	1.58***	-2.86	-2.13	-0.60	-0.69
Longer term (\$)	0.41	11.16	18.73	8.16	15.15
Longer term, diff-in-diff (\$)	1.61***	-1.79	-1.16	0.24	0.26
Average quarterly hours					
Short term	33.2***	214.7	378.1	177.2	349.0
Short term, diff-in-diff	54.3***	-24.7	18.7	-3.5	21.4
Longer term	44.3***	238.5	382.0	197.3	346.6
Longer term, diff-in-diff	65.4***	-0.9	26.5	16.6	18.2
Average quarterly earnings					
Short term (\$)	276*	3,908	6,881	2,592	5,105
Short term, diff-in-diff (\$)	814***	-1,228	-529	-289	-1
Longer term (\$)	438***	4,695	7,439	3,150	5,422
Longer term, diff-in-diff (\$)	976***	-440	75	270	422
Unemployment Insurance Benefits (average quarterly)					
Percent receiving, short term	-8.8***	22.7	---	15.8	---
Benefits, short term (\$)	-252***	710	3,128	415	2,610
Percent receiving, longer term	-1.5	15.1	---	11.0	---
Benefits, longer term (\$)	-29**	169	1,988	106	1,630

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

effect for difference-in-differences. 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 longer-term net impacts for the community and technical college I-BEST participants are shown in Table 9.5. These estimates suggest that the I-BEST exiters gain substantial labor market outcomes. The employment rate rose by 12.3 percentage points; the average hourly wage rose by \$1.61; and the average hours of work per quarter went up by 65

hours. Combined, these impacts resulted in an increase in average quarterly earnings of almost \$1,000. The longer-term net impacts on the receipt of UI benefits are inconsequential—an estimated decrease in receipt of 1.5 percentage points (not significant) and reduction in quarterly benefits of about \$30.

Table 9.6 Net Impact Estimates for CTC I-BEST Program for 2012/2013 Cohort

Outcome	Matched Sample				
	Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
		With 0	W/O 0	With 0	W/O 0
Employment (percentage points) ^a					
Short term	2.2	62.6	---	59.1	---
Average hourly wage					
Short term (\$)	-1.15***	11.67	18.46	9.59	16.05
Short term, diff-in-diff (\$)	0.46	-1.80	-1.08	1.79	1.49
Average quarterly hours					
Short term	19.3**	245.7	388.7	213.8	357.9
Short term, diff-in-diff	40.3***	-12.3	8.0	36.7	55.0
Average quarterly earnings					
Short term (\$)	-263*	4,674	7,395	3,485	5,834
Short term, diff-in-diff (\$)	359**	-1,157	-609	733	1,135
Unemployment Insurance Benefits (average quarterly)					
Percent receiving, short term	-4.4***	9.4	---	7.5	---
Benefits, short term (\$)	-50**	196	2,088	109	1,443

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The short-term net impacts, shown in Tables 9.5 and 9.6, are also quite positive for the I-BEST exiters, although they are not as large as the longer-term net impacts. The difference-in-differences estimators for the short term in the 2010/2011 cohort are all positive and statistically significant. Employment rises by over 7 points; the average hourly wage goes up by \$1.58; and average quarterly hours rises by almost 55 hours. These increases combine to increase average quarterly earnings by over \$800. Table 9.6 also shows positive outcomes in the short term, however, the increase in the employment rate and average hourly wage rate are not statistically significant. These are paired with an increase in average quarterly hours of over 40 hours and

average quarterly earnings of over \$350. Both tables show that in the short term, the net impact on UI benefits is significantly negative.

As we have done in prior chapters, we average the short-term net impact estimates from Table 9.5 and 9.6 to derive our preferred estimate for the short term. These averages are presented in Table 9.7, with the preferred estimates in “boxes.” Given that the constituent net impact estimates are fairly positive, it is not surprising that the preferred estimates in Table 9.7 are positive. These estimates suggests that three quarters after exiting, I-BEST participants have employment rates that are almost 5 percentage points higher; average hourly wage rates that are over \$1.00 per hour higher; average hours worked in a quarter that are almost 50 hours greater; and average quarterly earnings that are almost \$600 greater than comparable individuals who registered for Wagner-Peyser services.

Table 9.7 Short-Term Net Impact Estimates for CTC I-BEST

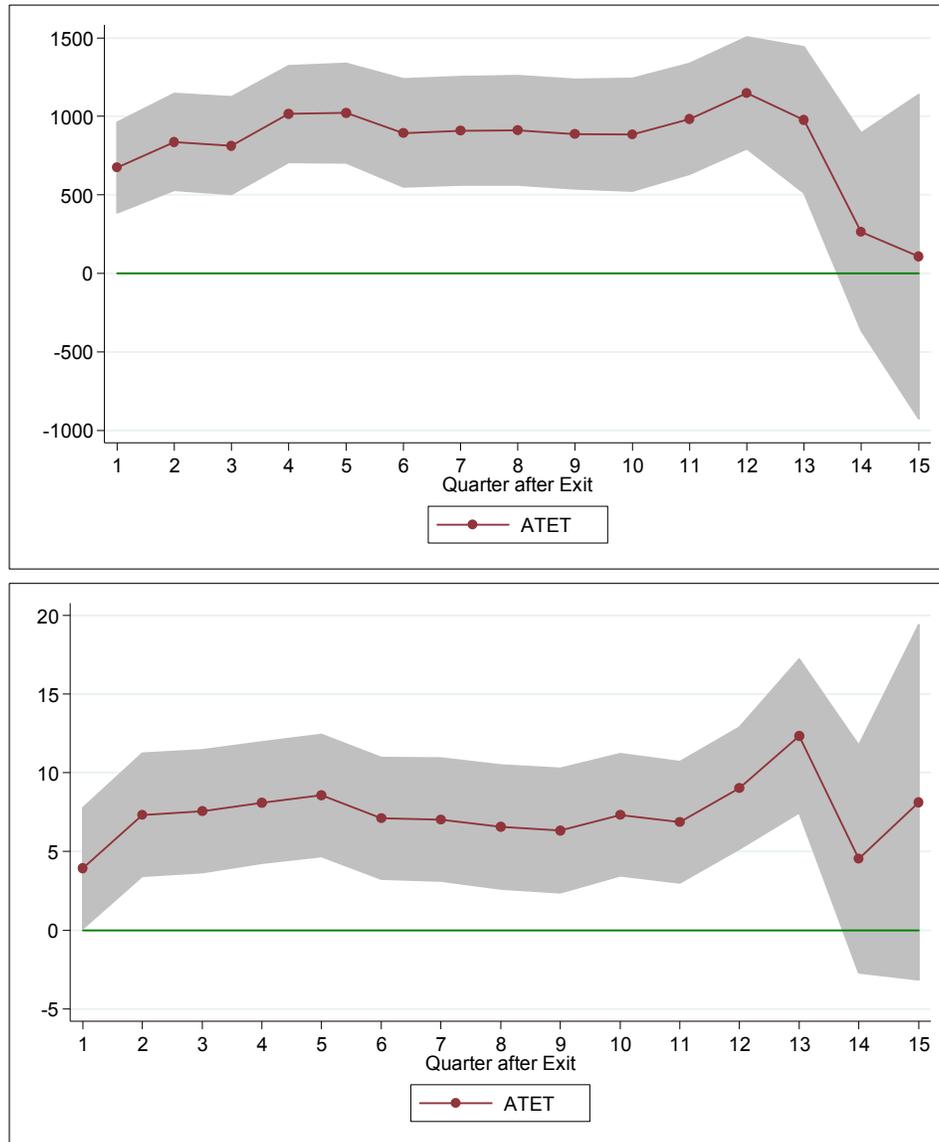
	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	7.1***	2.2	4.7***
Hourly wage			
Short term (\$)	0.37	-1.15***	-0.39
Short term, diff-in-diff (\$)	1.58***	0.46	1.02***
Quarterly hours			
Short term	33.2***	19.3**	26.3***
Short term, diff-in-diff	54.3***	40.3***	47.3***
Quarterly earnings			
Short term (\$)	276*	-263*	6
Short term, diff-in-diff (\$)	814***	359**	586***
Unemployment Insurance Benefits			
Percent receiving, short term	-8.8***	-4.4***	-6.6***
Benefits, short term (\$)	-252***	-50**	-156***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). Tests of significance are not appropriate for Average column.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

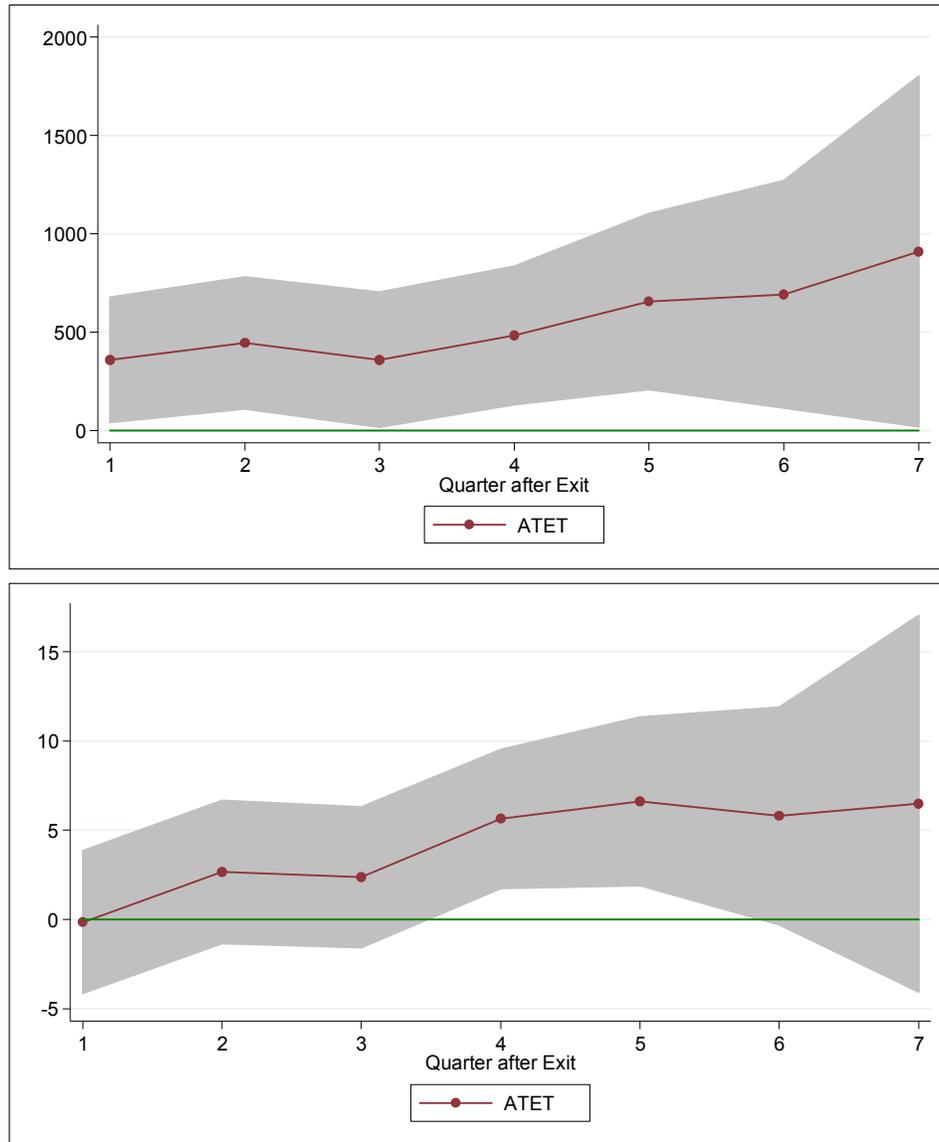
Figures 9.2 and 9.3 display graphically the net impacts over the first 15 and first 7 quarters after exiting the program for the 2010/2011 and 2012/2013 cohorts, respectively. As can be seen, they are positive and statistically significant through most of the follow-up quarters.

Figure 9.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC I-BEST, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 9.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of CTC I-BEST, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

10 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 licensed and regulated by the Workforce Board. The occupations for which students 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 Workforce Board. Because of its voluntary nature, the representativeness or generalizability of the data is uncertain, but thought to be reasonable.

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 many of the other programs including those at community and technical colleges, the comparison group consists of Wagner-Peyser (WP) program registrants who were 16 to 70 at the time of registration in 2010/2011 or 2012/2013 with individuals who were served by Washington's education and training programs removed from the data. The first two columns of numbers compare the private career school students who exited in 2010/2011 to individuals in the comparison group. The final two columns compare the exiters in 2012/2013 to WP registrants in the same year.

The populations are somewhat different. Over 50 percent of the Private Career School participants are females compared to under 45 percent of the WP registrants. The Private Career School students are also six to ten years younger than the WP comparison group, on average. A smaller share of the Private Career School participants are minorities than of Wagner-Peyser

Table 10.1 Descriptive Statistics for Private Career School Treatment Group and Comparison Group Universe

Characteristics	2010/2011		2012/2013	
	Training Program	Wagner-Peyser	Training Program	Wagner-Peyser
<u>Demographics</u>				
Female	52.1%	43.2%	51.0%	44.4%
Race:				
White	56.9%	64.7%	61.5%	62.4%
Black	7.9%	6.7%	8.2%	6.4%
Hispanic	6.9%	14.4%	9.8%	13.8%
Other race	14.5%	8.1%	14.9%	8.2%
Missing	13.8%	6.1%	5.6%	9.2%
Mean, age at registration	30.3	39.5	30.7	35.7
Disability	0.5%	5.2%	0.8%	5.1%
West WA	72.4%	60.3%	70.4%	60.3%
Urban county	60.2%	44.1%	29.6%	45.5%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	55.5%	70.4%	52.8%	67.6%
Average quarterly earnings	\$3,113	\$5,944	\$2,948	\$6,152
Mean, earnings trend	\$40.7	-\$5.5	\$43.7	\$115.7
Mean, earnings variance (in 10 ⁶ \$)	\$9.2	\$19.4	\$9.4	\$14.0
Job turnover	29.6%	19.2%	29.1%	12.7%
Percentage of quarters with multiple jobs	12.5%	14.9%	11.3%	11.6%
Had earnings dip	42.2%	57.5%	35.5%	27.9%
Mean, number of quarters since dip at registration	1.6	2.4	1.3	0.9
Average earnings dip size in percentage	33.4%	44.1%	27.6%	19.0%
Sample Size	18,509	333,316	16,436	182,399

NOTE: All differences in means are statistically significant at the 0.05 level (t-test). Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

registrants. A stark difference arises with disability status. Only about 0.5 percent of the Private Career School students identify themselves as disabled, whereas over five percent of the WP registrants are self-identified as disabled. Private Career School students are disproportionately from urban counties and from western Washington (inexplicably the percentage of Private Career School students from urban counties drops to under 30 percent in the 2012/2013 cohort).

In terms of labor market experience prior to schooling, the Private Career School students had lower levels of average quarterly earnings—about \$3,000 compared to almost \$6,000—lower prior employment rates, and more job turnover. The lower earnings may be explained by the younger ages of the Private Career School students.

Participation Model

Table 10.2 provides the results from the logit estimation of participation in private career schools. As with the analyses in the prior chapters, this regression used a 0 – 1 dependent variable, with the private career students being coded as one. 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 10.2 Coefficient Estimates from a Logit Model of being a Private Career School Student

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	0.070***	0.017	0.096***	0.019
Race: (White is the omitted category)				
Black	-0.237***	0.031	0.243***	0.034
Hispanic	-0.561***	0.032	-0.348***	0.032
Other	0.495***	0.024	0.655***	0.027
Missing	0.625***	0.025	-0.602***	0.038
Age	-0.048***	0.001	-0.013***	0.001
Disability	-2.198***	0.103	-1.818***	0.091
West WA	0.284***	0.020	0.760***	0.021
Urban county	0.631***	0.018	-1.006***	0.021
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.005***	0.000	-0.012***	0.000
Average quarterly earnings ^a (in 10 ² \$)	-0.001**	0.000	-0.003***	0.000
Earnings trend ^b (in 10 ² \$)	0.001	0.002	-0.004***	0.001
Earnings variance ^b (in 10 ⁸ \$)	-0.065***	0.034	0.152***	0.020
Job turnover	0.035***	0.000	0.034***	0.000
Percentage of quarters with multiple jobs	-0.022***	0.001	-0.016***	0.001
Had earnings dip	0.147**	0.049	-0.056***	0.056
Number of quarters since dip at registration	-0.093***	0.005	0.028***	0.007
Earnings dip size in percentage	-0.368***	0.050	-0.010	0.058
Constant	-2.334***	0.077	-2.529***	0.073
Observations	351,825		198,835	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

*, **, *** indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

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,

being a nonHispanic NonBlack minority, residing in western Washington, residing in an urban county (except in the 2012/2103 cohort), and job turnover. The following variables are significantly correlated with being in treatment group: minority status, age at registration, having a disability, average prior quarterly earnings, and having an earnings dip. All other covariates have insignificant coefficients, or coefficients that switch signs across 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. Table 10.3 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 0.16 and 0.22; whereas they are 0.05 and 0.07 for the comparison group. The 20th percentile indicators are around 64 percent. The means and the 20th percentile statistic indicate that the logit model of participation discriminates only moderately well between treatment and comparison group observations.

Table 10.3 Indicators of Propensity Score (p-score) Model Quality for Private Career Schools

Statistic	2010/2011	2012/2013
Mean p-score, Private Career Schools	0.160	0.224
Mean p-score, Wagner-Peyser	0.047	0.070
Percentile Wagner-Peyser, at 20th percentile Private Career Schools	64.2%	64.4%

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 10.4 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

Table 10.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Private Career Schools Analyses

Statistic/Characteristic	2010/2011		2012/2013	
	Private Career School	Labor Exchange	Private Career School	Labor Exchange
Sample size	18,509	335,449	16,436	183,505
Sample size used in match	18,509	333,316	16,436	182,399
Matched sample size	18,261	18,261	16,266	16,266
Number of observations used once	---	11,648	---	8,818
Number of observations used multiple times	---	1,813	---	2,139
Maximum number of repeats	---	147	---	73
<u>Demographics</u>				
Female	52.0%	52.0%	51.0%	51.0%
Race:				
White	57.2%	56.8%	61.7%	62.3%
Black	7.9%***	9.0%***	8.1%	8.5%
Hispanic	7.0%	6.6%	9.9%***	8.7%***
Other race	14.3%*	15.0%*	14.7%	15.0%
Missing	13.6%***	12.5%***	5.7%	5.5%
Mean, age at registration	30.4***	30.8***	30.7***	30.0***
Disability	0.5%**	0.7%**	0.8%	0.7%
West WA	72.1%**	70.9%**	70.2%*	69.2%*
Urban county	59.8%	60.0%	29.9%***	28.2%***
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	55.7%***	48.8%***	53.1%***	46.8%***
Average quarterly earnings ^a	\$3,148***	\$2,834***	\$2,976***	\$2,579***
Mean, earnings trend ^b	\$42.2**	\$32.2**	\$45.4***	-\$6.2***
Mean, earnings variance ^b (in 10 ⁶ \$)	\$9.3*	\$8.7*	\$9.5	\$9.2
Job turnover	28.7%***	27.2%***	28.4%***	26.2%***
Percentage of quarters with multiple jobs	12.6%***	11.5%***	11.3%***	10.3%***
Had earnings dip	42.4%***	37.8%***	35.5%***	33.9%***
Mean, number of quarters since dip at registration ^a	1.7***	1.5***	1.3**	1.2**
Average earnings dip size in percentage ^a	33.5%***	30.0%***	27.5%**	26.5%**
Sample Size	18,261	18,261	16,266	16,266

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

participants and matched comparison group is not especially strong. Many 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.

Balance

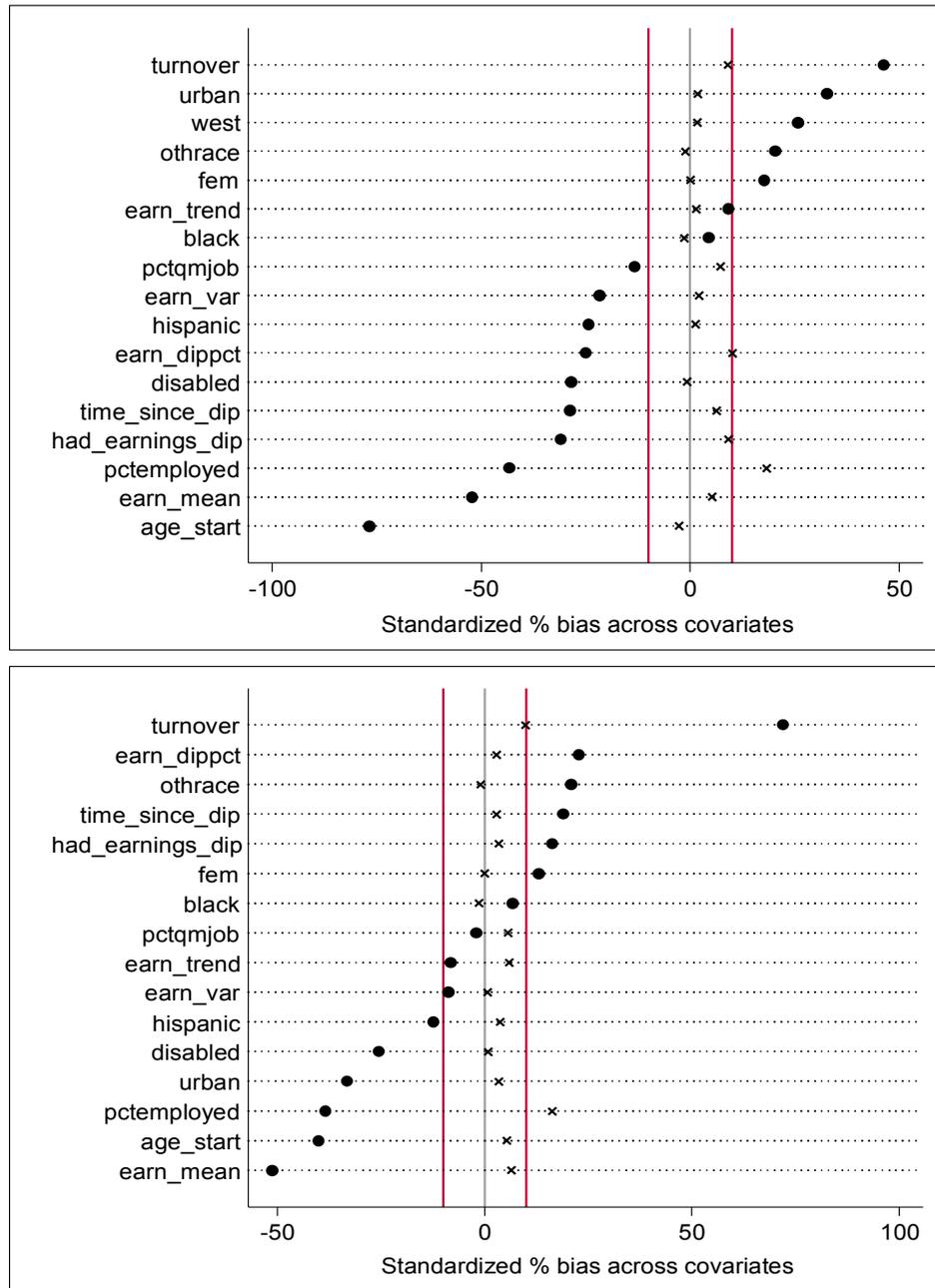
The fact that only most of the variables in Table 10.4 show significantly different means suggests that the matched populations are not well-balanced. However, Figure 10.1, which shows the standardized differences in means before and after the match, indicates that all but one of the variates in the match satisfy the ± 0.10 criterion for balance in both cohorts.

Net Impacts

Tables 10.5 and 10.6 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 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. The coefficient estimates that are in “boxes” present our preferred estimates using the preferred specification as chosen by Workforce Board staff—a difference-in-differences specification.

The longer-term net impacts in Table 10.5 show positive outcomes for private career school students. Although the change in the employment rate is an insignificant decrease, hourly wages increase by almost \$0.80 on average and average quarterly hours rise by 12 hours. These increases result in an estimated net increase in quarterly earnings of \$509. The longer-term results also show a statistically significant decrease in unemployment insurance benefits and reciprocity.

Figure 10.1 Standardized Difference in Means, Pre- and Post-match, Private Career Schools



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

The short-term impacts displayed in Tables 10.5 and 10.6 are, like the longer-term impacts, positive. In the former table, the estimated net impact on quarterly earnings is a little over

Table 10.5 Net Impact Estimates for Private Career School Programs for 2010/2011 Cohort

Outcome	Matched Sample				
	Estimator Average Treatment Effect	Comparison Group Means			
		Full Sample		Matched Sample	
		With 0	W/O 0	With 0	W/O 0
Employment (percentage points) ^a					
Short term	7.2***	54.1		50.2	
Ever-employed, longer term	1.5**	64.9		62.4	
Percent of quarters, longer term	4.5***	55.2		50.6	
Percent of quarters, longer term, diff-in-diff	-0.4	-7.3		8.3	
Hourly wage					
Short term (\$)	1.57***	9.89	18.05	7.77	15.23
Short term, diff-in-diff (\$)	1.18***	-3.75	-2.46	-0.13	-1.28
Longer term (4-quarter average) (\$)	1.17***	10.75	18.87	8.79	16.58
Longer term, diff-in-diff (\$)	0.78***	-2.89	-1.62	0.89	0.21
Quarterly hours					
Short term	42.3***	205.4	374.7	174.6	342.1
Short term, diff-in-diff	24.2***	-38.5	13.1	20.3	29.4
Longer term (4-quarter average)	30.1***	226.0	378.1	194.4	346.2
Longer term, diff-in-diff	12.0**	-17.9	20.1	40.1	38.4
Quarterly earnings					
Short term (\$)	835***	3,792	6,920	2,732	5,354
Short term, diff-in-diff (\$)	709***	-1,654	-771	-193	-66
Longer term (4-quarter average) (\$)	635***	4,475	7,409	3,445	6,047
Longer term, diff-in-diff (\$)	509***	-972	-242	520	719
Unemployment Insurance Benefits					
Percent receiving, short term	-7.3***	24.1		13.8	
Benefits, short term (\$)	-227***	783	3,242	412	2,979
Ever-received, longer term	-2.4***	14.9		9.8	
Benefits, longer term (4-quarter average) (\$)	-20***	170	2,016	103	1,898

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

\$700, comprised of increases in employment, average hourly wage, and average quarterly hours.

The hours worked in a quarter net impact is estimated to go down by 5.4 hours for the 2012/2013

cohort; however, the employment rate rises by 1.9 percentage points and the average hourly

wage net impact shows an increase of about \$0.50 per hour. These positives re-enforce each

other so that average quarterly earnings rise by \$183, which is approximately a 3 percent

increase. Also, in the short-term, reciprocity of and benefit levels of unemployment insurance

decrease significantly in both cohorts.

Table 10.6 Net Impact Estimates for Private Career School Programs for 2012/2013 Cohort

Outcome	Matched Sample		Comparison Group Means			
	Estimator	Treatment Effect	Full Sample		Matched Sample	
			With 0	W/O 0	With 0	W/O 0
Employment ^a						
Short term		1.9**	60.7		57.1	
Hourly wage						
Short term (\$)		0.33**	11.39	18.57	9.31	16.07
Short term, diff-in-diff (\$)		0.50**	-2.77	-1.50	1.50	0.42
Quarterly hours						
Short term		15.4***	235.9	384.8	209.5	361.8
Short term, diff-in-diff		-5.4	-26.5	1.3	59.4	70.5
Quarterly earnings						
Short term (\$)		253***	4,513	7,361	3,473	5,997
Short term, diff-in-diff (\$)		183**	-1,679	-945	640	1,018
Unemployment Insurance Benefits						
Percent receiving, short term		-4.6***	9.6		7.8	
Benefits, short term (\$)		-74***	202	2,110	141	1,823

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

As we have done in prior chapters, we average the short-term net impact estimates from Table 10.5 and 10.6 to derive our preferred estimate for the short term. These averages are presented in Table 10.7, with the preferred estimates in “boxes.” The results in this table suggest

Table 10.7 Short-Term Net Impact Estimates for Private Career School Programs

	2010/2011	2012/2013	Average
	Estimator	Estimator	
Employment ^a			
Short term	7.2***	1.9**	4.5***
Hourly wage			
Short term (\$)	1.57***	0.33**	0.95***
Short term, diff-in-diff (\$)	1.18***	0.50**	0.84***
Quarterly hours			
Short term	42.3***	15.4***	28.8***
Short term, diff-in-diff	24.2***	-5.4	9.4***
Quarterly earnings			
Short term (\$)	835***	253***	544***
Short term, diff-in-diff (\$)	709***	183**	446***
Unemployment Insurance Benefits			
Percent receiving, short term	-7.3***	-4.6***	-5.9***
Benefits, short term (\$)	-227***	-74***	-150***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

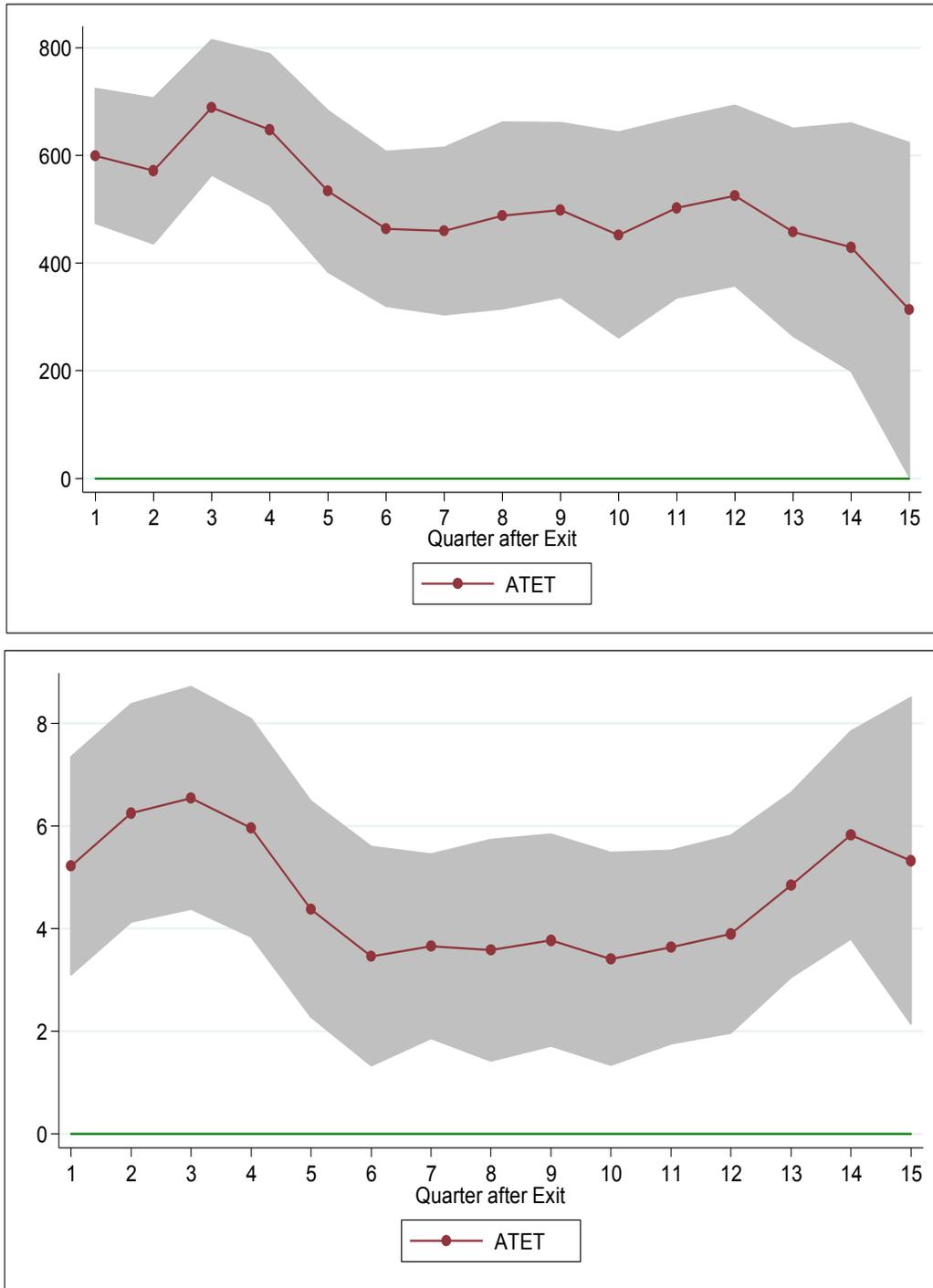
that in the short term, private career school programs provide substantially positive labor market outcomes for exiters. The short-term outcomes are, in fact, greater than the estimated longer-term impacts suggesting that the positive short-term impacts are attenuated, although they certainly do not disappear.

Figures 10.2 and 10.3 display the time paths of employment and earnings for Private Career School exiters for the 2010/2011 and 2012/2013 cohorts, respectively.

Subgroup Analysis

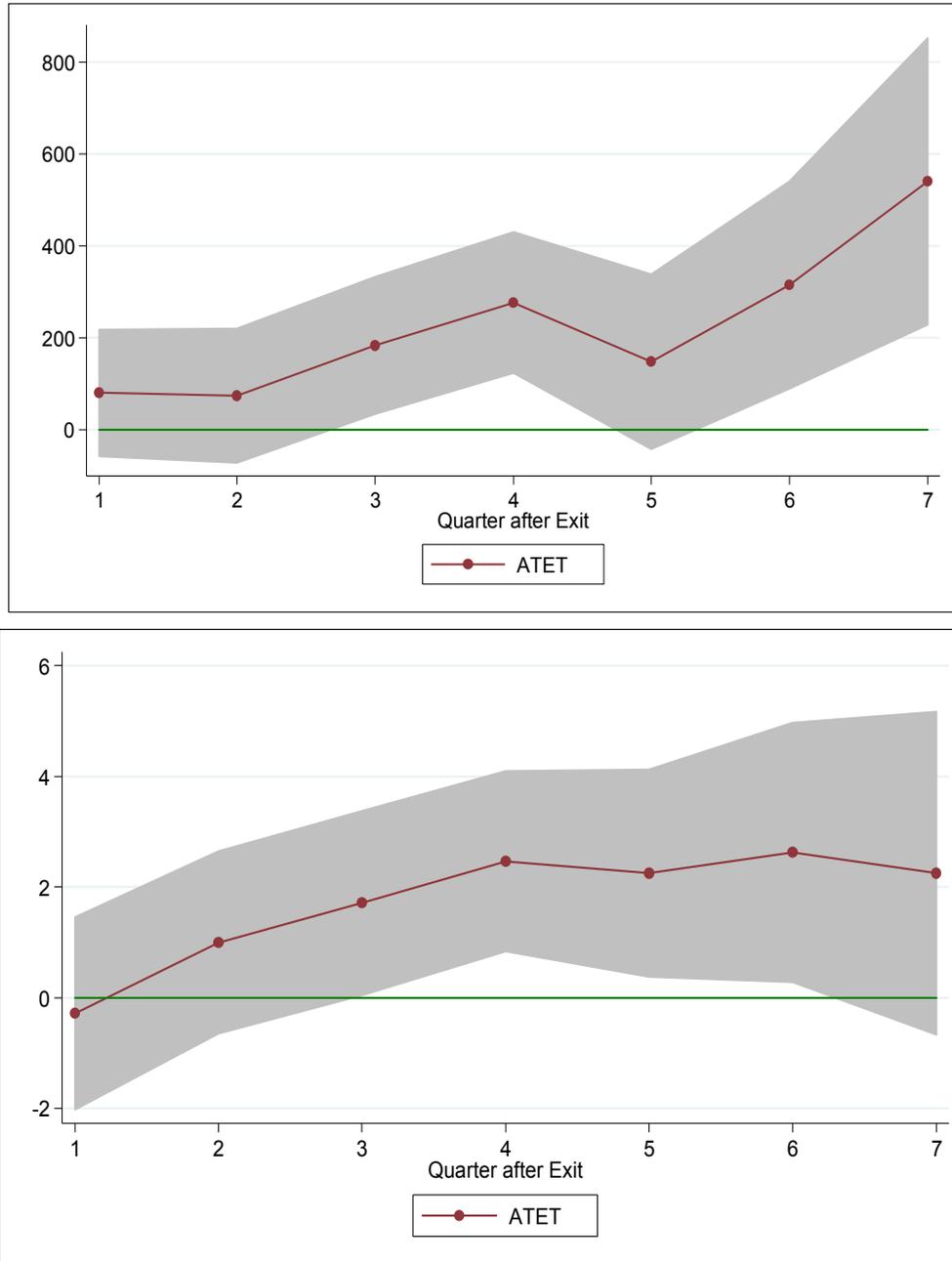
Tables 10.8 and 10.9 provide net impact estimates for the subgroup of the private career school participants for whom the administrative data indicated had completed their programs. Over 75 percent of the private career school students in these cohorts were reported to be completers, so the subsamples consist of a large share of the total treatment samples. The results are different and much stronger for completers than noncompleters, for the most part. For the 2010/2011 cohort of exiters, the short-term employment rate for the two subgroups are -8.8 and 1.0 percentage points for the noncompleters and completers, respectively. The estimated net impacts for the average hourly wage are $-\$0.60$ and $\$1.17$; for the average quarterly hours worked: -22.8 and 22.1 ; and for the average quarterly earnings: $-\$145$ and $\$698$. For the 2012/2013 cohort, the short-term employment rate net impacts for the two subgroups are -5.4 and 3.9 percentage points, for the noncompleters and completers, respectively. The average hourly wage net impacts are $-\$0.75$ and $\$1.03$ and the average quarterly hours worked net impacts are -31 and 7 . All together, the difference in the net impacts on quarterly earnings is over $\$750$. Completers' net impact on earnings is about $\$400$; whereas it is a reduction in quarterly earnings for noncompleters of about $\$350$.

Figure 10.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Private Career School Attendance, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 10.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Private Career School Attendance, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Table 10.8 Selected Longer-Term Net Impact Estimates for Subgroups of Private Career School Participants: 2010/2011 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-8.8%***	1.0%	62.4%
Hourly Wage	-\$0.60**	\$1.17***	\$8.79
Hours Worked (quarterly)	-22.8***	22.1***	194.4
Earnings (quarterly)	-\$145***	\$698***	\$3,445
UI Receipt	-2.8%***	-2.2%***	9.8%
UI Benefits (quarterly)	-\$28***	-\$17***	\$103
Subgroup Sample Size	4,089	14,168	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

Table 10.9 Selected Short-Term Net Impact Estimates for Subgroups of Private Career School Participants: 2012/2013 Cohort

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-5.4%***	3.9%***	57.1%
Hourly Wage	-\$0.75**	\$1.03***	\$9.31
Hours Worked (quarterly)	-30.7***	7.1**	209.5
Earnings (quarterly)	-\$352**	\$405***	\$3,473
UI Receipt	-4.3%***	-4.7%***	7.8%
UI Benefits (quarterly)	-\$67***	-\$76***	\$141
Subgroup Sample Size	3,617	12,649	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

11 REGISTERED APPRENTICESHIP PROGRAMS

The workforce development program that is the “treatment” in this chapter is Registered Apprenticeship programs. Apprenticeships are formal agreements between employed individuals (apprentices), 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 2,000 total on-the-job training hours and at least 144 hours of related and supplemental formal instruction. Registered Apprenticeships are administered in Washington by the Department of Labor and Industries.

Participant Characteristics

Table 11.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The comparison group consists of Wagner-Peyser (WP) registrants who were 16 to 70 at the time of WP 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 2010/2011 to individuals in the comparison group. The final two columns compare the exiters in 2012/2013 to WP registrants in the same year.

One major data limitation in our analyses of Registered Apprenticeship programs is the paucity of information about the individuals’ characteristics. The only characteristics available in the administrative data 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 11.1 Descriptive Statistics for Registered Apprenticeship Treatment Group and Comparison Group Universe

Characteristics	2010/2011		2012/2013	
	Apprenticeship	Wagner-Peyser	Apprenticeship	Wagner-Peyser
<u>Demographics</u>				
Female	8.6%	43.5%	9.0%	44.4%
Race:				
White	77.8%	63.8%	78.8%	61.7%
Black	5.3%	7.0%	5.4%	6.5%
Hispanic	8.6%	14.8%	7.0%	14.2%
Other race	8.4% ^{††}	8.2% ^{††}	8.8% ^{††}	8.3% ^{††}
Missing	0.0%	6.2%	0.0%	9.3%
Mean, age at registration	29.7	37.8	29.5	34.4
Veteran	10.6%	8.8%	11.3%	8.2%
West WA	78.1%	60.1%	76.7%	60.0%
Urban county	62.2%	43.9%	61.5%	45.2%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	72.5%	69.8%	70.2%	67.0%
Average quarterly earnings ^a	\$5,378	\$5,740	\$5,226	\$5,941
Mean, earnings trend ^b	\$175.2	-\$0.8	\$150.0	\$119.1
Mean, earnings variance ^b (in 10 ⁶ \$)	\$13.0	\$18.5	\$13.1 ^{††}	\$13.4 ^{††}
Job turnover	32.7%	19.6%	32.7%	13.0%
Percentage of quarters with multiple jobs	16.9%	15.1%	16.7%	11.8%
Had earnings dip	38.8%	57.1%	37.2%	27.8%
Mean, number of quarters since dip at registration ^a	1.5	2.4	1.4	0.9
Average earnings dip size in percentage ^a	26.6%	43.7%	25.7%	19.1%
Sample Size	3,424	311,603	2,974	174,392

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend 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 9 percent of Registered Apprenticeship participants are females compared to almost 45 percent of the WP registrants. The apprentices are considerably younger as well; they average over 5 years younger in both cohorts, and a smaller share of the apprentices are minorities. The prior employment rates, the trend in average quarterly earnings prior to registration, and prior job turnover of the apprentices are higher than the WP comparison group pool. Most of the other employment and earnings variables have similar means.

Participation Model

Table 11.2 provides the results from the logit estimation of Registered 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 11.2 Coefficient Estimates from a Logit Model of Participation in Registered Apprenticeships

Characteristics	2010/2011		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	-1.752***	0.065	-1.651***	0.067
Race: (White and missing are omitted classes)				
Black	-0.464***	0.082	-0.442***	0.087
Hispanic	-0.284***	0.067	-0.388***	0.078
Other	0.016	0.067	-0.024	0.070
Age	-0.087***	0.002	-0.041***	0.002
Veteran	0.152*	0.061	0.125	0.065
West WA	0.676***	0.047	0.647***	0.050
Urban county	0.691***	0.041	0.517***	0.044
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	0.005***	0.001	-0.003***	0.001
Average quarterly earnings ^a (in 10 ² \$)	0.006***	0.001	0.002**	0.001
Earnings trend ^b (in 10 ² \$)	0.023***	0.003	-0.004	0.002
Earnings variance ^b (in 10 ⁸ \$)	-1.203***	0.128	-0.178*	0.069
Job turnover	0.043***	0.001	0.036***	0.001
Percentage of quarters with multiple jobs	-0.016***	0.001	-0.007***	0.001
Had earnings dip	0.317**	0.099	0.143	0.111
Number of quarters since dip at registration	-0.132***	0.012	0.045**	0.014
Earnings dip size in percentage	-1.232***	0.107	-0.327**	0.119
Constant	-3.776***	0.189	-4.870***	0.220
Observations	315,027		177,366	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

***, ** indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

The coefficient estimates seem quite reasonable. The following variables are significantly correlated with being in the treatment group (i.e., Registered Apprenticeship) in both years of data: Being a veteran, being from Western Washington, residing in an urban county, average quarterly earnings prior to registration, job turnover, and having had an earnings dip. The

following variables are significantly correlated with being in treatment group: Female, minority, age at registration, prior multiple job holding, variance in earnings prior to registration, and length of time since and magnitude of an earnings dip.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients from the logit that was just described 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 Registered Apprenticeships. The mean propensity scores for the treatment groups are roughly 0.12 and 0.11 whereas they are 0.010 and 0.015 for the comparison group for 2010/2011 and 2012/2013 respectively. The 20th percentile indicator is approximately 80 percent for both cohorts. The means and the 20th percentile statistics indicate that the logit model of participation discriminated reasonably well between treatment and comparison group observations.

Table 11.3 Indicators of Propensity Score (p-score) Model Quality for Registered Apprenticeships

Statistic	2010/2011	2012/2013
Mean p-score, Registered Apprenticeship	0.121	0.113
Mean p-score, Wagner-Peyser	0.010	0.015
Percentile Wagner-Peyser, at 20th percentile Registered Apprenticeship	79.1%	79.5%

Statistical Match

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 the

matched comparison group. The balance between the registered apprentices and matched comparison group is not especially strong. Many of the differences in means in the table are significant, and about 8 percent of the comparison group pool observations were used multiple times.

Table 11.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Registered Apprenticeships Analyses

Statistic/Characteristic	2010/2011		2012/2013	
	Apprenticeship	Wagner-Peyser	Apprenticeship	Wagner-Peyser
Sample size	3,424	313,660	2,974	175,456
Sample size used in match	3,424	311,603	2,974	174,392
Matched sample size	3,335	3,335	2,951	2,951
Number of observations used once	---	2,608	---	2,364
Number of observations used multiple times	---	281	---	247
Maximum number of repeats	---	9	---	8
<u>Demographics</u>				
Female	8.7%	8.7%	9.0%	9.0%
Race:				
White	77.7%***	69.6%***	79.0%***	70.6%***
Black	5.3%	4.7%	5.5%	5.3%
Hispanic	8.6%	8.5%	6.9%***	5.2%***
Other race	8.3%	9.0%	8.7%	9.4%
Missing	0.0%***	8.2%***	0.0%***	9.5%***
Mean, age at registration	29.9	29.5	29.6***	28.8***
Veteran	10.6%	11.8%	11.3%	10.4%
West WA	77.9%	77.8%	76.5%	75.5%
Urban county	61.9%	60.2%	61.3%	60.4%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	72.3%***	66.9%***	70.2%***	65.5%***
Average quarterly earnings ^a	\$5,420**	\$5,080**	\$5,243***	\$4,666***
Mean, earnings trend ^b	\$151.5**	\$117.9**	\$151.1	\$116.4
Mean, earnings variance ^b (in 10 ⁶ \$)	\$13.1**	\$12.1**	\$13.2**	\$11.8**
Job turnover	31.3%	30.7%	32.2%	31.7%
Percentage of quarters with multiple jobs	17.0%***	15.8%***	16.7%	16.8%
Had earnings dip	39.6%***	35.0%***	37.4%	37.6%
Mean, number of quarters since dip at registration ^a	1.5***	1.3***	1.4	1.4
Average earnings dip size in percentage ^a	27.2%***	23.7%***	25.7%	26.3%
Sample Size	3,335	3,335	2,951	2,951

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^a Averages include observations with values of zero.

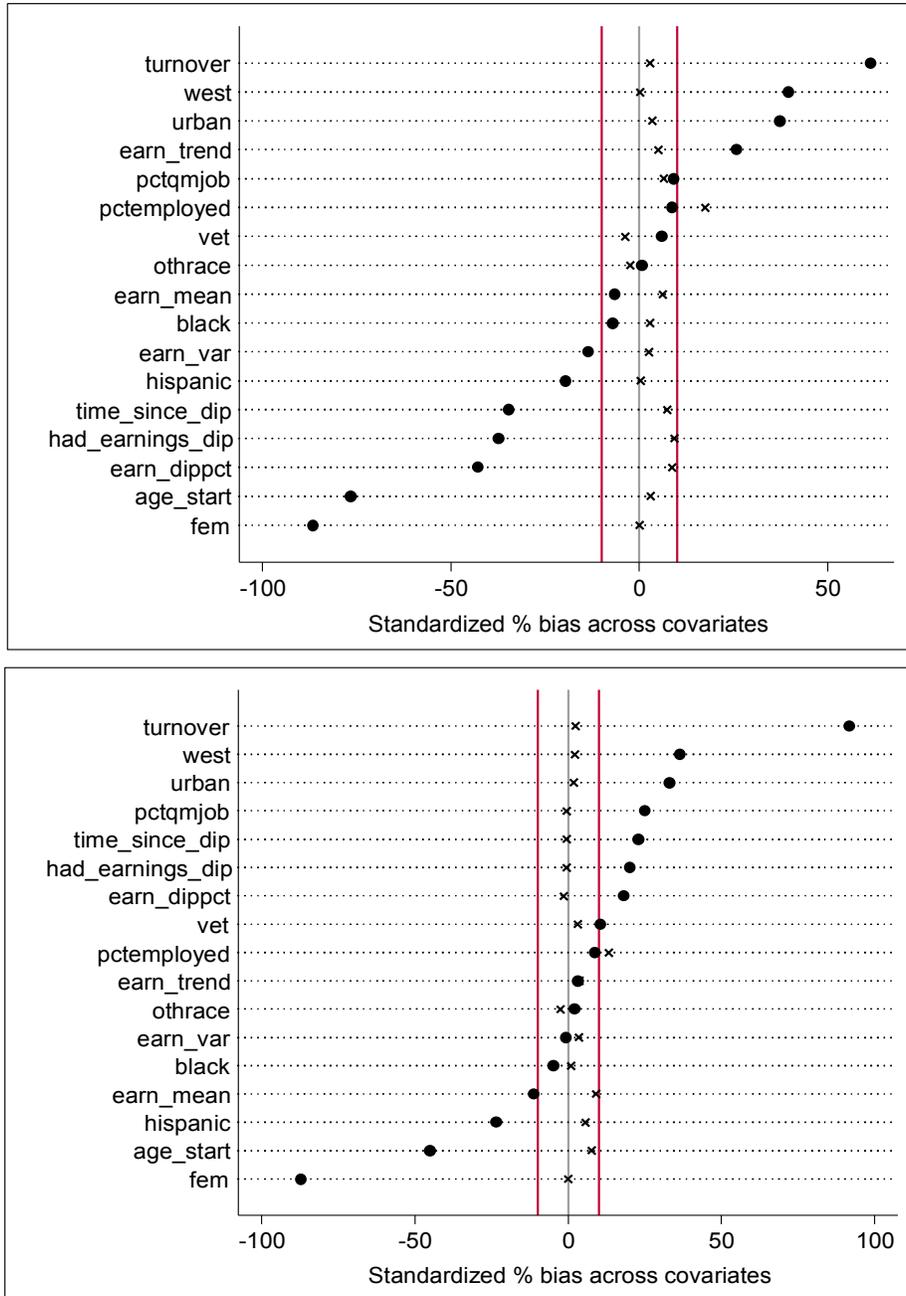
^b Trend and variance calculations include quarters with zero earnings, if any.

Balance

The fact that most of the variables in Table 11.4 show significantly different means suggests that the matched populations are not well-balanced. However, Figure 11.1, which

shows the standardized differences in means before and after the match, indicates that all of the variates in the match satisfy the ± 0.10 criterion for balance. Consequently, we believe that the matched samples are balanced.

Figure 11.1 Standardized Difference in Means, Pre- and Post-match, Registered Apprenticeships



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at ± 0.10 .

Net Impacts

Tables 11.5 and 11.6 provide the estimated net impacts of participating in Registered Apprenticeships. The longer-term impacts, which operate mainly through the hourly wage, are quite positive. The longer-term employment and quarterly hours worked net impacts are essentially zero, but the hourly wage net impact is over \$7.00, and that results in an estimated net impact on quarterly earnings of almost \$3,450 (a 40 percent impact). The longer-term net impacts on unemployment insurance reciprocity are an increase in the percentage of apprenticeship exiters getting UI and an increase in benefits.

Table 11.5 Net Impact Estimates for Registered Apprenticeship Programs for 2010/2011 Cohort

Outcome	Matched Sample		Comparison Group Means			
	Estimator					
	Average	Full Sample		Matched Sample		
	Treatment Effect	With 0	W/O 0	With 0	W/O 0	
Employment (percentage points) ^a						
Short term	9.5***	55.4	---	57.4	---	
Ever-employed, longer term	5.6***	66.7	---	69.6	---	
Percent of quarters, longer term	7.5***	56.9	---	59.5	---	
Percent of quarters, longer term, diff-in-diff	-0.8	-5.1	---	-1.5	---	
Average hourly wage						
Short term (\$)	9.07***	10.08	17.97	11.28	19.41	
Short term, diff-in-diff (\$)	8.48***	-3.27	-2.36	-2.03	-0.72	
Longer term (\$)	7.95***	11.06	18.84	12.67	20.43	
Longer term, diff-in-diff (\$)	7.36***	-2.28	-1.47	-0.64	0.60	
Average quarterly hours						
Short term	57.6***	211.5	377.1	224.0	385.4	
Short term, diff-in-diff	2.8	-30.2	16.2	-19.4	21.5	
Longer term	54.3***	234.3	380.8	250.5	389.1	
Longer term, diff-in-diff	-0.5	-7.4	23.9	7.2	27.6	
Average quarterly earnings						
Short term (\$)	4,294***	3,890	6,936	4,438	7,637	
Short term, diff-in-diff (\$)	3,638***	-1,430	-676	-1,045	-75	
Longer term (\$)	4,104***	4,636	7,456	5,448	8,343	
Longer term, diff-in-diff (\$)	3,447***	-684	-109	-35	748	
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	7.4***	23.4	---	22.1	---	
Benefits, short term (\$)	445***	747	3,190	739	3,346	
Percent receiving, longer term	10.2***	15.1	---	15.9	---	
Benefits, longer term (\$)	282***	171	2,007	172	2,042	

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

Table 11.6 Net Impact Estimates for Registered Apprenticeship Programs for 2012/2013 Cohort

Outcome	Matched Sample	Comparison Group Means			
	Estimator	Full Sample		Matched Sample	
	Average Treatment Effect	With 0	W/O 0	With 0	W/O 0
Employment ^a					
Short term	5.5***	61.8	---	64.4	---
Hourly wage					
Short term (\$)	8.93***	11.55	18.51	12.68	19.48
Short term, diff-in-diff (\$)	8.19***	-2.22	-1.37	-0.03	0.44
Quarterly hours					
Short term	59.2***	241.3	386.6	252.5	387.9
Short term, diff-in-diff	11.7	-16.9	4.9	17.7	49.7
Quarterly earnings					
Short term (\$)	4,759***	4,603	7,374	5,025	7,719
Short term, diff-in-diff (\$)	3,793***	-1,400	-812	91	1,024
Unemployment Insurance Benefits					
Percent receiving, short term	9.8***	9.4		10.2	
Benefits, short term (\$)	398***	199	2,101	213	2,084

NOTE: Monetary impacts in 2014 \$. 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The short-term net impacts shown in Tables 11.5 and 11.6 display hourly wage impacts that are similar to the longer-term net impact – over \$8.00 per hour. Unlike the longer-term net impacts, the estimated short-term net impacts on employment are substantial: 9.5 and 5.5 percentage points for the 2010/2011 and 2012/2013 cohorts, respectively. Those increases together with the large increases in hourly wage rates and small positive, but not significant, increases in quarterly hours worked result in large average quarterly earnings increases of greater than \$3,600. As with the longer-term net impacts shown in Table 11.5, the short-term impacts include an increase in receipt of unemployment insurance benefits, and an increase in the benefit levels.

As we have done in prior chapters, we average the short-term net impact estimates from Table 11.5 and 11.6 to derive our preferred estimate for the short term. These averages are presented in Table 11.7, with the preferred estimates in “boxes.” The results in this table suggest

that in the short term, registered apprenticeships bring substantial positive labor market outcomes in the form of employment and earnings to individuals.

Table 11.7 Short-Term Net Impact Estimates for Registered Apprenticeships

	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	9.5***	5.5***	7.5***
Hourly wage			
Short term (\$)	9.07***	8.93***	9.00***
Short term, diff-in-diff (\$)	8.48***	8.19***	8.34***
Quarterly hours			
Short term	57.6***	59.2***	58.4***
Short term, diff-in-diff	2.8	11.7	7.2
Quarterly earnings			
Short term (\$)	4,294***	4,759***	4,527***
Short term, diff-in-diff (\$)	3,638***	3,793***	3,715***
Unemployment Insurance Benefits			
Percent receiving, short term	7.4***	9.8***	8.6***
Benefits, short term (\$)	445***	398***	421***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

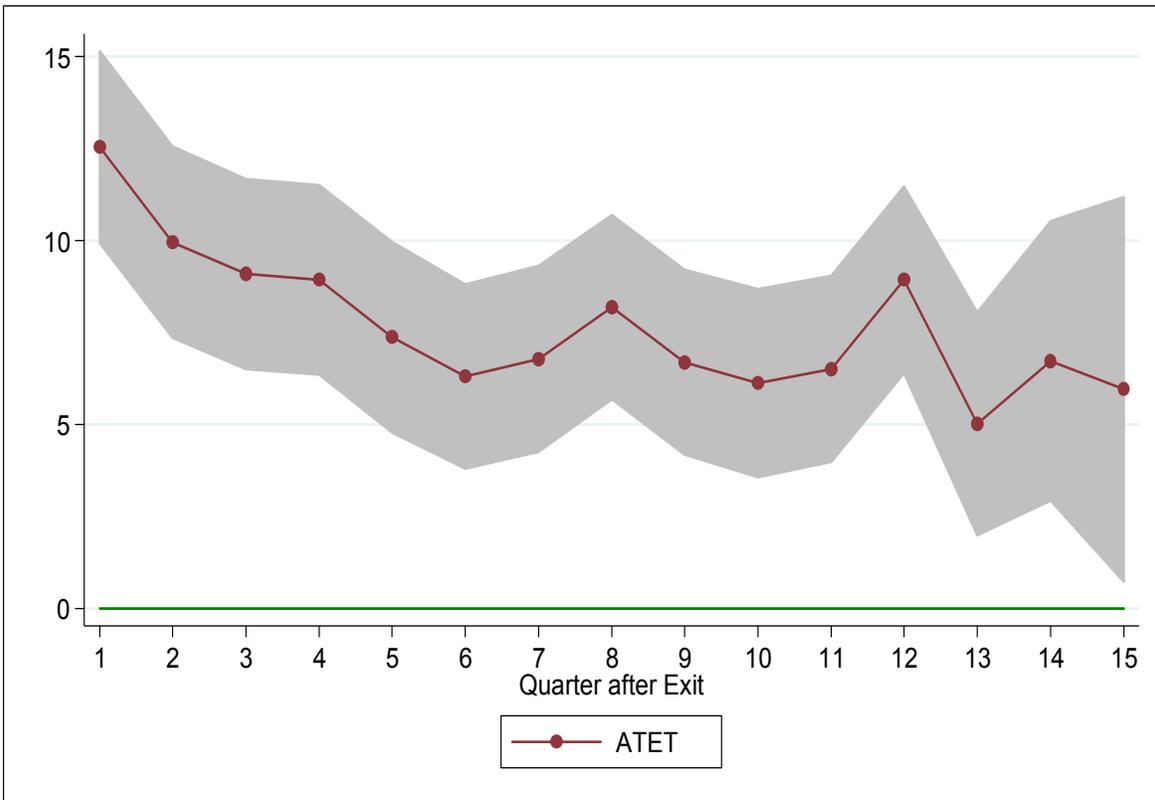
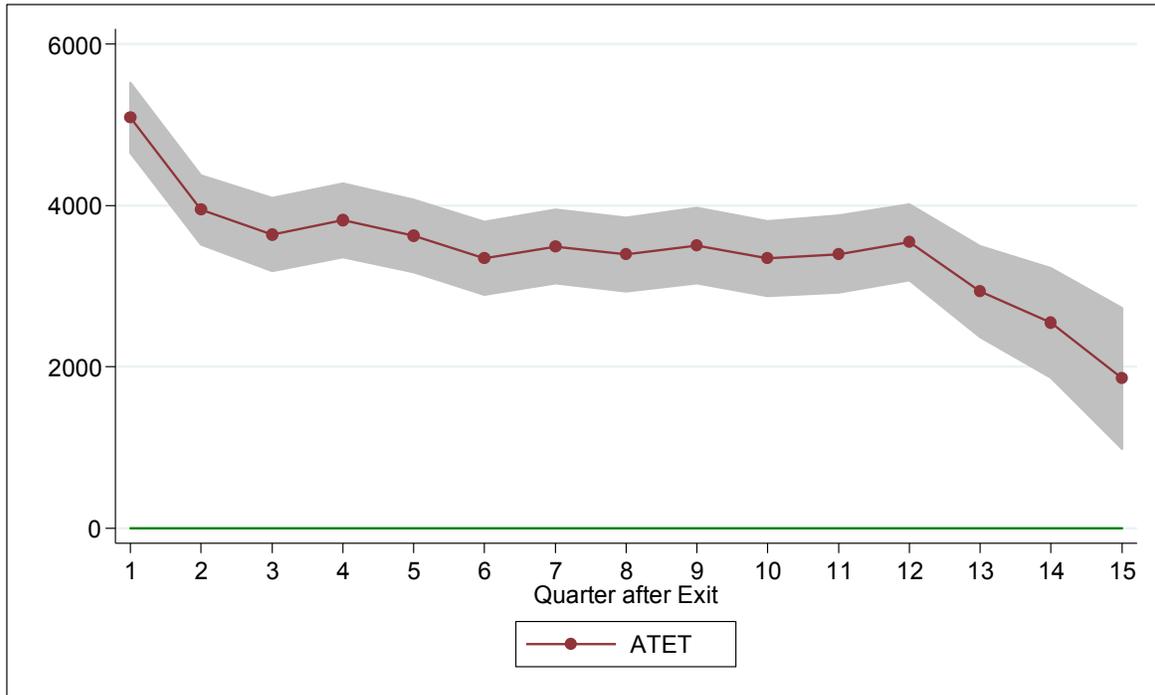
^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

Figures 11.2 and 11.3 show the dynamics of the increase in earnings and employment for apprentices after exiting from the program for the 2010/2011 and 2012/2013 cohorts, respectively.

Subgroup Analyses

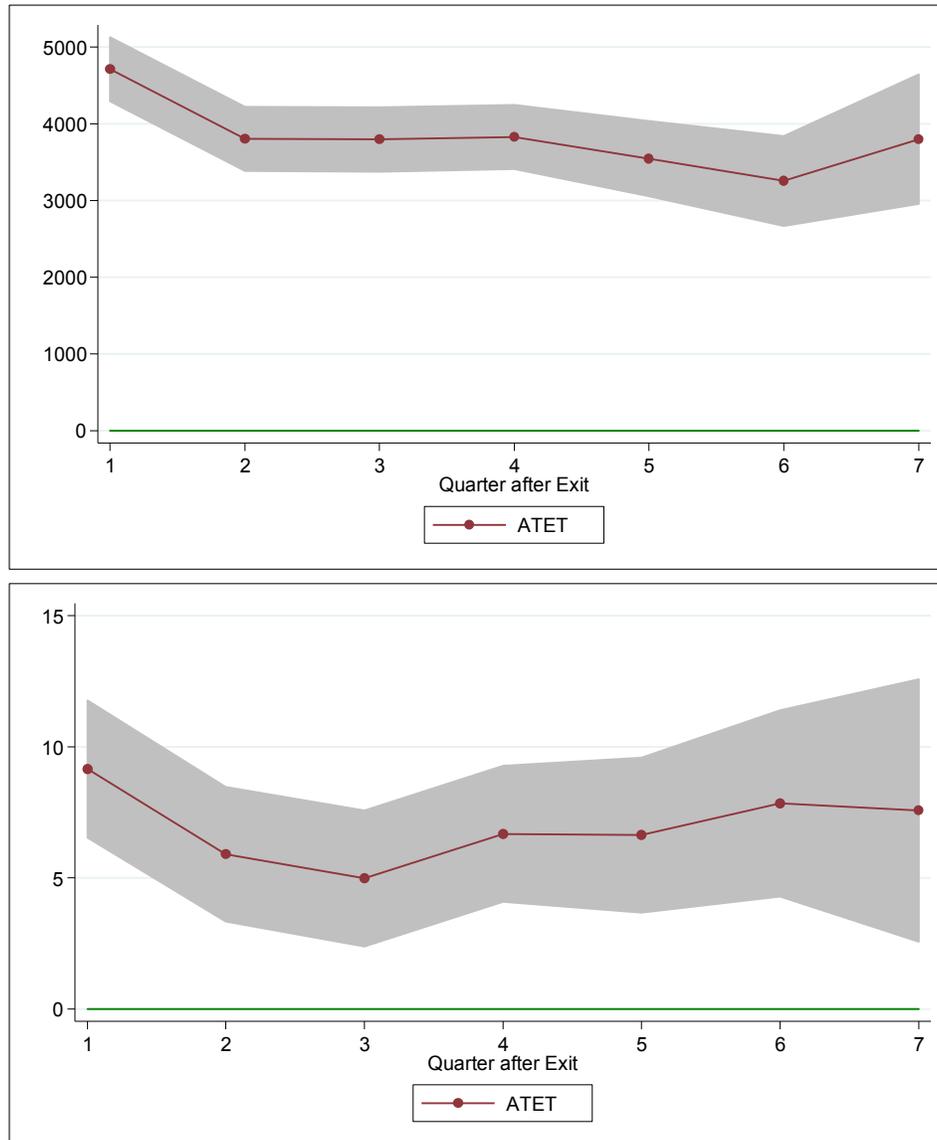
According to the administrative data, under 60 percent of the Registered Apprenticeship treatment groups in both cohorts actually complete their apprenticeships. Tables 11.8 and 11.9 display selected net impact estimates for the completers and for the noncompleters subgroup. All of the impacts in both tables are statistically significant. Clearly, the positive net impacts for the entire treatment group shown in Tables 11.5 and 11.6 are heavily weighted by the completers. In Table 11.8, which shows the longer-term net impacts, the employment rates rise by 7.7 percentage points, wage rates by over \$14.00, and quarterly earnings by over \$6,500.

Figure 11.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Registered Apprenticeships, by Quarter after Exit, 2010/2011 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 11.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Registered Apprenticeships, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Interestingly, the short-term net impact estimates for completers are slightly larger than for the longer-term estimates. The net impact for employment is 17.6 percentage points as compared to 7.7 percentage points in the longer-term. The short-term average hourly wage and average quarterly hours net impacts are \$15.67 per hour and about 37 hours as compared to

\$14.41 and about 32 hours in the longer-term. The average quarterly earnings impact is about \$300 greater in the short-term as well.

**Table 11.8 Selected Longer-Term Net Impact Estimates for Subgroups of Registered Apprenticeships:
2010/2011 Cohort**

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-10.2%***	7.7%***	59.5%
Hourly Wage	-\$0.14***	\$14.41***	\$12.67
Hours Worked (quarterly)	-34.8***	31.7***	250.5
Earnings (quarterly)	\$133***	\$6,559***	\$5,448
UI Receipt	-2.4%***	22.0%***	15.9%
UI Benefits (quarterly)	\$1***	\$545***	\$172
Subgroup Sample Size	1,615	1,720	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

**Table 11.9 Selected Short-Term Net Impact Estimates for Subgroups of Registered Apprenticeships:
2012/2013 Cohort**

Outcome	Subgroup		Matched Comparison Group Mean
	Noncompleters	Completers	
Employment	-8.8%****	17.6%***	64.4%
Hourly Wage	-\$0.25***	\$15.67***	\$12.68
Hours Worked (quarterly)	-13.1***	37.1***	252.5
Earnings (quarterly)	\$273***	\$6,858***	\$5,025
UI Receipt	0.9%***	17.3%***	10.2%
UI Benefits (quarterly)	\$35***	\$705***	\$213
Subgroup Sample Size	1,353	1,598	—

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). — means not applicable.

Participating in a registered apprenticeship seems to bestow quite significant labor market impacts for individuals; the completers subgroup is 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 \$270 in the short term and about \$130 in the longer-term.

12 AEROSPACE TRAINING²⁴

As one of the key economic drivers to the economy in Washington State, the impact of the aerospace workforce is of particular significant for continued health and growth of the aerospace industry. In 2012, Washington State Second Substitute House Bill 2156 established the Workforce Aerospace Pipeline Advisory Committee. The committee, made up of a tri-partite board, has been tasked with recommending training programs for review by the Workforce Board in coordination with the State Board for Community and Technical Colleges. Based on the committee’s recommendations in 2013, five programs have been examined in the Aerospace Manufacturing Skills: Supply, Demand, and Outcomes for Washington’s Aerospace Training Programs Annual Reports for 2013, 2014, and 2015. We have used this general framework but have expanded the analysis to both aerospace and aerospace-related training.

Exiting from one of these five educational programs is the “treatment” in this chapter. The comparison group pool comprises individuals aged 16 to 70 who registered Wagner-Peyser (WP) services at a WorkSource office. Because of data availability, the longer-term results for these programs come from the 2011/2012 fiscal year (matched to the 2010/2011 WP registrants). The short-term results come from the 2012/2013 fiscal year (matched to the 2012/2013 WP registrants).

Participant Characteristics

Table 12.1 provides descriptive data that compare the individuals in the treatment group to those in the comparison group pool. The individuals who were served by Washington’s

²⁴ The program description is from “Aerospace Manufacturing Skills: Supply, Demand, and Outcomes for Washington’s Aerospace Training Programs Annual Report – 2014,” Workforce Training and Education Coordinating Board and State Board for Community and Technical Colleges, February 2015.

education and training programs were removed from the comparison group pool. The first two columns of numbers compare the Aerospace Training participants who exited in 2011/2012 to individuals in the 2010/2011 WP comparison group. The final two columns compare the exiters in 2012/2013 to WP registrants in the same year.

Table 12.1 Descriptive Statistics for Aerospace Training Treatment and Comparison Group Universe

Characteristics	2011/2012	2010/2011	2012/2013	
	Aerospace	Wagner-Peyser	Aerospace	Wagner-Peyser
<u>Demographics</u>				
Female	12.3%	43.2%	12.7%	44.4%
Race:				
White	67.9%	64.7%	60.1%	62.4%
Black	4.4%	6.7%	5.6%	6.4%
Hispanic	4.1%	14.4%	5.8%	13.8%
Other race	23.5%	8.1%	28.3%	8.2%
Missing	0.1%	6.1%	0.1%	9.2%
Mean, age at registration	34.0	39.5	32.9	35.7
West WA	47.6%	60.3%	42.9%	60.3%
Urban county	---	44.1%	---	45.5%
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	63.7%	70.4%	63.0%	67.6%
Average quarterly earnings ^a	\$4,810	\$5,944	\$4,518	\$6,152
Mean, earnings trend ^b	-\$30.5 ^{††}	-\$5.5 ^{††}	\$13.4	\$115.7
Mean, earnings variance ^b (in 10 ⁶ \$)	\$16.3	\$19.4	\$14.4 ^{††}	\$14.0 ^{††}
Job turnover	30.0%	19.2%	28.4%	12.7%
Percentage of quarters with multiple jobs	12.1%	14.9%	11.8% ^{††}	11.6% ^{††}
Had earnings dip	51.6%	57.5%	48.1%	27.9%
Mean, number of quarters since dip at registration ^a	1.8	2.4	1.6	0.9
Average earnings dip size in percentage ^a	43.0% ^{††}	44.1% ^{††}	39.0%	19.0%
Sample Size	1,530	333,316	1,839	182,399

NOTE: All differences in means are statistically significant at the 0.05 level (t-test) unless otherwise denoted. Monetary data in 2014 \$. --- means not available. Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

Just as in our analyses of Registered Apprenticeship programs, there is a paucity of information about the individuals' characteristics. The administrative data available are gender, age, racial status, and residency. As these programs do not have "eligibility requirements" in the ways that programs like Worker Retraining or Welfare-to-Work programs have, data on education background, disability, limited English proficiency status, or employment or public assistance status at the time of enrollment into aerospace training programs are not collected.

These data deficiencies limit severely the quality of the participation model estimation and the statistical match as documented below.

Even with the few characteristics that are available, we see that the populations are quite different. Only about 12 percent of Aerospace Training exiters are females compared to almost 45 percent of the WP registrants. The trainees are considerably younger as well; they average 3 to 5 years younger, and a smaller share of the aerospace training exiters reside in western Washington. The prior employment rates of the Aerospace trainees and average quarterly earnings are lower than the WP comparison group pool; whereas most of the other employment and earnings variables have similar means.

Participation Model

Table 12.2 provides the results from the logit estimation of Aerospace Training participation. The independent variables include 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.

Most of the coefficient estimates are statistically significant. Only a handful of them are positive: being a racial minority other than Black or Hispanic, job turnover, and the size of an earnings dip prior to program registration. Most of the variables are significantly correlated with being in the treatment group: Female, Hispanic, age at registration (not significant in the 2012/2013 cohort), being from western Washington, percentage employment prior to registration, prior multiple job holding, having an earnings dip, and length of time since an earnings dip.

Table 12.2 Coefficient Estimates from a Logit Model of Participation in Aerospace Training

Characteristics	2011/2012		2012/2013	
	Coefficient	Standard Error	Coefficient	Standard Error
<u>Demographics</u>				
Female	-1.729***	0.081	-1.655***	0.073
Race: (White and missing are omitted category)				
Black	-0.355**	0.128	0.100	0.107
Hispanic	-1.314***	0.135	-0.778***	0.106
Other	1.207***	0.064	1.566***	0.057
Age	-0.035***	0.003	-0.002	0.002
West WA	-0.662***	0.053	-0.878***	0.050
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	-0.001	0.001	-0.006***	0.001
Average quarterly earnings ^a (in 10 ² \$)	0.002*	0.001	-0.002*	0.001
Earnings trend ^b (in 10 ² \$)	-0.018***	0.004	-0.001	0.002
Earnings variance ^b (in 10 ⁸ \$)	-0.136	0.082	0.072	0.049
Job turnover	0.038***	0.002	0.031***	0.001
Percentage of quarters with multiple jobs	-0.030***	0.002	-0.017***	0.002
Had earnings dip	-0.198	0.164	-0.202	0.144
Number of quarters since dip at registration	-0.176***	0.017	-0.016	0.016
Earnings dip size in percentage	0.582***	0.162	1.007***	0.147
Constant	-4.790***	0.271	-5.410***	0.249
Observations	334,846		184,238	

NOTE: Model also includes dummy variables for sector of most recent employment (22 categories).

^aAverage includes quarters with values of zero, if any.

^bTrend and variance calculations include quarters with zero earnings, if any.

***, ***, ** indicate statistical significance at p = 0.05, 0.01, and 0.001, respectively.

Propensity Score Statistics

The propensity score for an observation is the predicted probability using the estimated coefficients from the logit that was just described 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 12.3 provides these data for Aerospace Training. The mean propensity scores for the treatment groups are 0.036 and 0.066 whereas they are 0.004 and 0.015 for the comparison group for 2011/2012 and 2012/2013, respectively. The 20th percentile indicator is approximately 66 percent for the earlier cohort and

about 75 percent for the later cohort. The means and the 20th percentile statistics indicate that the logit model of participation discriminated only moderately well between treatment and comparison group observations.

Table 12.3 Indicators of Propensity Score (p-score) Model Quality for Aerospace Training Analyses

Statistic	2011/2012	2012/2013
Mean p-score, Aerospace Training	0.036	0.066
Mean p-score, Wagner-Peyser	0.004	0.015
Percentile Wagner-Peyser, at 20th percentile Aerospace Training	66.2%	73.3%

Statistical Match

Table 12.4 provides data about the sample sizes, number of matched observations that were duplicates, and a comparison of descriptive statistics between the treatment group and the matched comparison group. The balance between the Aerospace Training participants and matched comparison groups is not especially strong. Many of the differences in means in the table are significant, which would be characteristic of only a moderately successful match, but only 4 percent and 6 percent of the comparison group pool observations were used multiple times, which suggests that the match was reasonably successful.

Balance

The fact that most of the variables in Table 12.4 show significantly different means suggests that the matched populations are not well-balanced. However, Figure 12.1, which shows the standardized differences in means before and after the match, indicates that all of the variates in the match satisfy the ± 0.10 criterion for balance. Consequently, we believe that the matched samples are appropriately balanced.

Table 12.4 Matching Algorithm Statistics and Post-Match Comparison of Characteristics for Aerospace Training Analyses

Statistic/Characteristic	2011/2012	2010/2011	2012/2013	
	Aerospace	Wagner-Peyser	Aerospace	Wagner-Peyser

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

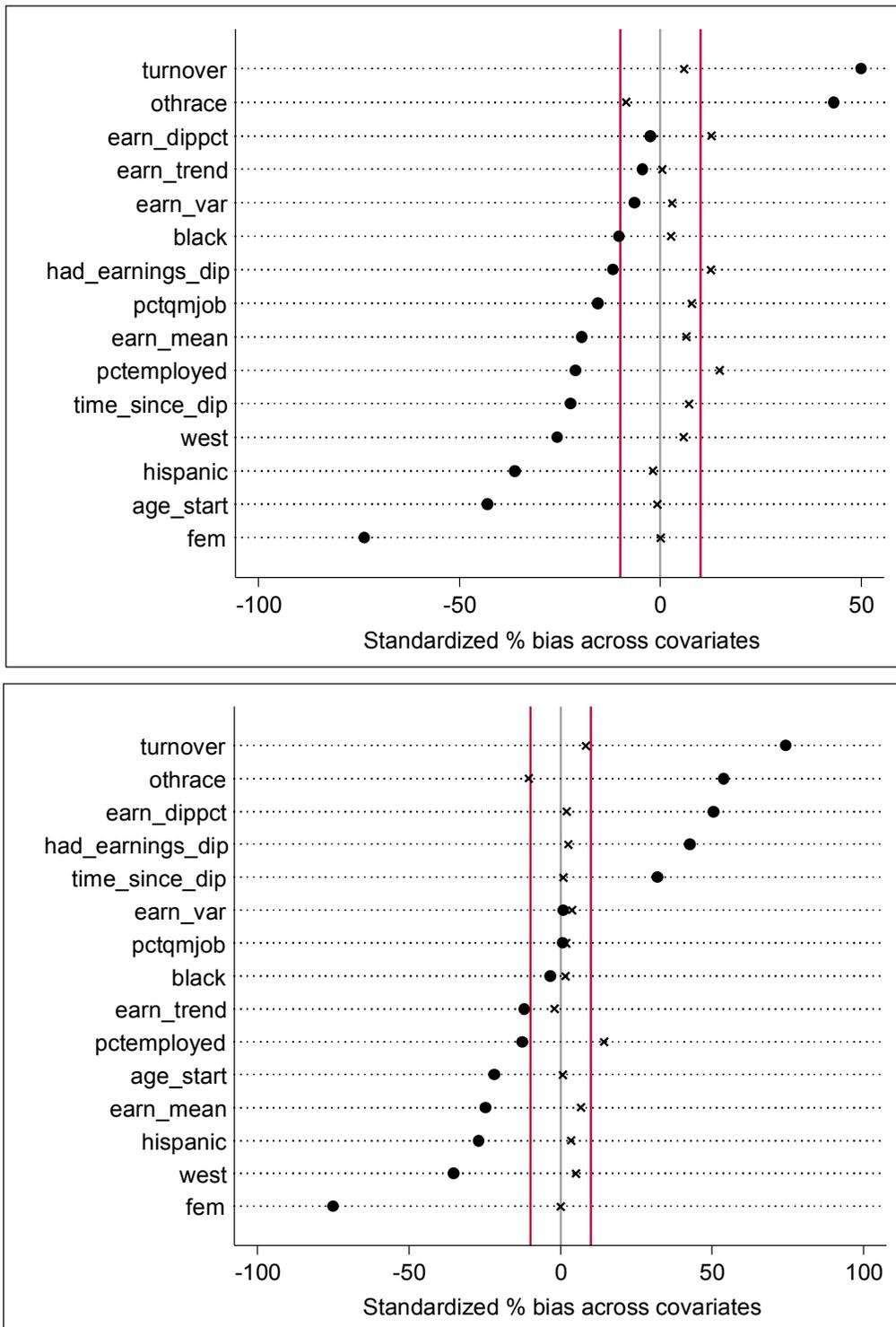
Sample size	1,530	335,449	1,839	183,505
Sample size used in match	1,530	333,316	1,839	182,399
Matched sample size	1,503	1,503	1,821	1,821
Number of observations used once	---	1,334	---	1,528
Number of observations used multiple times	---	63	---	112
Maximum number of repeats	---	8	---	13
<u>Demographics</u>				
Female	12.4%	12.4%	12.8%	12.8%
Race:				
White	68.3%***	58.3%***	60.7%***	52.6%***
Black	4.5%	3.9%	5.7%	5.3%
Hispanic	4.1%	4.7%	5.9%	4.9%
Other race	23.0%*	26.0%*	27.6%***	31.6%***
Missing	0.1%***	7.2%***	0.1%***	5.7%***
Mean, age at registration	34.1	34.2	33.0	32.9
West WA	48.3%	45.4%	43.2%	40.7%
Urban county	0.1%***	37.2%***	0.1%***	40.9%***
<u>Employment and Earnings (prior to registration)</u>				
Percentage of prior quarters employed	63.9%***	59.2%***	63.3%***	58.0%***
Average quarterly earnings ^a	\$4,876*	\$4,505*	\$4,558**	\$4,116**
Mean, earnings trend ^b	-\$28.2	-\$30.7	\$14.9	\$31.6
Mean, earnings variance ^b (in 10 ⁶ \$)	\$16.6	\$15.2	\$14.5	\$12.7
Job turnover	28.8%	27.5%	27.7%***	26.0%**
Percentage of quarters with multiple jobs	12.3%**	11.0%**	11.9%	11.5%
Had earnings dip	52.2%***	45.9%***	48.1%	46.9%
Mean, number of quarters since dip at registration ^a	1.8**	1.7	1.6	1.6
Average earnings dip size in percentage ^a	43.3%***	37.8%***	38.9%	38.1%
Sample Size	1,503	1,503	1,821	1,821

NOTE: Monetary values in 2014 \$. Statistically significant difference in means denoted by *, **, ***. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ (two-tailed test). – means not applicable.

^a Averages include observations with values of zero.

^b Trend and variance calculations include quarters with zero earnings, if any.

Figure 12.1 Standardized Difference in Means, Pre- and Post-match, Aerospace Training



NOTE: Standardized difference in means between comparison group pool and treatment group denoted by dot. Standardized difference in means between matched comparison group and treatment group denoted by x. Red vertical lines at +/- 0.10.

Net Impacts

Tables 12.5 and 12.6 provide the estimated net impacts of participating in Aerospace Training programs for the 2011/2012 and 2012/2013 cohorts, respectively. The first table displays both short-term and longer-term impacts, and the second table shows short-term net impacts. The longer-term impacts in Table 12.5, using difference-in-differences, are quite positive. The longer-term employment differential between the Aerospace Training participants

Table 12.5 Net Impact Estimates for Aerospace Training for 2011/2012 Cohort

Outcome	Matched Sample		Comparison Group Means			
	Estimator		Full Sample		Matched Sample	
	Average	Treatment Effect	With 0	W/O 0	With 0	W/O 0
Employment (percentage points)^a						
Short term	20.6***		54.1	---	51.4	---
Ever-employed, longer term	5.1**		64.9	---	66.7	---
Percent of quarters, longer term	13.8***		55.2	---	54.1	---
Percent of quarters, longer term, diff-in-diff	15.4***		-7.3	---	0.3	---
Average hourly wage						
Short term (\$)	4.86***		9.89	18.05	8.97	17.16
Short term, diff-in-diff (\$)	5.86***		-3.75	-2.46	-2.30	-1.90
Longer term (\$)	5.84***		10.75	18.87	10.50	18.48
Longer term, diff-in-diff (\$)	6.84***		-2.89	-1.62	-0.77	-0.19
Average quarterly hours						
Short term	154.0***		205.4	374.7	190.0	363.2
Short term, diff-in-diff	169.4***		-38.5	13.1	-20.9	12.7
Longer term	111.9***		226.0	378.1	218.8	364.2
Longer term, diff-in-diff	127.4***		-17.9	20.1	8.0	21.0
Average quarterly earnings						
Short term (\$)	3,333***		3,792	6,920	3,464	6,624
Short term, diff-in-diff (\$)	3,839***		-1,654	-771	-993	-378
Longer term (\$)	3,625***		4,475	7,409	4,399	7,182
Longer term, diff-in-diff (\$)	4,132***		-972	-242	-57	460
Unemployment Insurance Benefits (average quarterly)						
Percent receiving, short term	-13.2***		24.1	---	18.5	---
Benefits, short term (\$)	-450***		783	3,242	596	3,422
Percent receiving, longer term	-7.5***		14.9	---	13.4	---
Benefits, longer term (\$)	-105***		170	2,016	162	1,892

NOTE: Monetary impacts in 2014 \$. 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 12.4. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

and the matched comparison group members is over 15 percentage points. The hourly wage net impact is almost \$7.00 per hour, and the hours worked in a quarter increases by 127 hours. The positive differentials in employment, wage rates, and hours worked combine to result in an estimated longer-term quarterly earnings net impact of over \$4,000.

The short-term net impacts are almost as sanguine. In Table 12.5, the short-term net impact for employment is over 20 percentage points. Combined with an estimated wage impact of almost \$6.00 per hour and an estimated quarterly hours of employment of almost 170 hours yields an estimated net impact on quarterly earnings of just short of \$4,000. The entries in Table 12.6 suggest that relative to the comparison group, the short-term employment rate increases by over 9 percent; the average hourly wage increases by over \$3.00 per hour; and the quarterly hours worked increases by over 65 hours. When the employment, hourly wage, and hours worked net impacts are combined, the net impact for earnings is a positive \$1,920.

Table 12.6 Net Impact Estimates for Aerospace Training for 2012/2013 Cohort

Outcome	Matched Sample		Comparison Group Means		
	Estimator	Full Sample		Matched Sample	
	Average Treatment Effect	With 0	W/O 0	With 0	W/O 0
Employment (percentage points) ^a					
Short term	9.3***	60.7	--	62.0	--
Average hourly wage					
Short term (\$)	2.25***	11.39	18.57	11.02	17.69
Short term, diff-in-diff (\$)	3.14***	-2.77	-1.50	-0.22	0.24
Average quarterly hours					
Short term	75.4***	235.9	384.8	238.9	383.3
Short term, diff-in-diff	65.3***	-26.5	1.3	35.6	65.7
Average quarterly earnings					
Short term (\$)	1,672***	4,513	7,361	4,336	6,957
Short term, diff-in-diff (\$)	1,923***	-1,679	-945	-30	888
Unemployment Insurance Benefits (average quarterly)					
Percent receiving, short term	-4.4***	9.6	---	10.3	---
Benefits, short term (\$)	-67**	202	2,110	209	2,216

NOTE: Monetary impacts in 2014 \$. 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 12.4. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

As we have done in prior chapters, we average the short-term net impact estimates from Table 12.5 and 12.6 to derive our preferred estimate for the short term. These averages are presented in Table 12.7, with the preferred estimates in “boxes.” The results in this table suggest that in the short term, aerospace training has quite handsome payoffs for its students. These positive net impacts become even slightly larger in the longer term.

Table 12.7 Short-Term Net Impact Estimates for Aerospace Training

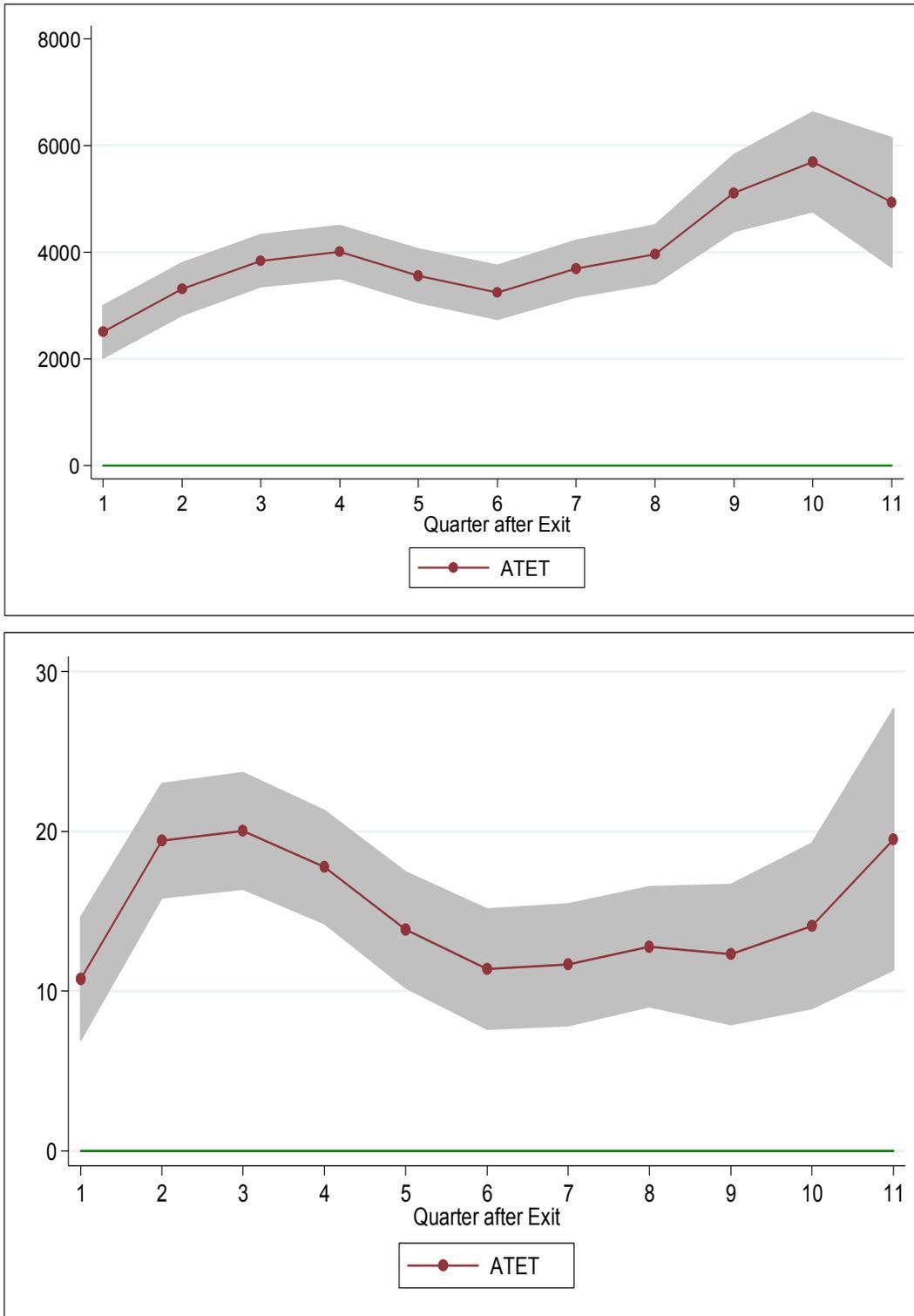
	2011/2012 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	20.6***	9.3***	15.0***
Hourly wage			
Short term (\$)	4.86***	2.25***	3.55***
Short term, diff-in-diff (\$)	5.86***	3.14***	4.50***
Quarterly hours			
Short term	154.0***	75.4***	114.7***
Short term, diff-in-diff	169.4***	65.3***	117.4***
Quarterly earnings			
Short term (\$)	3,333***	1,672***	2,502***
Short term, diff-in-diff (\$)	3,839***	1,923***	2,881***
Unemployment Insurance Benefits			
Percent receiving, short term	-13.2***	-4.4***	-8.8***
Benefits, short term (\$)	-450***	-67**	-258***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

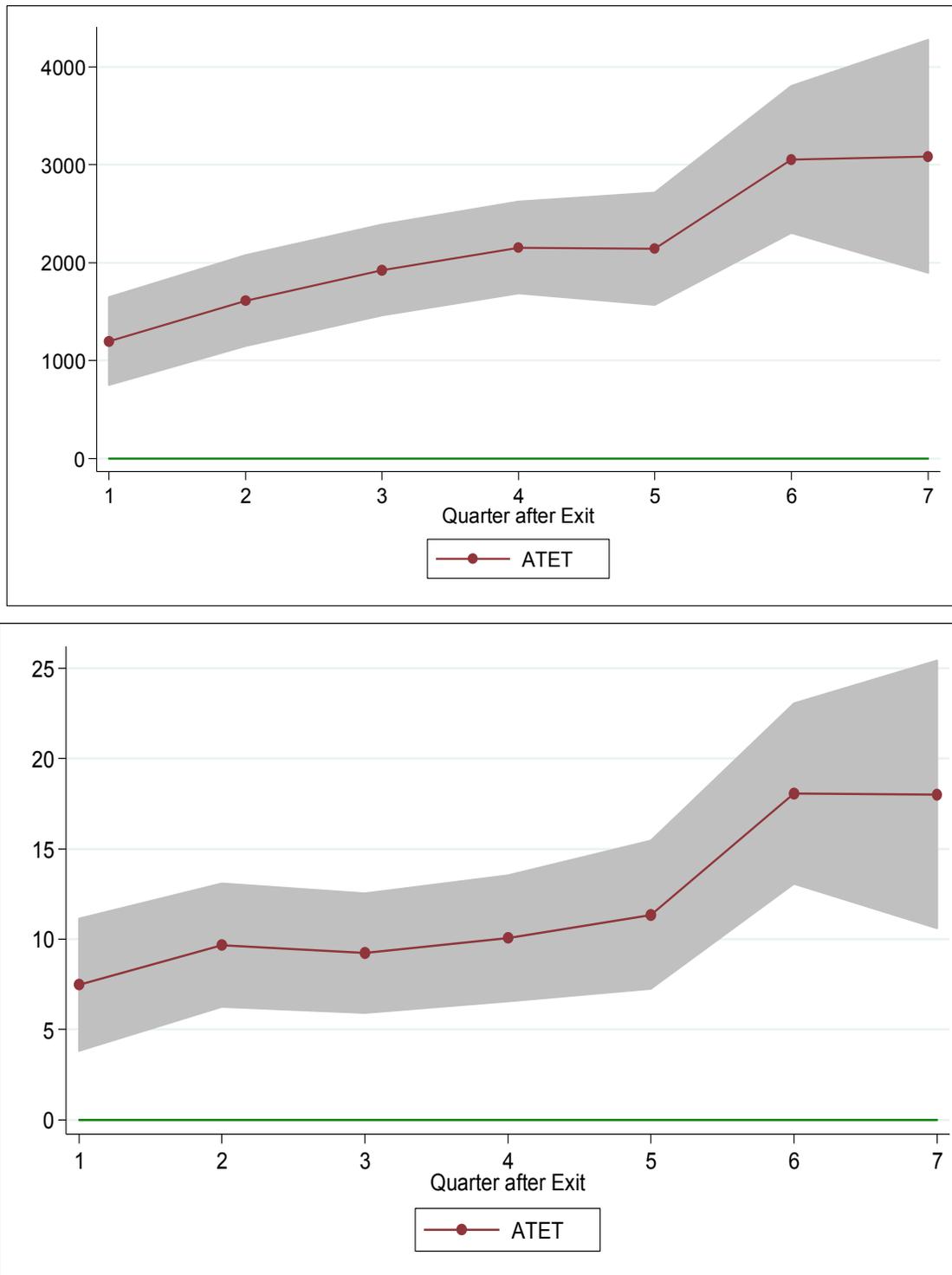
Figures 12.2 and 12.3 display the dynamics of the outcomes for the 2011/2012 and 2012/2013 cohorts, respectively. Since we used the 2011/2012 cohort for the longer-term net impact estimation, the first figures show only 11 quarters following exit.

Figure 12.2 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Aerospace Training, by Quarter after Exit, 2011/2012 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

Figure 12.3 Estimated Net Impacts on Earnings (top) and Employment (bottom) of Aerospace Training, by Quarter after Exit, 2012/2013 Cohort



NOTE: Earnings impacts are measured in 2014 \$. Employment impacts are measured in percentage points. ATET means average treatment effect on the treated (defined in text).

13 HIGH SCHOOL CAREER AND TECHNICAL EDUCATION (CTE) PROGRAMS

Secondary Career and Technical Education provides general workplace and, to some extent, specific occupational skills instruction to high school students. CTE classes in Washington are classified as exploratory or preparatory. Furthermore, all CTE classes are in one of 16 career clusters. 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.

In high school graduate data supplied to us by the Office of the Superintendent of Public Instruction (OSPI), each student observation has 0 – 1 flags for being a CTE completer or not and for being a CTE concentrator or not. A student is identified as a CTE completer if she or he had acquired 360 hours of instruction in a single CTE program area with at least D grades or better. CTE concentrators are students who enrolled in two or more CTE courses above the exploratory level in a single career cluster. High school graduates could be a completer only, a concentrator only, a completer and concentrator, or neither a completer or concentrator. We define the “treatment” for this study to be either a concentrator or completer (or both). The comparison group is students who are neither a completer nor a concentrator.

Participant Characteristics

Table 13.1 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

Table 13.1 Descriptive Statistics for High School CTE Treatment and Comparison Groups

Characteristics	2010/2011		2011/2012	
	CTE Completer or Concentrator	Non-CTE	CTE Completer or Concentrator	Non-CTE
<u>Demographics and Education</u>				
Female	---	---	48.9%	53.1%
Race:				
White	68.3% ^{††}	68.4% ^{††}	66.1% ^{††}	66.7% ^{††}
Black	4.1%	4.5%	4.2%	4.5%
Hispanic	14.9%	12.1%	15.5%	13.4%
Other race	12.7%	15.0%	14.2%	15.4%
Mean, age	17.7 ^{††}	17.7 ^{††}	17.7	17.7
Disability	9.3%	7.9%	9.4%	8.8%
Free-Reduced lunch	35.9%	32.3%	37.7%	35.1%
Bilingual	2.3%	2.5%	2.2%	2.4%
12th grade GPA	2.81	2.96	2.84	2.94
Reading score	424.6	429.1	426.0	429.4
Reading proficiency	93.5%	94.2%	92.2%	92.6%
Math score	399.8	407.4	408.1	412.8
Math proficiency	59.3%	67.8%	68.1%	72.5%
West WA	66.3%	67.1%	66.3%	67.7%
Urban county	53.4%	56.4%	57.9%	52.7%
<u>Employment and Earnings (prior to Senior year)</u>				
Percentage employed prior to Senior year	21.5%	19.6%	19.8% ^{††}	19.3% ^{††}
Average quarterly earnings ^a	\$245	\$213	\$213 ^{††}	\$215 ^{††}
Mean, earnings trend ^b	\$5.2 ^{††}	\$5.1 ^{††}	\$6.3 ^{††}	\$6.8 ^{††}
Mean, earnings variance ^b (in 10 ⁶ \$)	\$0.2	\$0.2	\$0.2 ^{††}	\$0.2 ^{††}
Job turnover	21.1%	19.4%	19.5% ^{††}	19.0% ^{††}
Percentage of quarters with multiple jobs	1.8%	1.6%	1.6% ^{††}	1.6% ^{††}
Had earnings dip	16.2%	14.8%	13.2% ^{††}	13.0% ^{††}
Mean, number of quarters since dip ^a	0.6	0.6	0.5 ^{††}	0.5 ^{††}
Average earnings dip size in percentage ^a	13.8%	12.8%	11.4% ^{††}	11.3% ^{††}
Sample Size	32,974	32,902	34,546	31,286

NOTE: Monetary data in 2014\$. Difference in means is significant at 0.05 level, unless otherwise denoted. --- means not available.

Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

Career and Technical Education completers and concentrators who graduated in 2010/2011 to the remaining students in the sample. The final two columns compare the 2011/2012 Career and Technical Education “treatment” group to other graduates.²⁵

The demographic and educational characteristics of the two groups of graduates are quite different for both cohorts. There are more males (variable not available in the first cohort), a higher share of Hispanic students, a higher percentage of disabled students, and a higher share of

²⁵Data were unavailable for the 2012/2013 academic year, so the analyses in this chapter use 2011/2012 for the short-term impact estimation.

students on free or reduced price lunch among the graduates who are in the treatment group (concentrators or completers). Conversely, there is a smaller share of black and of other racial backgrounds, a smaller share of bilingual students, and a smaller percentage of students from west Washington and from urban areas in the CTE treatment group. In terms of educational achievement, the CTE completers and concentrators have lower cumulative grade point averages and test scores than the comparison group graduates.

For the students in these data sets, the prior employment and earnings data are based on the labor market experiences prior to their senior year. Every one of the prior employment and earnings variables has no statistically significant difference in means for the 2011/2012 cohort. In the first cohort, the differences seem to be relatively minor. The CTE completers and concentrators have more employment experience, but also more job turnover and larger dips in earnings than their non-CTE treatment counterparts.

Net Impacts

For this program (and for Vocational Rehabilitation), the method that we relied on to estimate net impacts was to estimate a regression model in which the outcomes of interest were the dependent variables and the coefficient on a treatment dummy variable (equal to one if the observation was a CTE concentrator or completer; 0 otherwise) was the net impact. Tables 13.2 and 13.3 provide the estimated net impacts of being a CTE completer or concentrator in high school. The longer-term impacts, estimated from the 2010/2011 cohort, are all positive and statistically significant. The longer-term net impacts on employment, hourly wage, and quarterly hours worked are 2.9 percentage points, \$0.44, and 16.0 hours, respectively. These impacts are all in the range of 5 to 10 percent. Together, the estimated increases in employment, hourly

Table 13.2 Net Impact Estimates for High School CTE Graduates for 2010/2011 Cohort

Outcome	Full Sample Estimator	Comparison Group Means	
	Regression Adjusted	Full Sample	
	Treatment Effect	With 0	W/O 0
Employment (percentage points) ^a			
Short term	2.7***	34.4	---
Ever-employed, longer term	2.6***	61.7	---
Percent of quarters, longer term	2.9***	46.9	---
Percent of quarters, longer term, diff-in-diff	1.7***	46.4	---
Average hourly wage			
Short term (\$)	0.32***	3.74	10.47
Short term, diff-in-diff (\$)	0.29***	2.55	0.66
Longer term (\$)	0.44***	5.75	11.98
Longer term, diff-in-diff (\$)	0.41***	4.56	2.25
Average quarterly hours			
Short term	9.2***	80.4	224.9
Short term, diff-in-diff	8.9***	66.6	116.4
Longer term	16.0***	141.4	269.3
Longer term, diff-in-diff	15.6***	127.7	173.2
Average quarterly earnings			
Short term (\$)	112***	832	2,328
Short term, diff-in-diff (\$)	109***	696	1,360
Longer term (\$)	241***	1,745	3,309
Longer term, diff-in-diff (\$)	238***	1,609	2,555
Post-Secondary Education			
Post-Secondary Ed, longer term (%)	-1.6***	53.1	---

NOTE: Monetary impacts in 2014 \$. 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 the final row 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

wages, and hours worked combine to derive an estimated net impact of over \$240 in quarterly earnings, which is about a 12 percent impact.

For this population, we had very little data on unemployment insurance take up.

However, we did have postsecondary enrollment data. The estimated net impact on this outcome was a decrease relative to the comparison group of graduates of 1.6 percentage points.

It should be noted that the time frame for the longer-term analysis was 9 to 12 quarters after leaving high school, so the labor market outcomes will be a combination of the outcomes for individuals who are not in postsecondary education and the part-time employment experiences of those who are.

Table 13.3 Net Impact Estimates for High School CTE Graduates for 2011/2012 Cohort

Outcome	Full Sample	Comparison Group Means	
	Estimator	Full Sample	
	Regression Adjusted Treatment Effect	With 0	W/O 0
Employment ^a			
Short term	2.1**	36.0	---
Hourly wage			
Short term (\$)	0.23**	3.98	10.66
Short term, diff-in-diff (\$)	0.24**	2.87	0.87
Quarterly hours			
Short term	8.4***	84.2	225.3
Short term, diff-in-diff	8.5***	71.3	123.9
Quarterly earnings			
Short term (\$)	95***	907	2,426
Short term, diff-in-diff (\$)	98***	775	1,511
Post-Secondary Education			
Post-Secondary Ed, Short term (%)	-1.5***	57.1	--

NOTE: Monetary impacts in 2014 \$. 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 the final row 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.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The short-term (three quarters after graduation) outcomes for CTE students displayed in Tables 13.2 and 13.3 are very similar to the longer-term outcomes; however, they are smaller in size. The employment differentials between CTE treatment and comparison group students are estimated to be 2.7 and 2.1 percentage points for the 2010/2011 and 2011/2012 cohorts, respectively; the hourly wage differentials are \$0.32 and \$0.23; the hours worked in a quarter differentials are 9.2 and 8.4 hours; and the quarterly earnings impacts are estimated to be \$112 and \$95. As with the longer-term estimate, there is a negative differential in postsecondary enrollment for the 2011/2012 cohort that is almost the same size as the longer-term differential: -1.5 percentage points as compared to 1.6.

As we have done in prior chapters, we average the short-term net impact estimates from Table 13.2 and 13.3 to derive our preferred estimate for the short term. These averages are presented in Table 13.4, with the preferred estimates in “boxes.” The estimates in this table suggest that in the short term, CTE results in favorable labor market outcomes for graduates,

Table 13.4 Short-Term Net Impact Estimates for High School CTE Graduates

	2010/2011 Estimator	2011/2012 Estimator	Average
Employment ^a			
Short term	2.7***	2.1**	2.4***
Hourly wage			
Short term (\$)	0.32***	0.23**	0.28***
Short term, diff-in-diff (\$)	0.29***	0.24**	0.27***
Quarterly hours			
Short term	9.2***	8.4***	8.8***
Short term, diff-in-diff	8.9***	8.5***	8.7***
Quarterly earnings			
Short term (\$)	112***	95***	104***
Short term, diff-in-diff (\$)	109***	98***	104***
Post-Secondary Education			
Post-Secondary Ed. Short term (%)	-1.6***	-1.5***	-1.6***

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

although as noted above, these impacts confound part-time employment for students who continue their education at the postsecondary level with graduates who directly enter the labor market.

14 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 may be 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 from 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 participants, 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 and who did not get services, i.e., developed a rehabilitation plan.²⁶ The latter individuals became the comparison group pool. Table 14.1

²⁶ DVR created this variable. Essentially, the treatment consisted of having a rehabilitation plan. Some individuals successfully completed their plan and others did not. The comparison group comprised individuals who exited pre-plan.

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 DVR treatment exiters in 2010/2011 to the individuals in the comparison group. The final two columns compare the 2012/2013 exiters to their comparison group pool of applicants who exited pre-plan.

Table 14.1 Descriptive Statistics for DVR Treatment and Comparison Groups

Characteristics	2010/2011		2012/2013	
	DVR Treatment Group	Comparison Group	DVR Treatment Group	Comparison Group
Demographics and Education				
Female	43.5%	41.1%	43.9% ^{††}	43.1% ^{††}
Race:				
White	70.7%	67.9%	69.8%	66.9%
Black	8.5%	9.9%	9.4% ^{††}	10.3% ^{††}
Hispanic	8.3% ^{††}	9.0% ^{††}	8.7% ^{††}	9.6% ^{††}
Other race	9.9% ^{††}	9.6% ^{††}	9.1% ^{††}	9.6% ^{††}
Missing	2.5%	3.5%	3.1% ^{††}	3.5% ^{††}
Mean, age at registration	37.9 ^{††}	38.0 ^{††}	38.0 ^{††}	38.4 ^{††}
Employed at registration	14.4%	7.1%	14.0%	7.1%
Mean, years of education at registration	13.6	13.5	13.6	13.5
Veteran	0.7% ^{††}	1.1% ^{††}	1.1% ^{††}	1.5% ^{††}
Received SSDI	25.0%	21.1%	26.2% ^{††}	24.9% ^{††}
Received SSI	19.3% ^{††}	18.3% ^{††}	20.3%	22.6%
Received TANF	3.7%	6.7%	3.9%	6.7%
Received other public assistance	25.1%	35.3%	24.8%	31.1%
West WA	70.0%	64.0%	71.7% ^{††}	70.0% ^{††}
Urban county	46.0%	40.4%	47.2% ^{††}	45.6% ^{††}
Employment and Earnings (prior to registration)				
Percentage of prior quarters employed	48.2%	38.3%	45.9%	35.5%
Average quarterly earnings ^a	\$2,548	\$1,871	\$2,420	\$1,817
Mean, earnings trend ^b	-\$38.8 ^{††}	-\$46.4 ^{††}	-\$38.2 ^{††}	-\$30.6 ^{††}
Mean, earnings variance ^b (in 10 ⁶ \$)	\$7.6	\$5.6	\$6.9	\$5.8
Job turnover	32.1%	35.8%	30.7%	33.4%
Percentage of quarters with multiple jobs	11.3% ^{††}	11.4% ^{††}	11.1% ^{††}	10.5% ^{††}
Had earnings dip	44.2%	40.4%	39.8%	29.7%
Mean, number of quarters since dip at registration ^a	1.7 ^{††}	1.7 ^{††}	1.6	1.2
Average earnings dip size in percentage ^a	37.0% ^{††}	35.7% ^{††}	33.3%	26.1%
Sample Size	5,473	4,825	5,005	4,435

NOTE: Monetary data in 2014\$. Difference in means is significant at 0.05 level, unless otherwise denoted. --- means not available.

Prior employment and earnings variables are defined in Chapter 3 (pp. 24-25).

^aAverages include observations with values of zero.

^bTrend and variance calculations include quarters with zero earnings, if any.

^{††}Differences in means are not statistically significant at 0.05 level (t-test).

The purposes of Table 14.1 are twofold. The table presents a descriptive picture of DVR customers, and it demonstrates the differences between the treatment and comparison groups of

customers. The top panel of the table, labeled demographics and education, presents fairly straightforward descriptions of the populations of customers. Just over 40 percent of customers are women; about 70 percent of customers are white; their average age is about 38; between 7 to 14 percent of them are employed at registration; about one percent are veterans; a substantial percentage are receiving SSDI, SSI, and/or other public assistance at the time of registration; and about 70 percent are from the Western side of the state.

The bottom panel of the table is a bit more difficult to understand. It consists of variables that describe the labor market experiences of customer **prior to** applying for services. The first variable presents the percent of quarters in which the average customer worked during this time—less than 50 percent. The second variable presents the average quarterly earnings prior to applying for services; this average, which includes a high percentage of 0's, is between \$1,800 and \$2,500. The next two variables are the trend and variance of the trend in quarterly earnings for customers. The negative sign on the trend indicates that, on average, quarterly earnings go smaller. The next variable, job turnover, measures what percentage of customers had earnings from different employers. The next variable reports what percentage of quarters of employment had more than one employer in the quarter—this is about 11 percent of the quarters on average. The final set of variables refer to an earnings dip, which is a drop in earnings of 20 percent or more from one quarter to the next. About 40 percent of the customers had experienced an earnings dip prior to applying for services. On average, the dip occurred around 1.7 quarters prior to application and was, on average, about 35 percent.

In using the table to identify any systematic differences between the treatment and comparison cases, we find that many of the differences are not statistically significant. Relative to the individuals comprising the comparison group, the means presented in the table concerning

socio-demographic variables at the time of application for services show that the individuals in the treatment group are slightly less likely to be a minority, more likely to be employed at registration, less likely to be receiving TANF or other public assistance at the time of application, more likely to be from western Washington, and more likely to be from an urban county. The means in the table concerning employment and earnings histories prior to registration show that the treatment group had higher levels of employment and average quarterly earnings, and had less job turnover prior to applying.

Net Impacts

The major purpose of the study is to estimate the net impacts of the education and training programs on clients. Tables 14.2 and 14.3 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 2010/2011 cohort of program exiters. The second table is limited to the short-term net impacts for the 2012/2013 cohort. The table presents the net impact estimate from a regression model in which the dependent variables are the outcomes. The preferred specification uses levels of the outcome variables. The assumptions of the difference-in-differences specification are unlikely to hold for many of the treatment and comparison group cases. Many customers were unlikely to be employed during the base period and/or disabling conditions may have occurred between the base period and application. 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 longer-term payoffs for the individuals in the treatment group relative to those in the comparison group. The longer-term net

Table 14.2 Net Impact Estimates for DVR Programs for 2010/2011 Cohort

Outcome	Full Sample		Comparison Group Means	
	Estimator		Full Sample	
	Regression Adjusted	Treatment Effect	With 0	W/O 0
Employment (percentage points) ^a				
Short term	20.1***		18.7	---
Ever-employed, longer term	13.7***		29.0	---
Percent of quarters, longer term	2.4***		21.2	---
Percent of quarters, longer term, diff-in-diff	-0.6		-4.8	---
Average hourly wage				
Short term (\$)	-0.03		2.70	13.84
Short term, diff-in-diff (\$)	-0.34**		-1.31	-0.66
Longer term (\$)	0.45***		3.04	13.61
Longer term, diff-in-diff (\$)	0.05		-0.97	-0.69
Average quarterly hours				
Short term	9.0***		53.5	274.2
Short term, diff-in-diff	-0.1		-20.3	22.8
Longer term	10.8***		65.6	260.6
Longer term, diff-in-diff	-0.3		-8.1	45.8
Average quarterly earnings				
Short term (\$)	138***		751	3,852
Short term, diff-in-diff (\$)	-7		-421	67
Longer term (\$)	228***		956	3,742
Longer term, diff-in-diff (\$)	51		-216	446
Unemployment Insurance Benefits (average quarterly)				
Percent receiving, short term	0.1		4.9	---
Benefits, short term (\$)	-5		147	2,979
Percent receiving, longer term	1.1***		4.1	---
Benefits, longer term (\$)	25***		44	1,887

NOTE: Monetary impacts in 2014 \$. 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 the final row of Table 13.1. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit. Ever-employed, longer term is defined as having more than \$100 in any quarter from the 9th to the 12th quarter after exit. Percent of quarters, longer-term takes on values of 0%, 25%, 50%, 75%, or 100% for an observation depending on whether the observation was employed for 0, 1, 2, 3, or 4 quarters between the 9th and 12th quarter after exit.

impact of receiving services on the employment rate is estimated to be 2.4 percentage points.

The net impacts on hourly wage and quarterly hours worked are \$0.45 and 10.8 hours,

respectively. The impacts on average quarterly earnings is just under \$230. All of these

impacts are statistically significant. The increased employment and earnings apparently

increases the propensity of DVR service recipients to receive unemployment insurance (up 1.1

percentage points) and to receive higher levels of benefits (\$25 per quarter).

Table 14.3 Net Impact Estimates for DVR Programs for 2012/2013 Cohort

Outcome	Full Sample Estimator	Comparison Group Means	
	Regression Adjusted Treatment Effect	With 0	W/O 0
Employment ^a			
Short term	21.9***	21.7	---
Hourly wage			
Short term (\$)	0.10	2.95	13.03
Short term, diff-in-diff (\$)	-0.36***	-0.37	-0.76
Quarterly hours			
Short term	8.7***	62.4	276.1
Short term, diff-in-diff	-2.1	2.6	29.3
Quarterly earnings			
Short term (\$)	101**	883	3,906
Short term, diff-in-diff (\$)	-87	-104	273
Unemployment Insurance Benefits			
Percent receiving, short term	0.8**	2.2	---
Benefits, short term (\$)	11	50	2,221

NOTE: Monetary impacts in 2014 \$. 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 the final row of Table 13.1. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test). -- means not applicable.

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

The short-term net impacts shown in Tables 14.2 and 14.3 are also positive, for the most part. Especially large is the employment impact of over 20 percentage points. There is no impact on average hourly wage rates and a small positive impact on quarterly hours worked. Overall, there is an estimated net impact of \$138 (2010/2011 cohort) and \$101 (2012/2013 cohort) in quarterly earnings. As with the longer-term outcomes, Table 14.3 shows an increase in unemployment insurance take-up in the short term, however the take-up rate in the earlier cohort and the average quarterly benefits in both cohorts are not statistically significant.

As we have done in prior chapters, we average the short-term net impact estimates from Table 14.2 and 14.3 to derive our preferred estimate for the short term. These averages are presented in Table 14.4, with the preferred estimates in “boxes.” The results in this table suggest that in the short term, there is a huge (more than 20 percentage point) increase in employment. Since the long-term net impact is just 2.4 percentage points, it is likely that the large estimated net impact on employment is an artifact of the definition of treatment and the comparison

Table 14.4 Short-Term Net Impact Estimates for DVR Programs

	2010/2011 Estimator	2012/2013 Estimator	Average
Employment ^a			
Short term	20.1***	21.9***	21.0***
Hourly wage			
Short term (\$)	-0.03	0.10	0.04
Short term, diff-in-diff (\$)	-0.34**	-0.36***	-0.35***
Quarterly hours			
Short term	9.0***	8.7***	8.9***
Short term, diff-in-diff	-0.1	-2.1	-1.1
Quarterly earnings			
Short term (\$)	138***	101**	120***
Short term, diff-in-diff (\$)	-7	-87	-47
Unemployment Insurance Benefits			
Percent receiving, short term	0.1	0.8**	0.5
Benefits, short term (\$)	-5	11	3

NOTE: Monetary data in 2014 \$. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level (two-tailed test).

^aShort term employment is defined as having more than \$100 in quarterly earnings in the 3rd quarter after exit.

group's employment rate substantially catches up to the treatment group by the longer-term. The short-term net impacts on average quarterly hours of employment and quarterly earnings are modestly positive, and these impacts grow slightly in the longer-term.

15 BENEFIT-COST ANALYSES

In addition to the net impact analyses, we have conducted 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)
- Changes to UI benefits (if changes are negative; positive benefit to participants and negative benefit to society; vice versa if changes are positive)

The costs included the following:

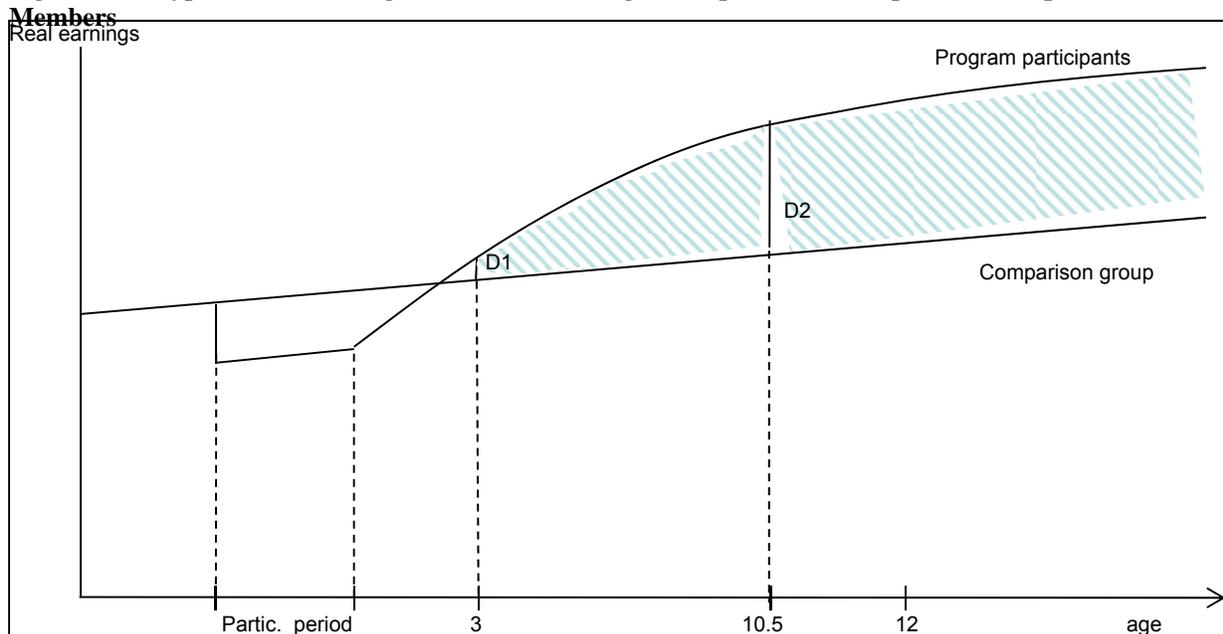
- Forgone earnings (reduced earnings during the period of program participation)
- Forgone tax receipts (cost to the public)
- Tuition payments, if any
- Program costs

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 15.1 shows the earnings profiles for an average individual in any one of the treatment groups and an average individual 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

Figure 15.1 Hypothetical Earnings Profiles of Training Participants and Comparison Group



group member's earnings, on average. These 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 from the data to which we had access) 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.

For this study, we interpolated the time path of unconditional earnings net impacts for the first 12 quarters after exit using a simple linearization²⁷ of the 2010/2011 cohort results. (Note these are the values that are graphed in the 2010/2011 cohort net impact figures above.) We used a single cohort in order to get a consistent base for the interpolation.

To extrapolate for quarters beyond the three years of follow-up data, the assumption was made that in all quarters after quarter 12 until the average participant turned 65, the net impact would be constant, i.e., the distance between the earnings outcomes for program participants and comparison group members shown in Figure 15.1 would stay constant after the 12th quarter.

Table 15.1 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. The U.S. Department of Labor Bureau of Labor Statistics, *Economic News Release*, No. 16-1808, September 8, 2016 reports the ratio of “Total Benefits” to “Wages and Salaries” for private in June 2016 to be 43.5 percent for “All U.S.” and 42.5 for the Pacific Census region. 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

²⁷ Equations (1) through (3) specify the interpolation used for these two programs.

- (1) $Trend_j = (Longterm_j - Shortterm_j) / 7.5$
- (2) $Constant_j = Shortterm_j - 3 * QtrEarnchange_j$
- (3) $Netearningsimpact_{jt} = Trend_j + Constant_j * q, q = 1, 12;$ where

$Longterm_j, Shortterm_j$ = longer-term and short-term average quarterly unconditional earnings net impact estimates for program j , and
 $Netearningsimpact_{jt}$ = interpolated average quarterly unconditional earnings net impact estimates for program j in quarter q

Table 15.1 Data Used in Earnings Interpolations and Extrapolations

Program	Short-term Net Impact ^a (‘14\$) (1)	Longer-term Net Impact ^b (‘14\$) (2)	Earnings Linearization ^c (‘14\$) (3)	Quarter 13 + Extrapolated Value ^d (‘14\$) (4)	Average Age at Exit ^e (5)	Number of Quarters until 65 (6)
WIA Adults	1,646	1,319	1,776.8 – 43.6q	1,253.6	37.6	109
WIA Dislocated Workers	1,881	1,455	2,051.4 – 56.8q	1,369.8	45.5	78
WIA Youth	363	250	408.3 – 15.1q	227.1	19.2	183
Workforce Education	1,454	1,372	1,486.7 – 10.9q	1,355.9	32.0	132
Worker Retraining	770	1,132	625.1 + 48.3q	1,204.7	41.8	93
Basic Education for Adults	130	–85	216.1 – 28.7q	0.0	32.0	132
I-BEST	814	976	749.2 + 21.6q	1,008.4	33.0	128
Private Career Schools	709	509	750.7 – 13.9q	583.9	31.0	136
Apprenticeship	3,638	3,447	3,685.7 – 15.9q	3,494.9	32.3	131
Aerospace Training	3,839	4,132	3,721.7 + 39.1q	4190.9	34.2	123
Career and Technical Education	112	241	20.5 + 30.5q	386.5	17.7	190
Vocational Rehabilitation	138	228	102.0 + 12.0q	246.0	39.3	103

^a Unconditional average quarterly earnings net impact for 3rd quarter after exit estimated from 2010/2011 cohort.

^b Longer-term unconditional average quarterly earnings net impact estimated from 2010/2011 cohort.

^c For first nine rows, trend regression on first 12 quarters of unconditional average quarterly earnings net impact estimated from 2010/2011 cohort. For final two rows, linearization as described in footnote 27.

^d Calculated from column (3) with q = 12.

^e Arithmetic average of average age at registration for 2010/2011 and 2012/2013 cohorts plus average duration of services.

estimation, we used the assumption that this ratio would be 40 percent (applied to the net impact earnings increments).

Employee Tax Liabilities

Higher earnings will lead to payment of increased payroll, sales/excise, and federal income taxes.²⁸ The increased taxes are a cost to participants and a benefit to the public. We used average (marginal) tax rates for each of the three types of taxes and applied these rates to the estimated 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

²⁸Washington does not have state income taxes.

(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 dislocated workers, community and technical college worker retraining, and apprenticeships. For the latter programs, in which recipients had higher incomes, we used a rate of 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%20Alternatives%20Model%2020055%ver2.xls> in March 2006. Table 15.2 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 15.2 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	
\$30–\$40,000	3,184	34,236	0.0903
\$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 Treasury, Internal Revenue Service, *SOI Tax Stats – Individual Statistical Tables by Size of Adjusted Gross Income* (<https://www.irs.gov/uac/soi-tax-stats-individual-statistical-tables-by-adjusted-gross-income.pdf>; accessed September 2016), Table 1.1. This table showed average tax payments for filing year 2015 (tax year of 2014). Table 15.3 includes some of that data 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 between \$5,000 and \$20,000 is 0.0449, and the average of the marginal tax rates for AGIs between \$20,000 and \$40,000 is 0.0866. Based on these two numbers, we decided to use a (marginal) tax rate of 0.045 for all the programs except WIA dislocated workers, community and technical college worker retraining, and apprenticeship. For the latter three programs, we use 0.09.

Table 15.3 Marginal Federal Income Tax Rate Calculations

Total adjusted gross income (1)	Average tax liability, 2014 (2)	AGI midpoint (3)	Marginal tax rate (4)
\$1 – 4,999	\$ 178	\$ 2,500	0.0042
\$5,000 – 9,999	199	7,500	0.0194
\$10,000 – 14,999	296	12,500	0.0704
\$15,000 – 19,999	649	17,500	0.0700
\$20,000 – 24,999	999	22,500	0.0904
\$25,000 – 29,999	1,451	17,500	0.0995
\$30,000 – 39,999	2,197	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. Department of Treasury, Internal Revenue Service, *SOI Tax Stats – Individual Statistical Tables by Size of Adjusted Gross Income*, Table 1.1.

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 youth programs, aerospace training, and secondary CTE programs. We were unable to estimate net

impacts of participation in the two workforce programs that serve youth (WIA youth and secondary CTE) because of a very small number of observations. So, we did not estimate this benefit or cost for those two programs.

Table 15.4 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 programs (i.e., basic education for adults and aerospace training) continue to be negative for the entire period. For registered 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 15.4 Interpolation/Extrapolation of Unconditional Quarterly UI Benefits, by Program

Quarter after exit	Program									
	WIA Adult	WIA DW	Workforce Educ.	Worker Retrain.	BEA	I-BEST	Priv. Career	Appren.	Aerospace	DVR
1	-197.2	-664.1	-276.2	-315.7	-126.4	-311.4	-190.7	464.5	0	51.6
2	-173.6	-581.3	-267.8	-277.6	-114.2	-281.7	-170.6	443	0	49.8
3	-150	-498.5	-259.4	-239.5	-102	-252.0	-150.5	421.5	0	48
4	-126.4	-415.7	-251	-201.4	-89.8	-222.3	-130.4	400	0	46.2
5	-102.8	-332.9	-242.6	-163.3	-77.6	-192.6	-110.3	378.5	0	44.4
6	-79.2	-250.1	-234.2	-125.2	-65.4	-162.9	-90.2	357	0	42.6
7	-55.6	-167.3	-225.8	-87.1	-53.2	-133.2	-70.1	335.5	0	40.8
8	-32	-84.5	-217.4	-49	-41	-103.5	-50	314	0	39
9	-8.4	-1.7	-209	-10.9	-28.8	-73.8	-29.9	292.5	0	37.2
10	15.2	81.1	-200.6	27.2	-16.6	-44.1	-9.8	271	0	35.4
11	38.8	163.9	-192.2	65.3	-4.4	-14.4	10.3	249.5	0	33.6
12 - 40	62.4	246.7	-183.8	103.4	7.8	15.3	30.4	228	0	31.8

NOTE: Entries are in 2014 \$. Extrapolation periods were 40 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.²⁹ The data sources for these types of costs are considered in turn.

Forgone Compensation

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, we used equation (4) to estimate mechanistically the forgone earnings. Note that we calculate them in real \$. Specifically, we calculate $Forgone_i$ for both 2010/2011 and 2012/2013 exiters and average them. Table 15.5 displays the data as tabulated from administrative records. Table 14.6 displays the estimated forgone earnings.

$$(4) \quad Forgone_i = \left[0.5 \times (\hat{E}_{-1_i} + \bar{E}_{-1_i}) - \bar{E}_{0_i} \right] \times d_i \quad ,$$

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

²⁹ The exception is private career schools, which are assumed to get no state subsidy.

- \hat{E}_1 = avg. quarterly earnings in 1st post-exit period for matched comparison group
- d = avg. program participation duration
- i = indexes program

Table 15.5 Average Quarterly Earnings and Average Training Duration, by Program

Program	\bar{E}_{-1}		\bar{E}_0		\hat{E}_1		d (in quarters)	
	2010/2011	2012/2013	2010/2011	2012/2013	2010/2011	2012/2013	2010/2011	2012/2013
	1							
WIA Adults	1,680	1,717	2,556	3,210	2,120	2,838	3.37	3.08
WIA Disloc. Workers	5,931	5,540	2,986	3,737	3,455	3,889	4.47	4.24
WIA Youth	355	364	1,103	1,187	1,267	2,350	3.32	2.94
CTC Workforce Educ.	3,722	3,056	3,332	3,345	2,441	3,180	4.65	5.27
CTC Worker Retraining	3,265	2,678	1,842	2,660	3,026	3,413	5.58	6.33
CTC BEdA	1,850	2,115	2,154	2,657	2,186	2,796	1.46	1.37
CTC I-BEST	1,949	1,700	2,257	2,413	2,405	3,163	1.71	2.70
Priv. Career Schools	2,843	3,015	2,159	2,274	2,156	2,891	1.87	1.50
Apprentice	6,713	6,580	9,402	9,649	3,603	4,208	10.94	11.87
Aerospace	2,636	2,936	3,052	3,292	2,965	3,702	3.23	3.20
Secondary CTE	315	281	857	853	1,219	1,331	1.47	1.46
DVR	1,529	1,311	2,025	1,820	814	959	4.59	5.24

NOTE: Average quarterly earnings data in columns (1) – (6) are in '14 \$.

Table 15.6 Estimated Forgone Earnings, by Program

Program	<i>Foregone</i>		
	2010/2011	2012/2013	Average
	(1)	(2)	(3)
WIA Adults	-2,214	-2,872	-2,544
WIA Disloc. Workers	7,627	4,194	5,911
WIA Youth	-968	500	-234
CTC Workforce Educ.	-2,444	-1,196	-1,820
CTC Worker Retraining	7,272	2,439	4,856
CTC BEdA	-199	-276	-238
CTC I-BEST	-182	57	-63
Priv. Career Schools	685	1,011	848
Apprenticeships	-46,417	-50,501	-48,459
Aerospace	-813	86	-364
Secondary CTE	-173	-68	-121
DVR Programs	-3,918	-3,601	-3,760

NOTE: Dollars in '14 \$.

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 quarters (see Table 15.5) to be retrained. Usually, their new jobs pay only a fraction of what their old jobs did. Unlike prior studies in which we estimated positive foregone earnings for most programs, with these two cohorts, we only found one other program with positive foregone earnings – Private Career Schools – and our estimate there was only about \$800. All of the other programs were estimated to have negative forgone earnings, meaning that the program participants were actually earning more than the comparison group on average during their participation in programs. These negative forgone earnings were relatively small for five programs – WIA Youth, BEdA, I-BEST, Aerospace Training, and CTE. They are relatively large for the remaining four programs – WIA Adults, Workforce Education at Community and Technical Colleges, DVR, and Registered Apprenticeship. The latter was quite large; almost \$50,000. This means that registered apprentices were earning almost \$5,000 more per quarter on average than their comparison group counterparts during their apprenticeships.

In the 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

WIA. The WIA costs were calculated from cost and participant data published in the Workforce Board's WIA Title 1-B Annual Reports for PY 10 and PY 12. Those reports provide annual participants and expenditures for youth, adults, and dislocated workers. We first

converted the published cost per participant to 2014\$ by using the CPI-U (in Appendix B). Then to adjust the expenditure per participant data (14\$) to expenditure per exiter (14\$), we used the average durations from Table 15.5. Finally, we averaged the PY 10 and PY 12 data to get a single cost for the cost/benefit analyses. Table 15.7 provides the data used in these calculations.

Table 15.7 WIA Costs per Participant, by Program

Program	2010/2011			2012/2013			Cost used in c/b analysis (14\$)
	Published cost/ participant	Cost/participant (14\$)	Cost/exiter ^a (14\$)	Published cost/ participant	Cost/participant (14\$)	Cost/exiter ^a (14\$)	
WIA Adults	\$2,451	\$2,670	\$2,250	\$2,776	\$2,865	\$2,199	\$2,224.50
Dislocated Workers	2,332	2,541	2,839	2,690	2,777	2,943	2,891
Youth	3,490	3,802	3,346	3,358	3,466	2,678	3,012

Community/Technical College Costs. Staff from the State Board for Community and Technical Colleges (SBCTC) supplied the cost data for the BEdA, Job Preparation, Worker Retraining, and Aerospace training programs to the WORKFORCE BOARD. In particular, SBCTC supplied the following average nominal costs for the state support and student cost for a full-time resident student:

<u>Year</u>	<u>State Cost</u>	<u>Student</u>
FY2011		
Workplace Ed.	\$4,548	\$1,956
Worker Retraining	4,576	1,966
BEdA ^a	4,736	0
Aerospace	4,519	1,941
FY2013		
Workplace Ed.	4,089	2,458
Worker Retraining	4,076	2,451
BEdA ^a	4,906	0

^aSBCTC staff noted that BEdA cost is not for tuition. It represents internal state subsidization from other mission areas because BEdA has no tuition.

Per state staff's suggestion, we assumed that Workplace Education students averaged 1.9 years; Worker Retraining participants averaged 1.3 years; and BEdA participants average 1.0 years of full-time equivalent course taking. We furthermore assumed that BEdA students did not pay tuition.

The program and private costs used in the cost-benefit calculations were derived by inflating all of the costs to 2014\$ and assigning the FY2011 data to the 2010/2011 cohorts and FY2013 data to the 2012/2013 cohort. In the cost-benefit analyses, the arithmetic average of the two cohorts' costs were used. Thus the public (state) cost for Workforce Education equaled \$8,717 [1.9 ftes * 0.5 * (\$4,955 + \$4,221)]. The public cost for Worker Retraining = \$4,705 [1.3 ftes * 0.5 (\$4,986 + \$4,207)]; and the public cost for BEdA = \$5,112 [1.0 fte * 0.5 * (\$5,160 + \$5,064)]. The private (tuition) costs for Workplace Education = \$4,435 [1.9 ftes * 0.5 * (\$2,131 + \$2,537)] and for Worker Retraining = \$3,037 [1.3 ftes * 0.5 * (\$2,142 + \$2,530)].

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 BEdA, 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.

Registered Apprenticeships. Registered Apprenticeships typically involve several years of on-the-job training plus related formal instruction. Data on the duration of related instruction came from the Department of Labor & Industries (L&I). The data on tuition and state subsidies from SBCTC were used to calculate private and public apprenticeship costs. The related instructional component of a Registered Apprenticeship is typically 144 hours, which works out to 0.16 fte. Registered Apprenticeships typically last four years, so a total of 0.64 fte per apprentice was assumed. In our prior study, we used information from the Washington Department of Labor & Industries (L&I) that suggested that the negotiated cost of the formal instruction part of apprenticeship programs is approximately one-half of the full-time equivalent tuition. Using the student cost data supplied by SBCTC staff persons in 2014\$ (\$1,964 in

FY2011 and \$2,344 in FY2013), assuming 0.64 ftes, and assuming that the employer/apprentice pays half of the tuition cost works out to a private cost of \$689. Typically, the employer would pay these charges, but ultimately, we assume that part of the cost is borne by the apprentice either directly or in lower wages. These costs do not include books, tools, or transportation.

The public cost includes the instructional subsidy to the community and technical college system plus the average administrative cost per registered apprentice. The instructional subsidy is 0.64 ftes times the average FY2011 and FY2013 state subsidy per fte of \$4,264, which equals \$2,729. Pro-rating the annual administrative cost of approximately \$1.6 million across the apprentices yields an estimate of about \$480 per exiter. Thus the public cost for a Registered Apprentice is \$3,209.

Aerospace training. As noted above in the description of the Aerospace Training programs that are occurring in the state, the education comprises technical workforce education within the community and technical college system to prepare individuals for aerospace occupations. Consequently, we have used the cost data for Community and Technical College Workforce Education for this specialized program.

Secondary Career and Technical Education. The Office of the Superintendent of Public Instruction provided a state and federal support level of high school CTE of approximately \$359.48 million in PY 2010-11 and \$365.21 million in PY 2012-13.³⁰ The online OSPI Washington State Report Card reports CTE high school enrollment of 259,405 and 190,316 for those two academic years, respectively. These figures represent a per student cost of \$1,385.8 and \$1,919.0 in nominal terms, in 2010-11 and 2012-13. Absent more specific information about the course taking of the concentrators and completers, we use the average of

³⁰ Memo from Phouang Hamilton to Colleen Seto, no date.

these costs inflated to 2014\$ as the cost of secondary CTE on a per student basis. This is \$1,745.3.

Division of Vocational Rehabilitation. Data provided by the Division of Vocational Rehabilitation that tracked precisely the expenditures for purchased services for the treatment groups analyzed in chapter 14 and that imputed counseling and guidance costs yielded a public cost of \$6,637 per individual customer who exited.

Results

Tables 15.8 – 15.19 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, if they are calculable.³¹ The results are present in real 2014\$ dollars, so everything has been adjusted for inflation. However, in addition, the participant's benefits are discounted by an annual rate of 3.0 percent to take into account the time value of money. However, the public's benefits are not discounted.

³¹ If investment costs are negative because the forgone compensation of participants is negative, no ROI can be calculated.

Table 15.8 Estimated Participant and Public Benefits and Costs per Participant in WIA Adult Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	14,787	0	96,274	0
Fringe Benefits	5,915	0	38,510	0
Taxes	-2,477	2,574	-16,126	23,370
Transfers				
UI	- 888	910	644	- 938
Costs				
Forgone compensation	-3,135	-426	- 3,135	-426
Program costs	0	2,225	0	2,225
Return on investment (quarterly)			--	19.6%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. – denotes not calculable.

Table 15.9 Estimated Participant and Public Benefits and Costs per Participant in WIA Dislocated Workers Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	16,734	0	67,803	0
Fringe Benefits	6,694	0	27,121	0
Taxes	-4,184	4,347	-16,951	23,301
Transfers				
UI	-3,105	3,190	505	-1,169
Costs				
Forgone compensation	6,798	1,477	6,798	1,477
Program costs	0	2,891	0	2,891
Return on investment (quarterly)			11.2%	16.4%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. – denotes not calculable.

Table 15.10 Estimated Participant and Public Benefits and Costs per Participant in WIA Youth Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	3,133	0	23,665	0
Fringe Benefits	1,253	0	9,466	0
Taxes	-525	545	-3,964	7,128
Transfers				
UI	0	0	0	0
Costs				
Forgone compensation	-288	-39	-288	-39
Program costs	0	3,012	0	3,012
Return on investment (quarterly)			–	1.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. – denotes not calculable.

Table 15.11 Estimated Participant and Public Benefits and Costs per Participant in Community and Technical College Workforce Education Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	13,709	0	114,581	0
Fringe Benefits	5,483	0	45,833	0
Taxes	-2,296	2,390	-19,192	30,099
Transfers				
UI	-1,522	1,570	-1,441	1,469
Costs				
Forgone compensation	-2,243	-305	-2,243	-305
Program costs	4,435	8,717	4,435	8,717
Return on investment (quarterly)			--	3.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. -- denotes not calculable.

Table 15.12 Estimated Participant and Public Benefits and Costs per Participant in Community and Technical College Worker Retraining Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	8,526	0	69,116	0
Fringe Benefits	3,411	0	27,646	0
Taxes	-2,132	2,227	-17,279	24,985
Transfers				
UI	-1,527	1,570	126	-122
Costs				
Forgone compensation	5,584	1,214	5,584	1,214
Program costs	3,037	4,705	3,037	4,705
Return on investment (quarterly)			11.6%	5.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. -- denotes not calculable.

Table 15.13 Estimated Participant and Public Benefits and Costs per Participant in Community and Technical College BEdA Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	576	0	367	0
Fringe Benefits	230	0	147	0
Taxes	-97	117	-61	22
Transfers				
UI	-733	758	-930	993
Costs				
Forgone compensation	-293	-40	-293	-40
Program costs	0	5,112	0	5,112
Return on investment (quarterly)			--	--

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. -- denotes not calculable.

Table 15.14 Estimated Participant and Public Benefits and Costs per Participant in Community and Technical College I-BEST Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	8,324	0	81,779	0
Fringe Benefits	3,329	0	32,711	0
Taxes	-1,394	1,737	-13,698	25,551
Transfers				
UI	-1,724	1,778	-1,371	1,348
Costs				
Forgone compensation	-77	-11	-77	-11
Program costs	0	5,112	0	5,112
Return on investment (quarterly)			-	4.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. - denotes not calculable.

Table 15.15 Estimated Participant and Public Benefits and Costs per Participant in Private Career School Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	6,484	0	50,796	0
Fringe Benefits	2,593	0	20,318	0
Taxes	-1,086	1,129	-8,508	13,455
Transfers				
UI	-1,038	1,070	-902	904
Costs				
Forgone compensation	1,045	146	1,045	146
Program costs	na	na	na	na
Return on investment (quarterly)			-	-

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. na denotes not available. - denotes not calculable

Table 15.16 Estimated Participant and Public Benefits and Costs per Participant in Apprenticeship Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	34,566	0	258,676	0
Fringe Benefits	13,827	0	103,470	0
Taxes	-8,642	8,996	-64,669	105,725
Transfers				
UI	-3,612	3,750	-9,956	11,392
Costs				
Forgone compensation	-55,728	-12,115	-55,728	-12,115
Program costs	4,689	3,209	689	3,209
Return on investment (quarterly)			-	4.1%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. - denotes not calculable

Table 15.17 Estimated Participant and Public Benefits and Costs per Participant in Aerospace Training

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	37,785	0	336,958	0
Fringe Benefits	15,114	0	134,783	0
Taxes	-9,446	9,842	-84,239	129,541
Transfers				
UI	-2,000	2,070	-3,871	4,322
Costs				
Forgone compensation	-419	-91	-419	-91
Program costs	4,435	8,717	4,435	8,717
Return on investment (quarterly)			-	14.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. - denotes not calculable

Table 15.18 Estimated Participant and Public Benefits and Costs per Completer in Secondary CTE Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	1,790	0	37,361	0
Fringe Benefits	716	0	14,945	0
Taxes	-300	315	-6,258	11,963
Transfers				
UI	0	0	0	0
Costs				
Forgone compensation	-149	-21	-149	-21
Program costs	0	1,745	0	1,745
Return on investment (quarterly)			-	3.1%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. - denotes not calculable

Table 15.19 Estimated Participant and Public Benefits and Costs per Participant in DVR Programs

Benefit/Cost	First 2.5 years		Lifetime (until 65)	
	Participant	Public	Participant	Public
Benefit				
Earnings	1,606	0	16,906	0
Fringe Benefits	643	0	6,762	0
Taxes	-269	281	-2,832	4,111
Transfers				
UI	-97	103	-819	973
Costs				
Forgone compensation	-4,634	-649	-4,634	-649
Program costs	0	6,637	0	6,637
Return on investment (quarterly)			-	-1.2%

NOTE: '14 \$. Participant benefits discounted at 3.0 percent annual rate. - denotes not calculable

APPENDIX A DATA EDITING

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 passes. The first pass 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 2 percent of the records; which means that about 98 percent of the records did not have imputed hours. CTE wage records do not have industry code so the imputation using industry median hours was skipped.

Table A.1 Percentage of Records with Imputed Hours

Program	2010/2011	2012/2013
WIA Adult	1.7%	1.9%
WIA Dislocated Worker	2.3	2.2
WIA Youth	0.9	0.6
CTC Workforce Education	1.7	1.7
CTC Worker Retraining	2.2	2.1
CTC Basic Education for Adults	1.7	1.7
CTC I-BEST	2.8	2.2
Private Career Schools	1.9	1.8
Registered Apprenticeships	1.8	1.6
High School CTE	0.5	0.4
Vocational Rehabilitation	2.0	1.9
Aerospace Training	2.2	2.0
Wagner-Peyser	2.6	2.6

NOTE: CTE participant cohorts are 2010/2011 and 2011/2012; Aerospace participant cohorts are 2011/2012 and 2012/2013.

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. The Workforce Board eliminated the individuals in the Wagner-Peyser program who ever were in other training programs in the same cohort. So the contamination of comparison group individuals in the treatment sample is not an issue.

Start date problems. For program participants that had no start date recorded, or had start date before 2002, the start date is re-coded to be at 20 quarters before the exit quarter. The percentages of affected records are listed in Table A.2.

Table A.2 Percentage of Records with Re-coded Start Date

Program	2010/2011	2012/2013
WIA Adult	0.0%	0.0%
WIA Dislocated Worker	0.0	0.0
WIA Youth	0.1	0.0
CTC Workforce Education	1.6	1.2
CTC Worker Retraining	2.3	6.4
CTC Basic Education for Adults	0.0	0.0
CTC I-BEST	1.5	1.0
Private Career Schools	0.1	0.0
Registered Apprenticeships	0.6	0.2
High School CTE	0.0	0.0
Vocational Rehabilitation	0.3	0.1
Aerospace Training	1.3	0.9
Wagner-Peyser	0.0	0.0

NOTE: CTE participant cohorts are 2010/2011 and 2011/2012; Aerospace participant cohorts are 2011/2012 and 2012/2013.

APPENDIX B EXPLANATORY NOTES FOR NET IMPACT ESTIMATE TABLES AND PRICE DEFLATORS

Outcomes

This table gives net impact estimates for each outcome in CTE and DVR programs. The first column, labeled “Regression Adjusted Treatment Effect”, 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 reciprocity 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 \geq \$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 2014 \$.

Regression Estimation

The outcome variables used in the CTE and DVR analyses are displayed in table B.1. They varied somewhat among these two programs (and cohorts). 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.

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

Program	Type of Variable			Employment and Earnings History/Labor Market
	Demographic	Educational	Regional	
Secondary CTE	Age, sex (except 10/11 cohort), minority, disability, free-reduced lunch status, bi-lingual status	12 th Grade GPA, math and reading scores and proficiency	Urban county western WA	9 prior employment/earnings
DVR	Age, sex, minority, veteran, various public assistance	Years of education	Urban county western WA	9 prior employment/earnings

The set of demographic variables included age, sex, and minority status for both programs save secondary CTE 2011/2012 cohort, for which gender is not available. In addition, we used the following variables if they were in the administrative data: veteran status and welfare assistance for DVR; disability status, free-reduced lunch status, and bi-lingual status for CTE.

All of the models 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 and is available in DVR data. Student performance measurements in CTE files include the following variables: 12th GPA, and math and reading scores as well as proficiency levels.

Finally, all of the models used the nine employment and earnings history variables that were used in the statistical matching in other training programs. 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, percent of quarters with multiple jobs, earnings dip prior to registration, number of quarters between dip and registration, and percentage dip in earnings.

Industry dummy variables for industry of employment were used in the DVR models.

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
2000	1	166.667	2007	2	203.232
2000	2	168.467	2007	3	203.596
2000	3	169.700	2007	4	205.335
2000	4	170.733	2008	1	207.715
2001	1	172.233	2008	2	212.903
2001	2	174.167	2008	3	215.495
2001	3	174.133	2008	4	208.097
2001	4	173.533	2009	1	206.542
2002	1	173.867	2009	2	209.224
2002	2	175.833	2009	3	211.001
2002	3	176.567	2009	4	211.752
2002	4	177.233	2010	1	212.879
2003	1	179.067	2010	2	213.974
2003	2	179.600	2010	3	214.136
2003	3	180.300	2010	4	214.878
2003	4	180.267	2011	1	217.986
2004	1	181.900	2011	2	222.406
2004	2	184.500	2011	3	223.233
2004	3	185.100	2011	4	222.674
2004	4	186.433	2012	1	224.612
2005	1	187.400	2012	2	226.549
2005	2	190.100	2012	3	226.936
2005	3	192.700	2012	4	226.819
2005	4	193.700	2013	1	228.173
2006	1	194.500	2013	2	229.450
2006	2	198.000	2013	3	230.327
2006	3	199.067	2013	4	229.347
2006	4	197.000	2014	1	231.157
2007	1	198.905	2014	2	234.120