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Net-Impact Analysis on Before-Tax Annual Earnings for the Training Benefits Program, 2002 through 2008

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The authors are listed alphabetically. While some authors contributed more to this study than others, the total effort was conducted as a team, with Dr. Ernst Stromsdorfer as lead researcher. Jeff Zahir performed all the statistical estimation. Dr. Greg Weeks is the team leader.

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The authors, of course, are responsible for any remaining errors.

For more information or to get this report in an alternative format, call the Employment Security Department Labor Market Information Center at 800-215-1617.

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Executive summary

This study compares the earnings of unemployment-insurance claimants who participated in the Training Benefits Program to the earnings of claimants who were eligible for the program but chose not to participate.

The analysis examines the outcomes for "all participants" and a subset of all participants who did not return to their former employers as their first job after completing training.

About the program

The state Legislature created the Training Benefits Program in 2000. The program allows eligible workers to claim 52 weeks of unemployment benefits (when combined with up to 26 weeks of "regular" benefits) while they train for careers in high-demand fields. If approved for the program, participants may receive unemployment benefits without having to look for work while they are enrolled and making progress in an approved training program. The Training Benefits Program does not pay for books, tuition or school-related fees. However, scholarship money may be available for those who qualify.

Findings

During the first two to three calendar years after becoming eligible for the Training Benefits Program, participants had lower earnings than the eligible unemployment-insurance claimants who did not enroll in the program. This is because participants forgo some earnings while in training and making the transition to their new careers.

However, as participants became established in their new jobs in subsequent years, their annual earnings surpassed those of nonparticipants by as much as $2,000 per year (*Figure 7*). Even after factoring in lost earnings while in training, as well as school-related expenses, the **return on investment** for participants was high.

Specific findings include:

- When comparing participants to nonparticipants, the present value of "lifetime" gains, less the costs of training, for all participants is an estimated average of $18,339. For participants who didn't return to their former employers, lifetime gains amounted to an estimated average of $22,985. (For this study, "lifetime" means earnings through age 65. The average age of male participants was 41, women 42.)
- The social rate of return on investment (ROI) for all participants is 15.8 percent, and for participants who didn't return to their former employers, 20 percent.
- When displaced workers lose their jobs, their earnings potential falls dramatically because some skills are no longer needed in the labor market. Training improves the earnings potential of these workers. As a result of training, all participants replaced an estimated average of 67.9 percent of their earnings potential, and participants who didn't return to their former employers replaced an estimated average of 98.2 percent of their earnings potential.

There is insufficient information to determine why the subset of participants who didn't return to their former employers has greater net benefits than all participants.

Study design

This study analyzes the net effects of the Training Benefits Program on seven different groups (cohorts) of individuals who were eligible for and enrolled in the program from 2002 through 2008. The researchers looked specifically at pre- and post-training earnings, value to participants over their lifetime and return on investment.

Only participants who completed their training as outlined in their Training Benefits Program application were included in the study. The data-analysis period extends from 2000 through 2009.

Every participant was matched to a similar unemployment-insurance claimant who was eligible for, but did not enroll in, the Training Benefits Program. By comparing the outcomes of participants and nonparticipants, we can determine the net effects of the Training Benefits Program. The treatment group (participants) and comparison group (eligible nonparticipants) were matched based on the year they entered the program, age, gender, workforce development area, eligibility for unemployment benefits, eligibility for the Training Benefits Program and earnings prior to program eligibility.

The scope of the study did not include the types of training programs or the occupations that the participants entered. These data are available in Employment Security's annual Training Benefits Program Report, which is available online at https://fortress.wa.gov/esd/employmentdata/reports-publications/special-reports/training-benefits-report.

Introduction

Legislative objectives of the Training Benefits Program[1]

> "The Training Benefits Program was created by the Washington State Legislature in 2000. The program provides extended unemployment benefits to dislocated workers whose occupations are in decline and who need training to obtain a new job. Training benefits provide income support while the dislocated workers are in training; the benefits are paid out of the State Unemployment Insurance Trust Fund. Direct costs of training (tuition, books, transportation, etc.) must be funded through other sources." Employment Security Department. *Fact Sheet.* Training Benefits Program. Doc. #08-030-E. December 2011.

Forgone earnings – the opportunity cost of the time spent in education and training – are a major cost to the worker and society of any educational and training program. Many dislocated or disadvantaged workers cannot afford to take the retraining and education that could benefit them because they cannot afford to stop work and lose earnings while attending formal classroom training and education.

Paying unemployment benefits to qualified, eligible dislocated workers for up to 52 weeks[2] while they are taking training and education helps to compensate for earnings lost as a result of spending time in a training or education program. This compensation allows the worker to take training that improves the worker's employment and earnings prospects. The desired result is that the individual worker, the government, taxpayers and society as a whole benefit.

This study estimates the net effects of the Training Benefits Program on the earnings of dislocated workers in Washington state who are eligible for, enroll in and complete their specified education or training program. By comparing a **cohort**[3] of trained, dislocated workers to a cohort of otherwise identical, eligible nonparticipants, we infer the extent to which an education and training effort has affected earnings.

This study employs several statistical techniques to help improve the ability to make causal inference between the services provided by the Training Benefits Program and the post-training or -education earnings of participants:

1. First, we exactly match the participant cohort (the treatment group) to a nonparticipating Training Benefits Program-eligible comparison group (the comparison group) on several key economic characteristics as described below.
2. Second, conditioned on the exact match, we estimate a **propensity function** that yields a measure of the probability that a participant or nonparticipant comparison group member would be in the Training Benefits Program, regardless of the individual's actual status. By matching each training cohort in this manner, some **selection bias** can be eliminated,

[1] This net-impact analysis of the Training Benefits Program reflects the program as defined in Substitute House Bill 3077, approved and filed Feb. 7, 2000.

[2] The 52-week estimate is composed of up to 26 weeks of regular unemployment benefits and whatever additional weeks are needed to reach 52 weeks of unemployment benefits that are available through the Training Benefits Program. The Training Benefits Program participant must exhaust regular unemployment benefits while in training before he or she can then collect training benefits.

[3] Words in bold are defined in the glossary in *Appendix 1.*

making the study more like the random-evaluation models used on project demonstrations or on ongoing government programs such as the Job Training Partnership Act (JTPA).[4]

3. Third, we subtract the before-tax earnings pre-treatment from the before-tax earnings post-treatment.[5] This helps eliminate unmeasured and unmeasurable factors that affect earnings, which is the measure of program outcome, and further reduces selection bias.
4. Finally, to account for potential differences in operating the Training Benefits Program over time, we model the data separately for each of the seven cohorts, while they are in training and in subsequent years through 2009.

Literature review

There is a long history of government-sponsored subsidies to dislocated and disadvantaged workers who seek training in occupations that offer the chance of improved employment and earnings. This modern history begins in 1961 with the passage of the federal Area Redevelopment Act (ARA),[6] which was largely targeted to dislocated coal miners and other disadvantaged workers in Appalachia.

Figure 1 displays the net effects on government-sponsored training programs for a selected set of studies. The bibliography provides the full citations of the studies in this figure and includes the citations of additional studies for programs other than those evaluated for Washington state. The results in *Figure 1* are first presented for the price level at which they were initially estimated, then results are converted to 2010 dollars.

The results are not exactly comparable to the results in this net-impact analysis, because this study estimates net effects starting from the year in which the participant becomes eligible for the program.[7] This method provides a direct estimate of the forgone earnings of participants while they are in training and avoids setting an arbitrary date of program "completion." Most of the historical studies reported in *Figure 1* begin their analysis after the time at which a program participant is presumed to have ended training. Other studies net the forgone earnings into the gross post-training earnings stream. (See Bloom, et al. 1997, for example.)

[4] See Bloom, et al., "The Benefits and Costs of JTPA Title II-A Programs: Key Findings from the National Job Training Partnership Act Study," *Journal of Human Resources*, Vol. 32, No. 3, Summer 1997. The authors conducted a classical random assignment experiment for the on-going operation of the JTPA in 16 selected sites nationwide. See *Figure* 1, Panel 12.

[5] From this point on, in the narrative that discusses net benefits and forgone earnings, we use the term "earnings" to always denote "before-tax earnings."

[6] Area Redevelopment Act. Public Law 87-27 (75 Stat. 47). Signed into law May 1, 1961. See the study: Ernst W. Stromsdorfer, "Determinants of Economic Success in Retraining the Unemployed: The West Virginia Experience," *Journal of Human Resources*, Vol. 3, Spring 1968.

[7] "Date of eligibility" was chosen to identify the treatment and comparison groups because a variable to describe "date of school enrollment" was not available and the treatment/comparison group match was more accurate using the eligibility date.

Figure 1. Literature review on the economic returns to government-subsidized occupational training programs – selected studies

Study title	Program evaluated	Study location	Study time period	Study design and comparison or control group	Earnings effect	Earnings effect – inflation-adjusted 2010 dollars, CPI-W[1]
Studies based on Washington state data						
1. *Net Impact and Benefit – Cost Estimates of the Workforce Development System in Washington State,* Hollenbeck and Huang, July 2003	Job Training Partnership Act – Classroom Training (JTPA) Title II-A Disadvantaged Adults	Washington – statewide	8 through 11 quarters after program exit defined as anytime during the period July 1997 – June 1998.	Nonexperiment; comparison group = registrants for job search services; propensity score matching with replacement.	$543 per quarter averaged over quarters 8 to 11, after program exit in 2001 inflation-adjusted dollars. This estimate includes completers and non-completers.	$670/quarter or the sum of $2,679 for quarters 8 through 11 after program exit.
2. Same as 1. above	JTPA Title III Dislocated Workers	Same as 1. above	Same as 1. above	Same as 1. above	$466 as 1. above	$575/quarter or the sum of $2,299 for quarters 8 through 11 after program exit.
3. Same as 1. above	Community College Worker Retraining Program`	Same as 1. above	Same as 1. above	Same as 1. above	$423 as 1. above	$522/quarter or the sum of $2,087 for quarters 8 through 11 after program exit.
4. *Net Impact and Benefit – Cost Estimates of the Workforce Development System in Washington State*, Hollenbeck and Huang, September 2006	Workforce Investment Act (WIA) Title 1-B Adults	Washington – statewide	9 through 12 quarters after program exit, defined as any time during the period July 2001 – June 2002.	Nonexperiment; comparison group = registrants for job search services; propensity score matching with replacement.	$443 per quarter averaged over quarters 9 to 12 after program exit, in 2005 Quarter 1 inflation-adjusted dollars This estimate includes completers and non-completers.	$496/quarter or the sum of $1,985 for quarters 9 through 12 after program exit.
5. Same as 4. above	WIA Title I-B Dislocated Workers	Same as 4. above	Same as 4. above	Same as 4. above	$752 as in 4. above	$842/quarter or the sum of $3,370 for quarters 9 through 12 after program exit.
6. Same as 4. above	Community and Technical College Worker Retraining Program`	Same as 4. above.	Same as 4. above.	Same as 4. above	$298 as in 4. above	$334/quarter or the sum of $1,335 for quarters 9 through 12 after program exit.
7. *Estimating the Returns to Community College Schooling for Displaced Workers*, Jacobson, LaLonde and Sullivan, February 2004; *Do Displaced Workers Benefit From Community College Courses? Findings From Administrative Data and Directions for Future Research,* Jacobson, LaLonde and Sullivan, October 2005	Economically Displaced Worker Adjustment Act (EDWAA) and WIA	Washington – statewide	Workers laid off from 1990 through 1994 who remained in the Washington state labor force from 1987 through 1995.	Nonexperiment; comparison group taken from unemployment benefit eligible recipients who were employed at least three years before being laid off – the study's definition of displacement. Results shown are for graded course completers only.	Fixed Effects Models: Men: $385/after-training quarter commencing in the 4th quarter after end of training; Women: $220/quarter as defined above for men. Nonlinear Effects of Credits Earned: Men - $600/post-training quarter Women – $288/ Post-training quarter Data are in 1995 prices.	Fixed Effect Models: Men - $2,200/year; Women: $1,257/year. Nonlinear Effects of Credits Earned: Men - $3,428 Women - $1,646.

Figure 1. Literature review on the economic returns to government-subsidized occupational training programs – selected studies (continued)

Study title	Program evaluated	Study location	Study time period	Study design and comparison or control group	Earnings effect	Earnings effect – inflation-adjusted 2010 dollars, CPI-W[1]
Studies based on data other than Washington state						
8. *Estimating the Effect of Training Programs on Earnings*, Ashenfelter, 1978	Manpower Development and Training Act (MDTA)	Nationwide	1964 Quarter 1 enrollees in training	Nonexperiment; Comparison group taken from the 0.1% Continuous Work History Sample using social security quarterly earnings data as the dependent variable.	Men: From $150/year to $500/year in first year after training; declining over time Women: From $300/year to $600/year with no decline over the five year follow-up period.	Men: $1,029/year to $3,429/year in first year after training Women: $2,057/year to $4,115/year in first year after training.
9. *Using State Administrative Data to Measure Program Performance,* Mueser, Troske, and Gorislavsky, November 2007	Job Training Partnership Act (JTPA) Title IIA: Adults at least age 22 and less than age 65	Missouri - statewide	Program period: July 1994 through June 1996	Nonexperiment; Propensity score matching with difference-in-differences net-impact estimation; Comparison group = Division of Employment Security job exchange services recipients who were deemed economically disadvantaged.	Men $769 Women $809 Data are summed for the 5th to 8th quarter after the quarter in which they registered for services. The statistics are the simple mean of 13 alternative matching models using difference-in-differences estimation.	Men: $1,130/year. Women: $1,189/year.
10. *The Economics and Econometrics of Active Labor Market Programs,* Heckman, LaLonde and Smith, 1999	Comprehensive Employment and Training Act (CETA) Economically disadvantaged adults	Nationwide	1976 and 1977	Nonexperiment	Survey of nine studies: Men – Estimates range from $1,638/year to -$1,555/year, with the median estimate at $61/year for white men. Women – Estimates range from $2,220/year to $24/year, with the median estimate at $1,286/year for white women and $2,669/year for nonwhite women.	White men: $83/year; White women - $1,745/year; Nonwhite women - $3,622/year.
11. *Evaluating Government Training Programs for the Economically Disadvantaged,* Friedlander, Greenberg, and Robins, December 1997	JTPA Classroom Training Adult Men and Women	16 Non-randomly selected cities or locations nationwide	November 1987 to September 1989	Classical experiment with random assignment to treatment and control.	Men: $1,032/year Women: $414/year. Follow-up in Year 2 1996 Q3 GDP Chain-type Index.	Men: $1,384/year. Women: $553/year.

Figure 1. Literature review on the economic returns to government-subsidized occupational training programs – selected studies (continued)

Study title	Program evaluated	Study location	Study time period	Study design and comparison or control group	Earnings effect	Earnings effect – inflation-adjusted 2010 dollars, CPI-W[1]
Studies based on data other than Washington state						
12. *The Benefits and costs of JTPA Title II-A Programs: Key Findings from the National Job Training Partnership Act Study*, Bloom, et al., Summer 1997	JTPA Title II-A Economically disadvantaged adults and out-of-school youth.	16 local JTPA Service Delivery Areas, non-randomly selected across the nation.	Sample selection ran from November 1987 to September 1989. There was a 30-month follow-up period from time of selection into the study	Classical experiment with random assignment to treatment and control.	Men: $1,599 over 30 months, or $640 per year. Women: $1,837 over 30 months or $734 per year. Data are significant for females at an alpha of 0.001 and for men at an alpha of 0.100. Data are in current dollars.	Men: $1,170 per year. Women: $1,342 per year. 1988 is chosen as the base year for calculating 2010 inflation-adjusted dollar prices.
13. *Workforce Investment Act Non-Experimental Net-Impact Evaluation*, Heinrich et al., December 2008	Workforce Investment Act (WIA) Title I Adult and Dislocated Workers	Connecticut, Indiana, Kentucky, Maryland, Missouri, Minnesota, Mississippi, Montana, New Mexico, Tennessee, Utah, and Wisconsin	June 2003 to June 2005 program entry period	Nonexperiment; comparison group = clients receiving core and intensive job search services; propensity score matching is used.	Men: $350 at 10 quarters after enrollment. Women: $700 at 10 quarters after enrollment. Dislocated Workers: 10 quarters after program entry, average quarterly earnings across the 12 states are approximately $400 per quarter. Results are in 2005 Q1 base period inflation-adjusted dollars.	Men: $392/quarter or $1,568/year. Women: $784/quarter or $3,137/year Dislocated workers: $448/quarter or $1,792/year.

Notes:

Unless otherwise noted, the CPI-W is used to convert current dollars to inflation-adjusted 2010 dollars.

[1] *Labor exchange services include self-assisted services, facilitated self-assisted services and staff-assisted services.*

Prior studies for Washington state

Hollenbeck and Huang (2003 and 2006) estimated net training outcomes for several different types of workers and training programs for two different time periods. The statistical methods and data used in their two studies are similar to the methods used in this study in that the authors attempt to adjust for selection bias by matching based on propensity scores. Their earnings and employment data come from the Unemployment Insurance Wage File. However, the defined target groups differ, and their comparison group comes from registrants for job-search services, whereas the comparison group in our analysis comes from the unemployment-insurance claimants who are eligible for, but who do not participant in, the Training Benefits Program. Thus, the comparison group match is statistically closer in this study than it is for the groups evaluated in the Hollenbeck and Huang studies. Also, net-impact earnings results for men and women are combined in their analysis; we estimate net effects on earnings for men, women and the total sample.

Both the 2003 and 2006 studies of Hollenbeck and Huang report net effects at approximately the beginning of the third year after program entry. For the 2006 study, these net estimates range from a low of $1,335 (in 2010 dollars) for participants in the Community and Technical College Worker Retraining program summed over the ninth to the 12th quarter after training entry (i.e., they are annualized) to a high of $3,370 for Workforce Investment Act (WIA) Title I-B Dislocated Workers summed over the same post-training period. In contrast, *Figure 7* shows no **statistically significant** difference in average annual earnings between the treatment group (participants)[8] and comparison group in follow-up year 3 after establishing program eligibility (quarters 9 to 12).

Jacobson, LaLonde and Sullivan (JLS, 2004 and 2005) estimate the effect of community college education on displaced[9] workers in Washington state. Displacement is defined as being permanently laid off from a firm after three or more years of employment. This definition of displacement is more stringent than that of the Training Benefits Program, which requires only two years of continuous employment with a given firm. However, the JLS definition does not require that the worker be severed from an occupation that is defined as declining in demand. The authors assess the effects job training on five cohorts of displaced workers who are eligible for unemployment benefits, starting with the 1990 cohort and ending with the 1994 cohort. Individuals are followed for up to 16 quarters after the quarter of initial layoff.

JLS estimate that it takes about three quarters after leaving training for earnings benefits to become positive – only about one-fourth of the time for the participants in this study. Thereafter, annualized in 2010 dollars, men earn an additional $2,200 per year, and women earn an additional $1,257 per year based on their fixed-effects model. Men earn an additional annualized $3,428, based on a weighted average of earnings as a function of total credits earned by the average participant; women earn an additional $1,646.

A critical policy finding of the JLS (October 2005) study is the estimate that "technically oriented and/or scientific and/or health-related courses" provide much higher net benefits compared to "all other community college courses." This finding is much more pronounced for women than for men. For women, the effect of one academic year of more technical credits increases their earnings

[8] As detailed later, this study of the Training Benefits Program analyzes two groups of participants: 1) all participants, which is the total sample of eligible participants, and 2) participants who didn't return to their former employers, which is a subset of the all-participants group whose first employer after training is not the employer that most recently laid them off.

[9] We use their term for dislocation, "displacement."

from 22 to 28 percent, compared to increases of only 5 to 7 percent for all other community college courses (JLS, October 2005, page 19 and Table 2, page 46).

The JLS treatment sample for these estimates includes only those who completed their training program. However, completion is defined for individuals who may have completed as few as one to five graded credits. The credits include courses that are and are not job-related. The authors note that their results contain selection bias, since even those members of the treatment group who complete only one to five credit hours have a positive net earnings outcome, though the effect is statistically significant for only one out of four alternative estimation methods.

Prior studies in other locations across the United States

There has been a variety of nonexperimental evaluations and experimental (random assignment) evaluations of government-sponsored training conducted under the authority of the Area Redevelopment Act, the Manpower Development and Training Act (MDTA), the Comprehensive Employment and Training Act (CETA), the Job Training Partnership Act and the Workforce Investment Act (WIA). We do not consider ARA evaluations, since this act was quickly superseded by the MDTA. We review what we consider to be the most technically reliable and comprehensive of the available studies.[10]

MDTA

Ashenfelter (1978) assessed the MDTA at the national level using Social Security Administration earnings data for the MDTA cohort enrolling in the first quarter 1964. He estimated that men earned an additional $1,029 to $3,429 in the first year after training, with earnings declining over time (2010 prices). Women were estimated to earn an additional $2,087 to $4,115 (2010 prices) in the first year after training, with no evidence of decline over time.

CETA

Heckman, LaLonde and Smith (1999) review nine studies of CETA. These studies vary considerably in the data and statistical methods used, which is revealed by the fact that some studies find statistically significant *negative* returns to training for economically disadvantaged adults.

- For men, the net estimates range from -$1,555 a year to $1,638 a year in **current dollars**, with the median estimate being $61 per year. Net negative earnings are possible if:
    - Forgone earnings during training exceed the future stream of positive earnings benefits, or
    - Relative to the control or comparison group, the treatment group members lose ground in the labor market due to lost on-the-job training opportunities while engaged in formal classroom training that does not compensate for the loss of on-the-job training, or
    - Some other statistical error or econometric misspecification exists, including an incorrect comparison group match, nonrandom measurement error, etc.
- Net earnings in current dollars for women range from $24 per year to $2,220 per year.

[10] "Barnow (1993) compares the eligibility rules of JTPA to those of …its predecessors, CETA…and MDTA…and finds only minor differences." Taken from Heckman, Ichimura and Todd (1997), page 616.

Since we did not have standard errors by which to weight these disparate results, we report the median of this set of estimates in 2010 dollars. For men, the median estimate is $83 per year; for white women, $1,745 per year; and for nonwhite women, $3,622 per year.

JTPA

Friedlander, Greenberg and Robins (1997) report on 16 classical experiments conducted for the JTPA program that operated in various locations throughout the United States. The experiments began in November 1987 and extended through September 1989. Men were estimated to earn, on average, $1,384 extra per year (2010 prices), and women, an extra $553 per year.

Bloom, et al. (1997) report on the National JTPA Experiment. This classical random assignment experiment reports results for people eligible to enroll in the JTPA program and people who actually enrolled in the JTPA program. Net earnings effects are statistically significant for economically disadvantaged adult women at a probability of 0.001 and are marginally significant for economically disadvantaged adult men at a probability of 0.100. Results are not statistically significant for male and female youths. In 2010 dollars, adult men earn an additional $1,170 per year, and adult women earn and an additional $1,342 per year.

Mueser, Troske and Gorislavsky (2007) evaluate the returns to training for adults in Missouri for the program period July 1994 through June 1996, using statistical methods, data sources and variables very similar to those used in this study. Their comparison group is customers of the Division of Employment Security who were deemed to be economically disadvantaged. The authors estimate that men earned an additional $1,130 per year, and women earned an additional $1,189 per year (both in 2010 dollars). These estimated effects of training do not take into account the effects of other services provided by the Division of Employment Security to the comparison group of economically disadvantaged workers. Therefore, this study may underestimate the true net effects of training.

WIA

Using statistical methods and earnings data sources similar to those used in this study, Heinrich, et al. (2008) analyze the net effect of WIA Title I on adult and dislocated workers. Data from 12 states are analyzed. Program entry was from June 2003 through June 2005. Participants were compared to individuals who received core and intensive job-search services from their respective state employment agencies. So, the true estimated net effect of training will be understated in the event that there are positive social returns to core and intensive job-search services in these 12 states.

The estimates to training represent a marginal increment over and above the returns to core and intensive job-search services. Heinrich, et al. find that men earn an additional $1,568 (in 2010 dollars) per year, starting 10 quarters after program entry. Women earn $3,137 per year (in 2010 dollars). Heinrich et al. find that dislocated workers earn an additional $1,792 per year (in 2010 dollars).

Meta-analysis of active labor market policy evaluations

Card, Kluve and Weber (2010) conducted a meta-analysis of 97 studies of active labor-market policies (ALMP) that contained 199 program estimates. The studies range across the globe but are concentrated in the United States, Canada, Great Britain and Western Europe. The authors conclude the following:

- Longer-term evaluations (more than one year after treatment) of ALMPs tend to be more favorable than shorter-term evaluations (one year or less after treatment), since training does not begin to yield benefits until the medium- or longer-term period – say, three years or so.
- ALMP programs do not appear to have differential effects on men versus women.
- Controlling for program type and the composition of the participant group, "only small and statistically insignificant differences in the distribution of positive, negative and statistically insignificant program estimates" exist between experimental and nonexperimental studies and published versus unpublished studies. [Card, Kluve, and Weber. (2010). p. 28.]

Study design

This study looks at the net effects of the Training Benefits Program on seven different cohorts of men and women over the 2002 through 2008 calendar years. The data for the study period extend from calendar year 2000 through 2009. The 2002 cohort has seven follow-up years after determining Training Benefits Program eligibility. The number of follow-up years declines by one year for each successive cohort. The 2008 cohort has only one follow-up year: 2009. All results are expressed in 2010 dollars, CPI-W.

Only Training Benefits Program participants who were eligible for, enrolled in *and* completed their training plan as outlined in the Training Benefits Program application are included in the analysis.[11] Anyone who withdrew from the planned course of study was excluded from the study sample.[12]

Training Benefits Program duration for participants

The Training Benefits Program allows an eligible individual to receive up to 52 weeks of unemployment benefits, which includes up to 26 weeks of regular unemployment benefits. Under the law that existed during the years covered in this study, these benefits may be paid over a two-year calendar period.[13]

As is discussed in Hollenbeck and Huang (2006), people in the state's Community and Technical College Worker Retraining program spent about 1.3 calendar years in training. The estimated results for our evaluation of the Training Benefits Program suggest participants had an average training duration of 1.5 calendar years.[14] Thus, the duration estimates for the studies are very similar.

Re-employment after training

As noted previously, the Training Benefits Program, "… provides extended unemployment benefits to dislocated workers whose occupations are in decline and who need training to obtain a new job."[15] However, unless the firm at which the participant was most recently employed has gone out

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[11] The data for this study indicate that, for the seven cohorts in the total sample (see *Figure 2*), 753 participants did not complete their training plan. That represents 6.9 percent of the 10,932 unemployment insurance claimants who were deemed eligible for the Training Benefits Program within our study period. The dropout rate for the 2009 cohort (not included in this study) was estimated at 10.1 percent. See the Washington State Employment Security Department, Labor Market and Economic Analysis branch, Training Benefits Program Report, November 2010, Table 7, Page 11.

[12] The prospective Training Benefits Program participant receives an eight-page application packet. The last six pages of this packet constitute the prospective participant's Training Benefits Plan. (Telephone communication with Steve Perry, Thurston County WorkSource Center, July, 14, 2011.) Page 4 of this plan initiates the Training Benefits Application. Question 3 on page 4 reads as follows: "My training will start (Mo/Day/Year) and end (Mo/Day/Year)." In the program database, this information is supplemented with: 1) The actual program end date if the participant calls in and notifies the program managers; and 2) a withdrawal date if, prior to the end date on the application, the participant informs the program managers that he or she has withdrawn from the program. If there is no withdrawal date, we assume the program participant has completed his or her training or education program.

[13] Relative to the start date of the training plan, the participant may no longer claim such benefits after the passage of two years. For recent changes in the Training Benefits Program, see Washington State Employment Security Department, *Fact Sheet,* 2011 Legislation: Tax Reduction and Benefit Enhancements, Doc. #11-001-B, Feb. 11, 2011. In general, the six major changes relax constraints on participation and increase funding. For more detail on the legislative changes to the Training Benefits Program, see State of Washington, *Bill Analysis Form,* Bill Number 1091, Version: As Passed, Version # EHB, Dated March 3, 2011, 1:21:16 p.m.

[14] From this point on, a program completer is referred to as a participant.

[15] Washington State Employment Security Department, *Fact Sheet,* Training Benefits Program, Doc. #08-030-E, December 2011.

of business, there is some probability that the participant may be rehired by that firm, even if that firm's industry is in decline, or the occupation within that firm/industry is in decline. The point is that if a worker defined under the act as "dislocated" is recalled to his or her firm of last employment, that worker is less likely to have suffered a loss of occupation-, industry- or firm-specific human capital. The individual's expected wage rate would not necessarily decline as a result of his or her most recent layoff. Training would not be necessary to recover the worker's reduced earnings, since no earnings reduction will have necessarily occurred.[16]

A participant's economic benefits due to training may be biased if the participant returned to the employer where he or she was most recently laid off prior to being eligible for the program. However, the direction of the potential bias is indeterminate.[17] To account for this possible bias, we estimate the net effects of the Training Benefits Program for two related groups of participants:

1. The "all participants" group is composed of Training Benefits Program participants who *do* and who *do not* return, as their first job after training, to the employer from which they were most recently laid off. This study group evaluates the Training Benefits Program as the law is written; and
2. The "participants who didn't return to their former employers" group is a subset of all Training Benefits Program participants. These *do not* return, as their first job after training, to the employer from which they were most recently laid off. This study group provides a more stringent test of the net economic benefits of the Training Benefits Program.

As shown in *Figure 2*, the overwhelming majority of participants who become re-employed after training do not return to the employer from which they were most recently laid off. This is increasingly true for the more recent cohorts of participants.[18]

[16] True dislocated workers have been estimated to lose from 1.4 to 2.8 years of pre-displacement earnings in present-value terms. See Davis, Steven J. and Till M. von Wachter, "Recessions and the Cost of Job Loss," Working Paper 17638, National Bureau of Economic Research, December 2011.

[17] An example of bias is as follows: The "dislocated" worker retrains and then is rehired into the same job he or she held prior to the education or training program taken. The worker was not dislocated. The worker, in effect, was on temporary layoff or "unpaid leave of absence" while taking training. Even so, the post-training earnings are attributed incorrectly to the training taken. It also is possible that a worker is re-employed, but at a lower wage rate than what that same employer was paying the worker prior to layoff. The lower wage would then be incorrectly attributed to the training. If re-employed at a higher wage, it is not clear how much of the wage increase would be due to the training.

[18] In sharp contrast, Corson and Nicolson (1981) report that 71.9 percent of those workers receiving benefits under the 1974 Trade Adjustment Assistance Act returned to their pre-UI/TAA firm and job. They were not dislocated. In effect, they were on temporary layoff. For a detailed discussion of the issue, see: Gathmann, Christina and Uta Schoenberg. "How General Is Human Capital? A Task-Based Approach." *The Journal of Labor Economics.* Vol. 28. No. 1. 2010; Lazear, Edward P. "Firm-Specific Human Capital: A Skill-Weights Approach." Hoover Institution and Graduate School of Business, Stanford University. September, 2002. Revised August 2004; Neal, Derek. "Industry-Specific Human Capital: Evidence from Displaced Workers." *The Journal of Labor Economics.* Vol. 13. No. 4. 1995; Corson, Walter and Walter Nicholson. "Trade Adjustment Assistance for Workers: Results of a Survey of Recipients under the Trade Act of 1974". In Ronald G. Ehrenberg, Editor. *Research in Labor Economics.* Vol. 4. 1981.

Figure 2. Re-employment, first job after training, all participants and participants who didn't return to their former employers, men and women, by cohort

Re-employed participants, first re-employment after program completion	Cohort year						
	2002	2003	2004	2005	2006	2007	2008
All participants[1]							
Men	1,389	926	1,485	424	423	433	465
Women	882	791	1,342	646	459	483	586
Participants who didn't return to their former employers[2]							
Men	1,159	694	1,154	393	387	404	449
Women	762	661	1,147	596	432	446	557
Percent of participants who didn't return to their former employers[3]							
Men	83.4%	74.9%	77.7%	92.7%	91.5%	93.3%	96.6%
Women	86.4%	83.6%	85.5%	92.3%	94.1%	92.3%	95.1%

[1] The "all participants" group is composed of participants who do and who do not return, as their first job after training, to the employer from which they were most recently laid off.

[2] The "participants who didn't return to their former employers" group is a subset of the all participants group. These do not return, as their first job after training, to the employer from which they were most recently laid off.

[3] Percent of participants who didn't return to their former employers equals panel 2 divided by panel 1, for each appropriate pair of cells.

Figure 3 shows the percent of participants in the two-digit North American Industry Classification System (NAICS) industry sector in which they found their first job after completing their training compared to the two-digit NAICS industry sector in which they were working when laid off just before establishing their Training Benefits Program eligibility. For a majority of two-digit NAICS sectors, from 20 to 39.9 percent of participants return to the two-digit industry sector from which they were most recently laid off. As shown in *Figure 3*, participants who originated in the healthcare and social assistance sector returned at a rate of 60.4 percent to this sector as their first job upon completing their training.

Even if they return to the same two-digit NAICS industry sector where they were employed prior to layoff, participants are not necessarily returning to the same employers. These employment data are based on six-digit NAICS codes collapsed to two-digit codes. It's possible for participants to change employers within a subsector or change subsectors of employment within a two-digit NAICS.

The second-largest group of re-employed participants is participants whose employment status is "not ascertained." This group includes people who are not working, have left the state, are retired, are working in industries not covered by unemployment insurance or are working in the **gray economy**.[19] There is no meaningful employment interpretation for this group. Finally, the third-largest group of re-employed participants is employed in the administrative and support services sector and in the healthcare and social services sector. Of the 25 two-digit NAICS sectors categorized in this study, participants from 20 two-digit NAICS sectors returned to work in these two sectors.

[19] Words in bold are defined in the glossary in *Appendix 1*.

Figure 3. Percent of participants who return to employment in the same industry as the industry of the employer who most recently laid off the worker, all study groups 2002 through 2008 combined, based on two-digit NAICS

0.0% - 0.9%	1.0% - 9.9%	10.0% - 19.9%	20.0% - 29.9%	30.0% - 39.9%	40.0% - 49.9%	50.0% - 59.9%	60.0% - 69.9%
	Management of companies and enterprises	Private households	Durable goods manufacturing	Administrative and support services	Construction	Educational services	Healthcare and social assistance
			Finance and insurance	Aerospace	Fishing and hunting		
			Information	Agriculture	Professional and technical services		
			Nondurable goods manufacturing	Leisure and hospitality			
			Real estate and rental and leasing	Other services except public administration			
			Transportation and warehousing	Public administration			
			Utilities	Retail trade			
			Waste management and remediation	Support activities for agriculture and forestry			
			Wholesale trade	Timber			

Interpretation: For the column heading 1.0% - 9.9%, between 1 and 9.9 percent of program participants returned to the same industry, as their first job after completing their training program, from which they were laid off immediately prior to establishing their eligibility for the Training Benefits Program – management of companies and enterprises. The actual percent of participants who returned to management of companies and enterprises is 8.5 percent. For the healthcare and social assistance sector, the actual percent is 60.4 percent. Typically, from 20 to 39.9 percent of participants returned to the two-digit NAICS industry from which they were most recently laid off, though not necessarily to the same firm or subsector.

Analysis period

As noted, the data for the follow-up period extends from the 2002 through 2009 calendar years. For each cohort, eight quarters of pre-program employment and earnings history are incorporated into the net-impact analysis, extending the full database back through calendar year 2000.

Analytic method

This is a nonexperimental analysis design. It is a **multivariate** statistical analysis guided by the economics of investment in human capital and wage determination. **Ordinary least squares** is used to estimate net effects on before-tax earnings. **Logit** is used to estimate the propensity functions. Given the **nearest-neighbor matching** that we employ to match the comparison group with the treatment group (participants), the net program effects are adjusted for age and age squared, education, ethnicity, pre-program working/not-working transition for successively paired quarters, and pre-program industry attachment. *Appendix 2* defines these variables.

Year-by-year analysis

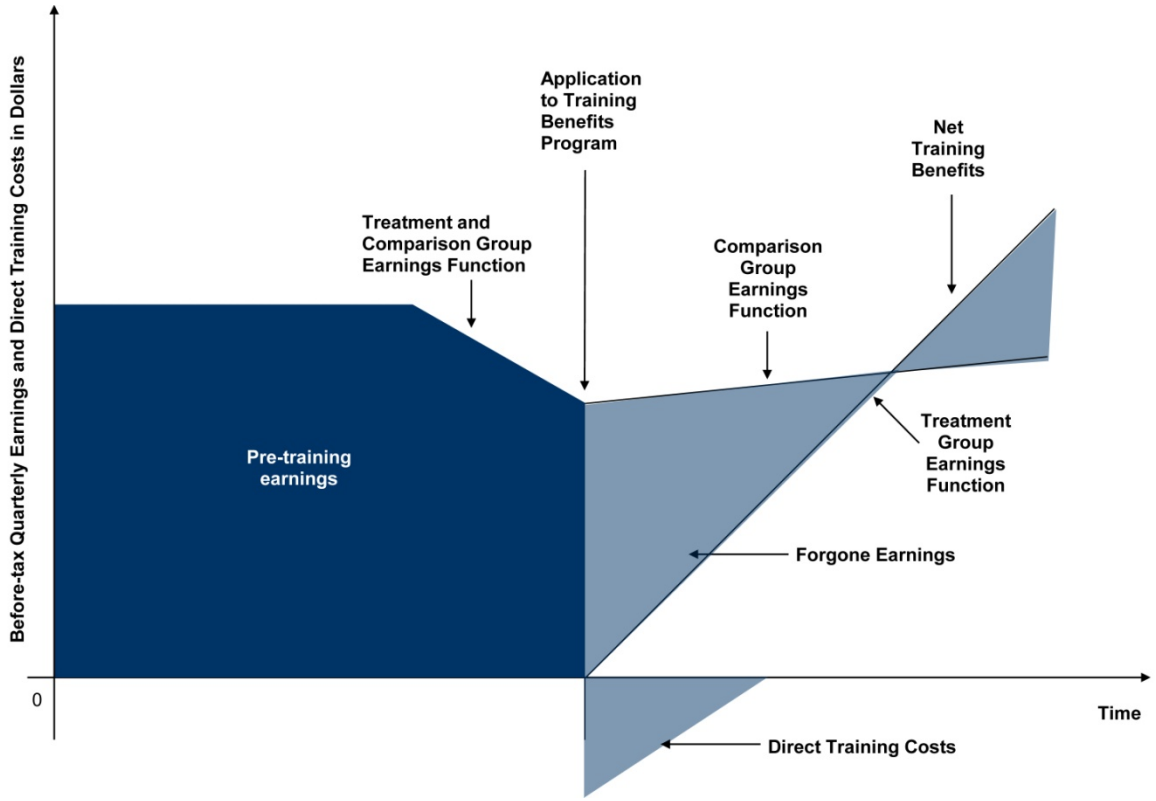
We estimate the before-tax earnings of each of the seven cohorts by gender, for each follow-up year separately, beginning with the year in which eligibility for the Training Benefits Program begins and ending with 2009, the last full year of available earnings data.

The 2002 cohort has seven years of follow-up data, the 2003 cohort has six years, and so on. The 2008 cohort has only one year of complete follow-up data – time that was largely devoted to training. For each follow-up year, the weighted average estimate for that year is computed, with seven cohort estimates available for calculating the mean of the first year of follow-up, six for the second year, five for the third year, and so on, with one follow-up year – 2009 – available for the 2008 cohort.

By starting the net-impact analysis with the year in which eligibility for the Training Benefits Program begins, we directly estimate the forgone earnings attributable to participation in the program. We also trace the time pattern of net earnings so that we see when the participant begins to have net positive returns and whether the net earnings increase, decrease or remain stable over time.

Figure 4 presents a stylized picture of the pre-training, training and post-training periods. The costs below the horizontal line represent the **opportunity costs** of education and training, such as tuition, books, and travel to and from training. Program administration costs also are included in this measure. Forgone earnings are depicted as well as the crossover to positive net earnings due to the training experience. The diagram shows that at some point, when training is completed, net earnings gains can occur.

Figure 4. Idealized analysis diagram for the Training Benefits Program



Discussion and interpretation of the idealized analysis diagram

- Pre-training earnings are measured for two years prior to the calendar year in which the unemployment claimant becomes eligible for the Training Benefits Program. Typically, earnings decline in the period immediately prior to the determination of program eligibility.
- Net program effects are measured from January 1 of the calendar year in which the unemployment claimant becomes eligible for the Training Benefits Program and begins collecting unemployment benefits.
    - Direct training costs are measured from this point.
    - Employment Security Department administrative costs are measured from this point.
- Unemployment benefits are paid for no more than 52 weeks within a two-year period, but forgone earnings may extend to three years.
- Typically, after no more than three calendar years, positive earnings occur, ranging from mid-$100 to $1,000-$2,000 a year, before taxes.
- The costs above the horizontal line in *Figure 4* are the opportunity costs of forgone earnings.

Data sources

We use the Unemployment Insurance Wage File to measure before-tax quarterly earnings. We use the Unemployment Benefits/Training Plan Table for explanatory variables other than pre-program before-tax earnings, including detail on Training Benefits Program client characteristics. See *Appendix 2* for the detailed variable list and variable definitions.

The study samples

Figure 5 and *Appendix Figure 7-2* detail the structure of the samples used to estimate the net effects of the program. *Appendix Figure 7-2* details the sample composition for estimating the **propensity function**. This sample totals 45,826 individuals. For the study sample, there is an average of 2.9 comparison group individuals for every treatment group member (participant). For some gender/cohorts, there are as many as 10 potential comparison matches for each participant; for other cells, there can be fewer than two matches.

Matching method

Once the propensity function is estimated for each cohort by gender and the estimated net propensity (probability) values are calculated, we match treatment and comparison group members based on the nearest-neighbor strategy. The nearest-neighbor strategy is employed as follows:

- The fitted values of the probability of being a member of the treatment group are calculated to six significant digits, e.g., 0.781234. We first match every treatment individual we can at six digits. We then proceed to match at five digits, (e.g., 0 .78123), then four digits, (e.g., 0.7812) and so on, to a final match at two digits (e.g., 0.78).

It turns out that for some propensity values, there is less than one expected comparison group match per individual in the treatment group – in particular, for those estimated values in the range greater than the probability interval 0.40 to 0.50. (See the paired treatment group and comparison group histograms in *Appendix 3*.) Therefore, we perform matching by returning the comparison group member to the comparison group pool. Given this replacement, we match the comparison- and treatment-group members on the basis of random selection, using a random-number generator.

Figure 5. The matched-cohort analysis for the Training Benefits Program[1]

Gender	Cohort							
	2002	2003	2004	2005	2006	2007	2008	Total
All participants								
Male	1,962	1,466	2,220	670	646	616	734	8,314
Female	1,156	1,304	1,948	912	626	624	786	7,356
Total	3,118	2,770	4,168	1,582	1,272	1,240	1,520	15,670
Participants who didn't return to their former employers								
Male	1,704	1,212	1,936	622	574	570	712	7,330
Female	1,124	1,114	1,742	854	586	582	750	6,752
Total	2,828	2,326	3,678	1,476	1,160	1,152	1,462	14,082

[1] *There is an exact match on cohort, gender, Training Benefits Program eligibility for that year, unemployment benefits eligibility for that cohort and before-tax earnings to the nearest $1,000 for the (summed) calendar quarters 1 to 8 prior to the year and quarter that establishes program eligibility. Conditioned on the exact match, the sample is then matched via propensity score estimation based on the nearest-neighbor strategy. Each cell count is split 50/50 between the treatment group (all participants) and the comparison group (eligible nonparticipants).*

Estimating the propensity function

Propensity function outcome variable

- Treatment status: Program participant = 1; Comparison group member = 0

Variables used in the propensity function analysis

The propensity function is estimated for each gender/cohort taken separately, conditioned on the exact match in each gender/cohort sample for the following variables:

- Cohort
- Gender
- Unemployment benefits eligibility
- Training Benefits Program eligibility
- Summed pre-tax earnings for quarters 1 to 8 prior to determining program eligibility, matched to the nearest $1,000.

Propensity function explanatory variables

- Workforce development area (WDA) location at year of eligibility for the Training Benefits Program.
- Age and age squared.

Estimating the net-impact function for annual before-tax earnings

Variables used in the net outcome function

Outcome variable

- Annual before-tax earnings expressed in 2002 dollars, based on the Consumer Price Index – Urban Wage Earners and Clerical Workers (CPI-W)[20]

Policy (treatment) variable

- Is the eligible individual enrolled in the Training Benefits Program? Yes = 1; No = 0[21]

Explanatory variables for the earnings estimation measured at program eligibility determination

- Age and age squared
- Education
- Gender
- Ethnicity
- Pre-program labor-force transition variable
- Industry attachment at time of separation or lay-off

[20] After statistical estimation, we reweight the net earnings effects to reflect 2010 prices.

[21] This is a "black box" treatment variable that does not account for whether a person has earned a diploma, certificate or license. It does not account for curriculum structure, grades earned or the degree to which courses are designed to help individuals get jobs.

Selection and other statistical bias

This study avoids two major sources of statistical bias that are present in many net-impact evaluations of social programs. First, the variables in this analysis for the treatment and comparison groups come from identical sources. Second, the variables are identically defined for the treatment and the comparison groups. Third, we adjust for selection bias by matching participants in the Training Benefits Program with otherwise eligible unemployment-insurance claimants who are not participants in the Training Benefits Program. As noted, we use two forms of matching.

First, exact matching with respect to:

- Cohort
- Gender
- Before-tax earnings to the nearest $1,000 summed over quarters 1 to 8 prior to the quarter of when program eligibility was determined.
- Eligibility to participate in the Training Benefits Program, which includes eligibility to receive unemployment benefits.

The last two eligibility conditions identify the potential match as having a relatively strong attachment to the labor force and a high likelihood of being permanently dislocated.

Second, via a statistically estimated propensity function conditioned on the exact match above, we adjust for age and local labor market conditions and any differential behavior that may affect program outcomes based on the operation of the various WorkSource centers located around the state. Matching via the propensity function for local labor market area (workforce development area, in this study) is particularly important since it adjusts for common labor market conditions facing the participants and comparison groups at the onset of program eligibility determination.[22] (See *Appendix 3* for a precise exposition of the logic underlying the propensity function matching procedure.)

[22] Matching on labor market location appears to be critical in estimating unbiased nonexperimental program effects. "The major source of bias arising from the application of nonexperimental estimators to evaluate training programs … arises from the mismatch of questionnaires (the study variables and their exact definitions) and labor markets across treatment groups and comparison groups, and not because of the failure of econometric estimators to eliminate selection bias." Heckman, Ichimura and Todd (1997), p. 608. (Parentheses added.) The present Training Benefits Program evaluation avoids these problems.

Findings

Societal net effects of the Training Benefits Program in Washington state, undiscounted "lifetime" gains

Figure 6 shows the average annual earnings benefits for the Training Benefits Program participants from the viewpoint of society or the public. These earnings are undiscounted. Thus, this estimate is similar to statements like "the college graduate earns an additional $1 million over his or her working life compared to the high school graduate."

Net-impact estimates are shown for all participants and for participants who didn't return to their former employers, by gender and for the total sample. The estimates shown are measured before taxes are deducted from earnings and they exclude unemployment benefits, which are transfer payments, and therefore not social costs. Finally, the estimates include Employment Security Department administrative costs and the social costs of training. Notes at the bottom of the figure define these costs and their data sources.

All participants – Figure 6, Panel 1

Men and women display a similar pattern to their undiscounted net earnings over time, but the gain for men exceeds that of women.

- Forgone wages exist on net for the first two years after program eligibility is determined.
- In follow-up year 3, relatively small positive or negative earnings differences exist, but these differences are not statistically significant.[23]
- Positive earnings occur in follow-up year 4 and continue through follow-up year 7.
- For all participants (Panel 1), in 2010 dollars, the undiscounted "lifetime" earnings gain before taxes is $50,779 for men; $29,678 for women; and $39,028 for the total sample.

Participants who didn't return to their former employers – Figure 6, Panel 2

The pattern of forgone earnings, the crossover to positive net earnings and the resulting net earnings increase are similar, but not identical, to that of all participants.

- Men who didn't return to their former employers gain $6,782 more over their "lifetime" than do men in the all participants group ($57,561 - $50,779 = $6,782). Women who don't return to their former employers gain $1,031 less than do women in the all participants group. Men and women together who didn't return to their former employers gain $6,602 more over their working "lifetime" than do the all participants group.

There is insufficient data to determine why these earnings outcomes differ.

[23] Even though the estimated earnings differences in follow-up year 3 are not statistically significant, we include them into the summed "lifetime" earnings stream, rather than set the values for the follow-up year 3 equal to zero.

Figure 6. Social before-tax earnings "lifetime" estimates, undiscounted, adjusted by average annual forgone earnings cost, training costs and Employment Security Department administrative costs, for all participants and participants who didn't return to their former employers, in 2010 dollars, CPI-W

Sample	Follow-up year, beginning with program eligibility year start							
	1	2	3	4	5	6	7	Undiscounted "lifetime" gain[2,3]
Panel 1: All participants. Forgone earnings plus $1,908 educational costs in year 1 and $954 in year 2 plus $424 in Employment Security program administrative costs in year 1.[1]								
Male	($7,830)	($4,201)	$544	$1,800	$3,129	$2,651	$3,218	$50,779
Female	($6,593)	($3,233)	($390)	$830	$1,889	$1,959	$2,201	$29,678
Total	($7,285)	($3,859)	($360)	$1,215	$2,483	$2,269	$2,696	$39,028
Panel 2: Participants who didn't return to their former employers. Forgone earnings plus $1,908 educational costs in year 1 and $954 in year 2 plus $424 in Employment Security program administrative costs in year 1.[1]								
Male	($6,582)	($3,190)	$473	$2,088	$3,343	$3,051	$3,434	$57,561
Female	($5,922)	($2,902)	($395)	$691	$1,934	$1,993	$2,078	$28,647
Total	($6,299)	($3,082)	$22	$1,553	$2,667	$2,597	$2,916	$45,630

Interpretation: For the social benefit stream in Panel 1, the total sample of all participants (men and women together) earn an additional $39,028 over their "lifetime," up to age 65. The earnings stream is undiscounted. Thus, this estimate is similar to statements like "the college graduate earns an additional $1 million over his or her working life compared to the high school graduate."

[1] Unemployment-benefits are excluded from this benefit stream. Unemployment benefits are transfer payments and do not enter into the estimation of social or public costs and benefits. However, unemployment benefits do represent benefits to private individuals and costs to the government and taxpayers. Therefore, these payments enter the private individual stream as a positive benefit and the government and taxpayer stream as a cost.
Total social costs of training and education for the average participant are based on the sum of total state general funds plus dedicated funds – local divided by total academic year headcounts. The estimates are calculated for each academic year, starting with 2002-2003 and ending with 2008-2009. These annual estimates are then weighted by percent of Training Benefit Program participants in each year covered by the study, relative to the total number of participants summed across the seven cohorts. The estimates are expressed in 2010 dollars, CPI-W. The headcount basis is used rather than a full-–time equivalent (FTE) basis, since participant enrollment in schooling is reflected as a headcount basis. Total social costs are underestimated, since we do not have estimates of the extra costs of education such as books and travel.

[2] The estimates for each follow-up year are the average, weighted by cohort size, of the net-impact estimates of the seven cohorts for each follow-up year separately. For example, the data for men in follow-up year 1 are the average, weighted by the cohort sample size, of the net effect of the program for the first follow-up year for each cohort, estimated separately. Therefore, this average is based on seven separate estimates. By follow-up year 4, the mean estimate is based on five separate cohort estimates.

[3] "Lifetime" earnings are extended an additional 16 years after follow-up year 7 for men and 15 years for women.

Data sources: Unemployment Insurance Data Warehouse; Data in Appendix 7; Washington State Board of Community and Technical Colleges, Expenditures – College/Research/Comparative Expenditure Data and Enrollment Headcounts – Student Historical Headcount and FTEs by College by Year, present retroactive through 1986

Private individual net effects of the Training Benefits Program in Washington state, undiscounted "lifetime" gains

Figure 7 shows the time pattern of net earnings from the standpoint of the individual participant. These "lifetime" gains incorporate:

1. Forgone earnings;
2. Unemployment benefits received;
3. Participant tuition costs; and
4. Net increases in before-tax earnings.

Forgone earnings, before-tax earnings and unemployment benefits received are all reduced by a 20 percent income-tax rate. This is a **sensitivity analysis** conditioned on three different assumptions as to tuition paid by the participant:

1. Full tuition over a two-year calendar period.
2. Half tuition over a two-year calendar period.
3. No tuition paid.

For half tuition and no tuition, the assumption is that scholarship money can be acquired by the participant.[24]

Individual participant viewpoint: all participants – Figure 7, Panels 1, 2 and 3

Figure 7, Panel 1 assumes the participant pays full tuition and student fees in each of two years after the year of the date of program eligibility. The unemployment benefits received are included in the two-year period over which the program will pay such benefits. Note in particular that receiving these benefits results in a positive income level in the first year of the training period. Forgone earnings plus tuition dominate the income level in the second year. In the third year, earnings become positive for men, but are still negative for women and the total study sample.[25] Starting in follow-up year 4, the earnings stream becomes positive and is always statistically significant.

Thus, we see for men who pay full tuition, the undiscounted net earnings stream becomes $44,776 over the projected working "lifetime" of the participant. For women, the undiscounted sum is $28,361, and for the total sample of men and women combined, $35,007.

In *Figure 7,* Panels 2 and 3, the undiscounted earnings streams increase, presumably because tuition and student fees decrease. If the participant can manage to have all tuition and student fees covered with scholarships or grants, Panel 3 shows that the undiscounted net earnings flow becomes $48,262 for men, $31,847 for women, and $39,202 for the study sample as a whole. We do not know what such scholarship or grant payments may be, so they are not included in the earnings flow. Not including scholarships or grant payments understates the earnings flow.

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[24] Thurston County WorkSource officials indicated that approximately $7,000 in scholarship funds were available for a qualified participant. Meeting at Thurston County WorkSource office, Feb. 2, 2011.

[25] The earnings differences in the third year are never statistically significant. However, the estimated sums are retained in the figure to simplify the discussion. This pattern of positive net earnings beginning two to three years after the onset of training is consistent with finding in the literature, both for studies done previously for Washington state and for studies done for other states. See *Figure 1*.

Figure 7. Private individual before-tax earnings "lifetime" estimates, undiscounted, adjusted by average annual forgone earnings, training benefits payments, and tuition and student fees, for all participants and participants who didn't return to their former employers, in 2010 dollars, CPI-W

Sample	Follow-up year beginning with eligibility year start							
	1	2	3	4	5	6	7	Undiscounted "lifetime" gain[3]
Total program participants								
Panel 1: Participant pays full tuition and student fees in each of two years. Forgone earnings plus $1,743 per year in tuition costs and student fees for each of two years.[1] Participant receives unemployment benefits paid through the Training Benefits Program in follow-up years 1 and 2.[2] A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$9,232	($5,770)	$358	$1,184	$2,057	$1,743	$2,116	$44,776
Female	$7,505	($5,131)	($256)	$545	$1,242	$1,288	$1,448	$28,361
Total	$8,320	($5,545)	($237)	$799	$1,633	$1,492	$1,773	$35,007
Panel 2: Participant pays half tuition and student fees in each of two years. Forgone earnings plus $872 per year in tuition costs and student fees for each of two years. Participant receives unemployment benefits paid through the Training Benefits Program in follow-up years 1 and 2.[2] A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$10,103	($4,899)	$358	$1,184	$2,057	$1,743	$2,116	$45,460
Female	$8,376	($4,260)	($256)	$545	$1,242	$1,288	$1,448	$30,703
Total	$9,191	($4,674)	($237)	$799	$1,633	$1,492	$1,773	$37,458
Panel 3: Participant pays no tuition or student fees. Forgone earnings only. Participant receives unemployment benefits paid through the Training Benefits Program in follow-up years 1 and 2.[2] A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$10,975	($4,027)	$358	$1,184	$2,057	$1,743	$2,116	$48,262
Female	$9,248	($3,388)	($256)	$545	$1,242	$1,288	$1,448	$31,847
Total	$10,063	($3,802)	($237)	$799	$1,633	$1,492	$1,773	$39,202
Participants who didn't return to their former employers								
Panel 4: Participant pays full tuition and student fees in each of two years. Forgone earnings plus $1,743 per year in tuition costs for each of two years. Participant receives unemployment benefits paid through the Training Benefits Program in follow-up years 1 and 2.[2] A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$10,056	($5,103)	$311	$1,373	$2,199	$2,006	$2,258	$49,228
Female	$7,948	($4,912)	($260)	$454	$1,272	$1,310	$1,366	$27,668
Total	$8,971	($5,032)	$14	$1,022	$1,753	$1,708	$1,917	$40,066
Panel 5: Participant pays half tuition and student fees in each of two years. Forgone earnings plus $872 per year in tuition costs for each of two years. Participant receives unemployment benefits paid through the Training Benefits Program for follow-up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$10,927	($4,232)	$311	$1,373	$2,199	$2,006	$2,258	$50,970
Female	$8,819	($4,041)	($260)	$454	$1,272	$1,310	$1,366	$29,410
Total	$9,842	($4,161)	$14	$1,022	$1,753	$1,708	$1,917	$41,808
Panel 6: Participant pays no tuition or student fees. Forgone earnings only. Participant receives unemployment benefits paid unemployment benefits paid through the Training Benefits Program in follow-up years 1 and 2.[2] A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net before-tax earnings benefits.								
Male	$11,799	($3,360)	$311	$1,373	$2,199	$2,006	$2,258	$52,714
Female	$9,691	($3,169)	($260)	$454	$1,272	$1,310	$1,366	$31,154
Total	$10,714	($3,289)	$14	$1,022	$1,753	$1,708	$1,917	$43,552

Interpretation: For the private individual benefit stream in Panel 1, the all participants group earns an additional $35,007 over their lifetime, up to age 65. The earnings stream is undiscounted. Thus, this estimate is similar to statements like "the college graduate earns an additional $1 million over his or her working life compared to the high school graduate."

[1] *Total private costs of training and education are based on historical community and technical college tuition costs. Tuition costs are estimated in 2010 dollars, CPI-W, for academic years 2002-2003 through 2008-2009. These are then weighted by the percent of participants in each cohort and summed to gain an average tuition cost for all participants. Tuition costs are used rather than some other measure, such as FTE costs, since the program participants are charged tuition for the credits earned. Full private costs are underestimated, since we do not have estimates of the extra costs incurred in addition to tuition and student fees, such as books and travel costs.*

Estimated forgone earnings occur in follow-up years 1 and 2. Forgone earnings are less in the second year than in the first year, suggesting, on average, that less than the entire second calendar year is spent in training. For men, second-year forgone earnings are 49.4 percent of the first year's forgone earnings; for women, 50.8 percent. As noted, the State Board for Community and Technical Colleges estimated a dislocated worker spent 1.3 years in training. Our estimates of forgone earnings suggest 1.5 calendar years of training. The two estimates are very close.

[2] *Training benefits are the unemployment benefits received by each participant. An alternative estimate of "net" program benefits would be to net out the unemployment payments of the comparison group from the unemployment benefits paid under the Training Benefits Program (52 weeks of training benefits, less any regular unemployment benefits which the participants received during the two-year program window). This procedure would lower total net benefits paid to participants. However, the estimated net benefits are so large, absent this subtraction, that the fundamental fact that the program is an efficient educational investment to the private individual is unchanged. Finally, from the participant's viewpoint, he or she makes the decision to engage in training based on the actual, not the net, unemployment benefits offered by the program.*

[3] *"Lifetime" earnings are extended to age 65, an additional 16 years after follow-up year 7 for men and 15 years after follow-up year 7 for women, based on the average ages of male and female participants.*

Individual participant viewpoint: participants who didn't return to their former employers – Figure 7, Panels 4, 5 and 6

Figure 7, Panels 4, 5 and 6 show the net earnings stream for the participants who didn't return to their former employers.[26] As a whole, these participants benefit more from the program than the all participants group. As noted previously, we do not have sufficient information to determine why this is so.

Panel 4 shows that for men who pay full tuition, the undiscounted sum of earnings gains is $49,228, for women, $27,668, and for the total study sample, $40,066. If participants gain scholarship and grants to cover tuition and student fees, then men gain $52,714, women gain $31,154, and the total study sample gains $43,552. (See *Figure 7*, Panel 6.)

Summary

The Training Benefits Program strongly benefits participants in two ways.

First, significant income support is given to the participant during training such that, during the first full year of training, the participant's income is positive on net. Then, by fostering training and education, the participant's human capital is increased and the participant's net earnings become positive approximately three years after the date at which the participant became eligible for the program.

[26] However, after their first job after completing training, they may have returned to the employer of record – the one that laid them off – or to the NAICS of that employer for their second or any subsequent job.

Social net present values based on before-tax "lifetime" gains

Figure 8 shows the **net present values** (NPVs), that is, the discounted earnings and cost flows, of the Training Benefits Program. The NPV is the capital sum one would need, at the given discount rate, to provide the undiscounted earnings totals that are shown in *Figure 6*. The estimates in *Figure 8* are based on a sensitivity analysis since there are several critical variables in the benefit-cost evaluation whose values are not known with precision. The sensitivity analysis attempts to bracket the reasonable possibilities. These sensitivity assumptions are:

- The earnings and cost flows are discounted at three different discount rates:
  - 3 percent, to represent the social rate of discount; [27]
  - 4.69 percent, the recent interest rate that the state has paid on bond issues;[28] and
  - 10 percent, the interest rate that approximates the private before-tax rate of discount. This rate is somewhat higher than the maximum student loan borrowing rates.
- The earnings streams are subjected to a depreciation rate over time:
  - 0 percent, as a base of reference; and
  - 3.4 percent, an estimated depreciation rate for human capital.[29]
- There are several social cost assumptions:
  - Forgone earnings plus $1,908 direct educational costs[30] in year 1 and $954 in year 2.
  - $424 in Employment Security Department administrative costs for the first training year.[31]
  - There are no costs attributed to books, travel, etc. – extra costs of training.[32]

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[27] For a discussion of the social rate of time preference, see Edward M. Gramlich, *A Guide to Benefit-Cost Analysis*, Second Edition, Long Grove, Illinois: Waveland Press, Inc., 1998, Page 104 ff.

[28] A conversation with an official of the Washington State Office of Financial Management verified this interest rate estimate.

[29] See Johnson, Thomas, "Returns from Investment in Human Capital," *American Economic Review*, Vol. 68, No. 4, September 1970 and Johnson, Thomas and Frederick J. Hebein, "Investments in Human Capital and Growth in Personal Income 1956 - 1966," *American Economic Review*, Vol. 64, No. 4, September 1974.

[30] See the notes to *Figure 6* for a full discussion of the source and estimation of social educational costs.

[31] This sum of $424 represents administrative costs of new entrants to the Training Benefits Program and the costs of tracking participants already in the program. It is not possible to decompose the administrative costs between these two groups. We have made the simplifying assumption that the tracking costs are minimal and so do not attribute administrative costs to the second year of the participant's training period. Adding in such costs would reduce all of the estimated net present values by about $400. The social efficiency conclusions remain the same.

[32] Thus, the NPVs are several hundred dollars higher than they would be if valid costs of books and travel could be attributed to participation in the Training Benefits Program.

Figure 8. Social net present values: sensitivity analysis for all participants and participants who didn't return to their former employers, by gender and total sample, with alternative assumptions for discount rates, and the annual decay in "lifetime" earnings projections, 2010 dollars – CPI-W

Discount rate, training cost assumptions and administrative cost estimates	Men		Women		Total sample	
	"Lifetime" annual decay rate		"Lifetime" annual decay rate		"Lifetime" annual decay rate	
	0%	3.4%	0%	3.4%	0%	3.4%
All participants						
Panel 1. Forgone earnings plus $1,908 educational costs in year 1 and $954 in year 2 plus $424 in Employment Security program administrative costs in year 1.						
3 Percent – The social rate of discount	$32,355	$23,271	$18,372	$12,657	$25,005	$17,393
4.69 Percent – State bond rate	$24,306	$17,457	$13,305	$8,958	$18,339	$12,601
10 Percent – Return to private capital	$9,310	$6,311	$3,808	$1,860	$5,993	$3,481
Participants who didn't return to their former employers						
Panel 2. Forgone earnings plus $1,908 educational costs in year 1 and $954 in year 2 plus $424 in Employment Security program administrative costs in year 1.						
3 Percent – The social rate of discount	$37,711	$28,816	$17,921	$12,526	$30,292	$22,061
4.69 Percent – State bond rate	$29,032	$21,723	$13,114	$9,011	$22,985	$16,780
10 Percent – Return to private capital	$12,779	$9,578	$4,085	$2,245	$9,358	$6,641

Interpretation: *For all participants, in Panel 1, at a 0 percent annual decay rate and a 3 percent discount rate, $25,005 is the present value sum which is equivalent to the undiscounted earnings of $39,028 shown in Figure 7, Panel 1. Total social costs. See Figure 7 notes.*

All participants

Figure 8, Panel 1 shows men, women and the total sample all have positive discounted net present values at the 3 percent, 4.69 percent and 10 percent discount rates. The data are interpreted as follows:

- At a 3 percent discount rate and a 0 percent "lifetime" annual **decay rate**, a present value sum of money equal to $25,005 (money in the bank) is equivalent to the undiscounted sum of lifetime earnings of $39,028 displayed in *Figure 6*, Panel 1. At a 10 percent discount rate and 0 percent decay rate, $5,993 discounted dollars is equivalent to $39,028 in undiscounted "lifetime" earnings.

To summarize, under a reasonable array of cost, discount rate and decay rate estimates, the Training Benefits Program is an efficient human capital investment and labor-market intervention for society, since all of the NPVs are positive. In addition, since the Training Benefits Program is an efficient investment for society, it is also an efficient investment for government and the taxpayer.

Participants who didn't return to their former employers

For the total sample of men and women combined, with one exception,[33] NPVs for the participants who didn't return to their former employers group are all higher than the net present values for the all participants group (*Figure 8*, Panel 2). Referring to Panel 2, for participants who didn't return to their former employers and a 0 "lifetime" annual decay rate in earnings, we find that at a 3 percent discount rate, the net present value of $30,292 is equivalent to the undiscounted earnings sum of $57,561. For the same assumptions, but a 10 percent discount rate, the NPV of $9,358 is equivalent to the undiscounted sum of $57,561.

[33] The exception is for women at the 4.69 percent discount rate and 0 "lifetime" annual decay rate.

As before, the Training Benefits Program is an efficient social investment under a variety of cost, discount rate and earnings decay rate assumptions. Likewise, the Training Benefits Program is therefore an efficient training and education investment for government and the taxpayer.

Individual participant net present values

For a social program such as the Training Benefits Program to be successful, the private individual also must gain positive net benefits; otherwise, the individual will not participate in the program, regardless of how valuable the program may be to society as a whole or to the government and taxpayer. *Figure 9* displays the estimated net present value for private individuals in the Training Benefits Program.

Sensitivity analysis

To test the incentive structure of the Training Benefits Program to the private individual, we set up three scenarios with respect to the participant's tuition payments and student fees to the community college or post-secondary technical college system. These scenarios bracket the range of tuition cost and student fee possibilities that face participants. These assumptions are:

1. The participant pays full tuition and student fees in each of two years. Forgone earnings[34] and $1,743 per year in tuition and student fees for each of two years (in 2010 dollars).[35] The participant receives unemployment benefits in follow-up years 1 and 2, the calendar year period during which these can be received under the program. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits;
2. The participant pays half tuition and student fees in each of two years. Forgone earnings and $872 per year in tuition and student fees for each of two years (in 2010 dollars). The participant receives unemployment benefits in follow-up years 1 and 2, the calendar year period during which these benefits can be received under the program. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits; and
3. The participant pays no tuition or student fee, but has forgone earnings. The participant receives unemployment benefits in follow-up years 1 and 2, the calendar year period during which these benefits can be received under the program. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.

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[34] Recall from *Figure 4* that we directly estimate forgone earnings to the training experience. Forgone earnings are estimated to exist during two calendar years after the initial period in which unemployment insurance claimants become eligible for the Training Benefits Program. Based on the pattern of forgone earnings, it appears that, on average, a Training Benefits participant takes up to two calendar years to complete his or her training program. Forgone earnings for men are considerably higher than forgone earnings for women. These differences in forgone earnings can be due in part to the wage rate and hours worked and training duration.

It is possible to work part-time and still collect unemployment benefits under the auspices of the Training Benefits Program. Gross earnings are taxed via the following formula: [(Gross earnings - $5.00) x 0.75 = Earnings deduction from the weekly unemployment benefit.] Average weekly unemployment benefits are currently about $400. A person would have to earn between $270.34 and $271.66 in a week to lose $200 of unemployment benefits; and between $537.01 and $538.33 in a week to lose $400 of unemployment benefits.

[35] Tuition and student fees are a weighted average over the 2002 through 2009 academic years, expressed in 2010 inflation-adjusted dollars, CPI-W.

A major factor that drives the calculation of net present value for the participant is the potentially large amount of unemployment benefits received during the authorized two-year training window. As a result of these unemployment benefits, all net present values, regardless of discount rates, decay rates and cost assumptions, are positive and large. As shown in *Figure 9,* Panel 1, for the total sample, no NPV estimate is below $18,000. For men, no estimate is below $21,000, and for women, no estimate is below $16,000.

The relationship between NPV and undiscounted "lifetime" earnings

Refer back to *Figure 7*, Panel 1, for the total sample. At a 3 percent interest rate, $29,060 invested at the start of a participant's eligibility would yield the participant $44,776 at the retirement age of 65. At a 10 percent interest rate, $18,768 invested at the start of a participant's eligibility would yield $35,007 for individuals in the all participants group.

Figure 9. Private individual net present values: sensitivity analysis for all participants and participants who didn't return to their former employers, men, women and total sample, with alternative assumptions for discount rates, participant educational costs and the annual decay in "lifetime" earnings projections, 2010 dollars – CPI-W

Discount rate	Men		Women		Total sample	
	"Lifetime" annual decay rate		"Lifetime" annual decay rate		"Lifetime" annual decay rate	
	0%	3.4%	0%	3.4%	0%	3.4%
Total program participants						
Panel 1. Forgone earnings plus $1,743 per year in tuition costs and student fees for each of two years. The participant pays full tuition in each of two years and receives unemployment benefits in follow-up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$40,209	$34,174	$28,510	$24,699	$34,123	$29,060
4.69 Percent – State bond rate	$34,595	$30,037	$24,904	$21,997	$29,442	$25,617
10 Percent – Return to private capital	$23,807	$21,793	$17,863	$16,542	$20,462	$18,768
Panel 2. Forgone earnings plus $872 per year in tuition costs and student fees for each of two years. The participant pays half tuition in each of two years and receives unemployment benefits for follow up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$40,744	$34,728	$29,044	$25,253	$34,657	$29,614
4.69 Percent – State bond rate	$35,115	$30,576	$25,424	$22,536	$29,962	$26,156
10 Percent – Return to private capital	$24,286	$22,289	$18,342	$17,039	$20,940	$19,265
Panel 3. Forgone earnings only; no tuition or student fees. The participant receives unemployment benefits for follow up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$41,279	$35,283	$29,579	$25,807	$35,192	$30,168
4.69 Percent – State bond rate	$35,635	$31,115	$25,944	$23,075	$30,482	$26,695
10 Percent – Return to private capital	$24,765	$22,786	$18,821	$17,535	$21,420	$19,761
Participants who didn't return to their former employers						
Panel 4. Forgone earnings plus $1,743 per year in tuition costs and student fees for each of two years. The participant pays full tuition in each of two years and receives unemployment benefits in follow up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$43,744	$37,306	$28,212	$24,613	$37,613	$32,141
4.69 Percent – State bond rate	$37,714	$32,852	$24,778	$22,032	$32,508	$28,375
10 Percent – Return to private capital	$26,096	$23,949	$18,045	$16,796	$22,682	$20,854
Panel 5. Forgone earnings plus $872 per year in tuition costs and student fees for each of two years. The participant pays half tuition in each of two years and receives unemployment benefits for follow up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$44,279	$37,850	$28,747	$25,166	$38,147	$32,694
4.69 Percent – State bond rate	$38,234	$33,391	$25,298	$22,571	$33,028	$28,914
10 Percent – Return to private capital	$26,575	$24,446	$18,524	$17,293	$23,161	$21,350
Panel 6. Forgone earnings only; no tuition or student fees. The participant receives unemployment benefits for follow up years 1 and 2. A 20 percent income-tax rate is assumed on unemployment benefits, forgone earnings and net earnings benefits.						
3 Percent – The social rate of discount	$44,814	$38,415	$29,282	$25,721	$38,682	$33,249
4.69 Percent – State bond rate	$38,754	$33,930	$25,818	$23,110	$33,548	$29,453
10 Percent – Return to private capital	$27,055	$24,942	$19,004	$17,790	$23,641	$21,847

Note: Total private costs. See Figure 7 notes.

All participants

Full-tuition cost assumption – Figure 9, Panel 1

Men earn a high NPV of $40,209 at a 3 percent discount and 0 percent decay rate; their low is $21,793 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $28,510 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $16,542 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $34,123 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $18,768.

Half-tuition cost assumption – Figure 9, Panel 2

Men earn a high NPV of $40,744 at a 3 percent discount and 0 percent decay rate; their low is $22,289 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $29,044 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $17,039 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $34,657 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $19,265.

No tuition cost assumption – Figure 9, Panel 3

Men earn a high NPV of $41,279 at a 3 percent discount and 0 percent decay rate; their low is $22,786 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $29,579 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $17,535 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $35,192 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $19,761. Compare to *Figure 7*.

Participants who didn't return to their former employers

As above, this group has higher NPVs, under all assumptions of **discounting**, decay rate, and costs compared to the all participants group. Typically, except for women, the gains are $2,000 to $3,000 higher, regardless of the assumptions made.

Full-tuition cost assumption – Figure 9, Panel 4

Men earn a high NPV of $43,744 at a 3 percent discount and 0 percent decay rate; their low is $23,949 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $28,212 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $16,796 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $37,613 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $20,854.

Half-tuition cost assumption – Figure 9, Panel 5

Men earn a high NPV of $44,279 at a 3 percent discount and 0 percent decay rate; their low is $24,446 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $28,747 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $17,293 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $38,147 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $21,350.

No tuition cost assumption – Figure 9, Panel 6

Men earn a high NPV of $44,814 at a 3 percent discount and 0 percent decay rate; their low is $24,942 at a 10 percent discount rate and a 3.4 percent decay rate. Women earn a high NPV of $29,282 at a 3 percent discount rate and a 0 percent decay rate. They earn a low of $17,790 at a 10 percent discount rate and a 3.4 percent decay rate. The total sample earns a high of $38,682 at a 3 percent discount rate and a 0 percent decay rate; the low at 10 percent discount with a 3.4 percent decay rate is $21,847.

Summary of net present values

A reasonable range of discount rates is selected. The earnings stream is assumed not to decay over time and then to decay at a low rate as established in the economic literature. A conventional tax rate is applied to all income, from whatever source. Finally, the tuition and student fees assumptions bracket reasonable possibilities. This sensitivity analysis creates 54 different NPV estimates for both all participants and for the fully dislocated sample. All of these scenarios yield positive and relatively high net present values.

These are uniformly high NPVs, considering that the training typically takes less than two calendar years to complete. In effect, the estimated NPVs for the private individuals constitute "money in the bank." The Training Benefits Program is an efficient human capital investment opportunity for the participant.

The issue of earnings replacement[36]

How much earnings Training Benefits Program replace?

The truly dislocated worker has been estimated to lose from 1.4 years to 2.8 years of pre-dislocation earnings in present value terms as a result of being permanently laid off.[37] This earnings loss is directly related to the level of unemployment in the economy when the worker is laid off. When the unemployment rate is below 6 percent, the net present value loss is approximately 1.4 times pre-layoff earnings – 140 percent. When the unemployment rate exceeds 8 percent, the permanently laid off worker suffers a loss of 2.8 times his or her pre-layoff earnings in present value terms – 280 percent.

Social replacement percent

Figure 10 shows the pattern of earnings replacement for the Training Benefits Program. The average annual before-tax earnings of the all participants group was $36,821 in quarters 5 to 8 prior to establishing program eligibility; for the participants who didn't return to their former employers, annual before-tax earnings were $30,835. We assume, for the purposes of illustration, that the participant loses one year's worth of earnings in present-value terms. For the total sample, at a 3 percent discount rate and a 0 "lifetime" annual decay rate, the percent of earnings replaced is 67.9 percent for all participants and 98.2 percent for the participants who didn't return to their former employers.

[36] Jeff Zahir is responsible for the ideas in this presentation.

[37] This loss is calculated at a 5 percent discount rate over a 20 year post-layoff period. See Davis, Steven J. and Till M. von Wachter, "Recessions and the Cost of Job Loss," Working Paper 17638, National Bureau of Economic Research, December 2011, page 1.

Private individual replacement percent

The average annual before-tax earnings of the all participants group was $29,457 in quarters 5 to 8 prior to establishing program eligibility; for participants who didn't return to their former employers, annual after-tax earnings were $24,668. At a 3 percent discount rate and a 0 "lifetime" annual decay rate, the percent of earnings replaced is 115.8 percent for all participants and 152.5 percent for the participants who didn't return to their former employers.

Figure 10. Replacement of lost earnings by the Training Benefits Program, all participants and participants who didn't return to their former employers[1]

Discount rate	Total program participants[1]			Participants who didn't return to their former employers		
	Pre-layoff[2] earnings[2]	Present value[3] replacement[3]	Percent replaced[4]	Pre-layoff earnings[2]	Present value replacement[3]	Percent replaced[4]
Replacement percent: social perspective						
3 percent	$36,821	$25,005	67.9%	$30,835	$30,292	98.2%
4.69 percent	$36,821	$18,339	49.8%	$30,835	$22,985	74.5%
10 percent	$36,821	$5,993	16.3%	$30,835	$9,358	30.3%
Replacement percent: individual participant perspective						
3 percent	$29,457	$34,123	115.8%	$24,668	$37,613	152.5%
4.69 percent	$29,457	$29,442	99.9%	$24,668	$32,508	131.8%
10 percent	$29,457	$20,464	69.5%	$24,668	$22,684	92.0%

[1] The base of reference is the total sample (all participants) used in the analysis. A 0 percent "lifetime" annual decay rate is assumed. Private individual pre-layoff earnings are reduced by a 20 percent tax rate. The present value of replacement reflects all benefits and costs of training. The private individual is assumed to pay full tuition costs and student fees.

[2] This value is the sum of all earnings for quarters 5 through 8 prior to January 1 of the year during which the participant becomes eligible to enroll in the program. We consider this period to be a period of stable, steady-state earnings.

[3] These NPVs are taken from Figures 8 and 9.

[4] Percent replaced = present value replacement divided by pre-layoff earnings.

The social return on investment (ROI)

The standard method to summarize a cost and earnings stream over time for any human capital investment is to calculate the return on investment (ROI). The ROI is the same as the internal rate of return (IRR).[38] We compute the social ROI from our estimated cost-earnings stream for the present study. We cannot compute a ROI for the private individual, since the cost-earnings stream for the private individual (*Figure 7*) cuts the horizontal axis that separates costs from benefits at two points. In such a case, there is no unique (single) IRR to this cost-earnings stream. For the private individual, given our cost-earnings estimates, we compute the net present values that are discussed in *Figure 9*.

We estimate social ROI for all participants and for the participants who didn't return to their former employers under several different assumptions:

- For men, women and the total sample
- For different decay rates in "lifetime" earnings:
  - A 0 percent decay rate – no depreciation over time in the skills learned.
  - A 3.4 percent decay rate – the skills acquired depreciate at 3.4 percent a year.

To place these estimates in context, as previously stated, the social rate of return on investment for the United States is approximately equal to the historical real annual growth rate – roughly 3 percent per year. There is no risk or inflation premium applied to this rate. The total sample ROI exceeds this percent considerably. The same is true for the ROI for men and women.

The *Bond Buyer's 20 Bond Index* shows a municipal bond capital cost of borrowing of 4.69 percent for 2009. This rate is a good measure of the opportunity cost of capital – the long-term borrowing rate – for Washington state.[39] All of the social ROI exceed this rate – total sample, men and women. Since all of the social ROI estimates for the total sample in *Figure 11* exceed the opportunity cost of capital for the state of Washington, from the state government's and taxpayers' standpoint, the Training Benefits Program is an efficient investment.

The private rate of return on equity capital is approximately 10 percent before taxes. This is the sum of the social rate of return, plus historical risk and inflation components. The social Training Benefits Program ROI estimates are not directly comparable to this before-tax private rate of return. However, these ROI estimates generally exceed the cost of borrowing for student loans, thus indicating that the Training Benefits Program is also an efficient investment for the eligible unemployment claimant.

Paul Sommers (2006), reviewing the work of Psacharopoulos and Patrinos (2004) for studies of the returns to formal education for 73 countries reports that, for higher education, the global private rate of return is estimated at 19 percent and the social rate at 10.8 percent across the world economies. All of the ROI in *Figure 11* exceed the 10.8 percent social rate of return for higher education across the world economies. Additionally, the ROI are much higher than the state's borrowing rate for bonds. Therefore, the ROI estimates affirm that the Training Benefits Program is

[38] The internal rate of return (IRR) is the discount rate that makes the present value of the summed stream of benefits equal to the present value of the costs that are due exclusively to undertaking training and education.

[39] A conversation with an official of the Washington State Office of Financial Management verified this interest rate estimate.

an efficient social investment in human capital and it also is efficient from the standpoint of government and the taxpayer.

Figure 11. Social rates of return on investment (ROI), "lifetime" projection, alternative assumptions for direct social costs of education/training and the annual decay in "lifetime" earnings projections, all participants and participants who didn't return to their former employers

	0% Decay rate	3.4% Decay rate
All program participants		
Men	18.3%	16.6%
Women	14.3%	12.4%
Total	15.8%	14.0%
Participants who didn't return to their former employers		
Men	22.9%	21.3%
Women	15.0%	13.2%
Total	20.0%	18.3%

Note: Cost assumptions: Before-tax forgone earnings plus $1,908 educational costs in year 1, $954 in year 2 and $424 Employment Security administrative costs in year 1, 2010 prices, CPI-W.

Summary

Outcomes:

- Large, statistically significant forgone earnings occur during the first two follow-up years, beginning with the year in which the participant becomes eligible to enroll in the Training Benefits Program.
  - These forgone earnings approach or exceed in magnitude the other components of social and private cost of the Training Benefits Program.
  - It is these large forgone earnings which the Training Benefits Program is designed to mitigate.
- Undiscounted benefit streams:
  - The social benefit stream for all participants is $39,028; for the participants who didn't return to their former employers, $45,630.
  - Men gain from $20,000 to $30,000 more than women.
  - The participants who didn't return to their former employers group gain more than the all participants group.
- Net present values (NPVs):
  - Social NPVs are large and positive for three different assumptions concerning the discount rate. The Training Benefit Program is an efficient investment in human capital and improves the functioning of the labor market.
  - Private NPV estimates for all participants are quite high and are sufficient, at a 10 percent discount rate and a 3.4 percent decay rate, to cover all forgone earnings and tuition costs incurred by participants. The program is an efficient, economically beneficial investment for eligible unemployment-insurance claimants.
- Earnings replacement rates:
  - From the social perspective
    - For all participants, the range is from 67.9 percent to 16.3 percent.
    - For participants who didn't return to their former employers, the range is from 98.2 percent to 30.3 percent.
  - From the private individual perspective:
    - For all participants, the range is from 115.8 percent to 69.5 percent.
    - For participants who didn't return to their former employers, the range is from 152.5 percent to 92 percent.

- Social ROI
  - Social ROI is very high for all participants, even assuming a 3.4 percent decay rate in the "lifetime" stream of forgone earnings and net earnings benefits.
  - Social ROI for the participants who didn't return to their former employers are somewhat higher than the social ROI for all participants. Thus, the Training Benefits Program clearly benefits those unemployed dislocated workers for whom the program is intended.

Study design:

- Seven cohorts of participants (the treatment group) are analyzed, starting with the 2002 calendar year and ending with the 2008 calendar year.
- The comparison group is composed of eligible unemployment-insurance claimants who do not enroll in the Training Benefits Program.
- Net effects are estimated for all participants and for participants who didn't return to their former employers.
- Exact matching, propensity function matching and differencing the dependent variable are used to reduce selection bias.
  - Comparison group members are matched with the treatment group members (participants) by:
    - Using an exact match on gender, unemployment benefits eligibility, Training Benefits Program eligibility and annual before-tax earnings.
    - Using the estimated probability of program participation based on an estimated propensity function, with the match occurring on a nearest-neighbor basis with replacement of comparison group members in the pool of individuals to be matched.
- Common definitions of all variables are used for the treatment and the comparison groups, an otherwise major source of statistical bias in natural experiments.
- Common labor market locations exist for the treatment and comparison groups, an otherwise major source of statistical bias in nonexperimental evaluation designs.
- Ordinary least squares, using difference-in-difference specification of the dependent earnings variable, is used to estimate net earnings effects.
- We directly estimate forgone earnings for men and women, separately, who are eligible for and who enroll in the Training Benefits Program.
- Social and private individual NPVs are estimated.
- Earnings replacement rates are estimated.
- Social ROIs are estimated.

Caveats

- The ROI and NPV estimates depend heavily on the assumption of the "lifetime" earnings stream and the assumed decay rates in the forgone earnings and net earnings benefit stream.
- The estimated ROI and NPV estimates apply only to the studied population of Training Benefits Program participants. The ROI and NPV estimates cannot be generalized to the population of community and technical college enrollees overall or to unemployment-insurance claimants overall.
- Propensity score matching corrects only for differences among the treatment and comparison groups for observed variables that are included in the propensity function. Selection bias based on any unobserved and unmeasureable characteristics not accounted for in the difference-in-differences method still remains in the analysis.
- Workers disappear from the database over time post-treatment due to:
    - Leaving the state, regardless of labor force attachment condition
    - Leaving covered employment, regardless of labor force attachment condition
    - Self-employment
    - Retirement
    - Working in the "gray economy"
- Expansion of the Training Benefits Program could change the general equilibrium earnings and employment results, that is, the overall effects on the state's economy, and lower private NPVs and the social ROI estimates. At this time, however, the Training Benefits Program is very small relative to the state labor force of over 3 million workers and relative to the total amount of training that occurs in the state's community and technical college system. In the fall of 2002, 260,448 students were enrolled in the state's community and technical colleges; for the fall of 2008, the figure was 266,703. In short, displacement from jobs of otherwise employable individuals by Training Benefits Program participants is not likely to be an economic problem.

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Appendices

Appendix 1. Glossary

Benefits, governmental/taxpayer

These are benefits as perceived from the standpoint of the government or the taxpayer, such as income taxes due to the fact that a retrained worker becomes re-employed and now has taxable earnings. Other examples are sales taxes or fees for the use of governmental facilities, such as state or federal parks. In short, any revenue that adds to the government balance sheet is a benefit to the government or taxpayer.

Benefits, private individual

These are benefits as perceived from the standpoint of the private individual, such as earnings net of taxes, subsidies received such as TANF payments, unemployment benefits, and the Earned Income Tax Credit. Private benefits can be both monetary in nature and nonmonetary.

Benefits, social

From a monetary standpoint, these are earnings or other financial gains due to economic activity, such as pre-tax business profits. Social benefits, sometimes termed public benefits, are net of all transfer payments such as TANF payments, unemployment benefits, and the Earned Income Tax Credit. Social benefits can be both monetary in nature and nonmonetary.

Cohort

A cohort is a sample of individuals whose economic (or other) behavior is studied over a defined period of time, such as several years, months, or weeks.

Costs, administrative

Administrative costs are costs incurred in the process of effectuating the operation of the program. They are a form of overhead or indirect costs, such as maintaining fiduciary records on participants, managing the payment of unemployment benefits to claimants, or determining the eligibility of an individual for the program.

Costs, direct-training

In this study, direct-training costs represent the costs of all economic resources that are devoted to the education or training of an individual, such as teacher's salaries and administrative overhead. In-state students pay tuition and student fees to cover some of these costs and any additional resource expenditures are then covered by the government/taxpayer. Transfer payments to students, such as state-provided scholarships, are not included in the direct costs of training.

Costs, governmental/taxpayer

These are costs as experienced by the government/taxpayer, such as transfer payments given to individuals, TANF payments, unemployment benefits, the Earned Income Tax Credit payments, and housing or rent subsidies. They also include the use of resources in the administration of government activities and programs such as the purchase of gasoline to fuel school buses and the costs of servicing bond debt, incurred, say, in the construction of schools and government buildings. In short, any expenditure that draws down the revenue in the state's balance sheet is a cost to the government or taxpayer.

Costs, private individual

These are costs from the perspective of the private individual, such as the tuition and student fees he or she must pay to attend a community or technical college. Taxes on earnings and other types of income are also perceived as a private cost.

Costs, social

These are costs from the perspective of society or the public as a whole and represent the drawdown of total resources used to provide some good or service. In the context of this study, social costs can be teacher's salaries and benefits, costs of debt service on buildings or other capital goods such as a school bus fleet, payments for heat and light, but not such expenditures as the subsidized component of school lunches. All transfer payments are excluded from the accounting of social costs. Social costs can be monetary or nonmonetary in nature.

Covariate

A covariate is a variable that is related either positively or negatively to some other variable. Education is a covariate of earnings, since earnings vary depending on how many years of education one achieves.

CPI-W

The Consumer Price Index for Urban Wage Earners and Clerical Workers.

Current dollars

Current dollars are monetary quantities that are not adjusted for inflation.

Decay rate

The decay rate in this study is the percentage rate at which a person's earnings decrease due to the fact that, over time, a given set of his or her skills become increasingly obsolete in the labor market and the economy.

Discounting

Discounting is the mathematical process of converting a stream of earnings that stretch into the future into a single sum that is measured in terms of its present worth – a present discounted value, "net present value."

Earnings

Earnings are the product of the hourly wage rate times the number of hours worked. A salary is earnings that are awarded for work on a time-basis other than hourly.

Earnings function

The earnings function is the statistical relationship between earnings and the economic and demographic variables that determine or predict those earnings.

Earnings replacement

In this study, the earnings replacement is the amount of earnings necessary to fully compensate a displaced worker for the earnings he or she has lost due to displacement. The earnings replacement is expressed in terms of a net present value to account for the fact that the replacement of lost earnings typically occurs over time.

Fitted value

A fitted value is a quantity or number estimated via a statistical method to reflect the effect of the variables used to explain the phenomenon in question. An example would be the earnings of a white male, aged 25 based on a statistical function that explained earnings on the basis of race or ethnicity, gender and age; or, the probability that a white male with a high school education would enroll in a training program, where the probability of enrollment is explained as a function of race or ethnicity, gender, and education.

Forgone earnings or forgone wages

These are the earnings or wages one gives up when engaging in any activity that precludes one's ability to work, such as attending a training program. Forgone earnings are a form of opportunity cost.

Gray economy

The gray economy, sometimes known as the underground economy, is the sector of the economy where all payments for goods and services are made in terms of cash (or sometimes check) and no taxes or other deductions are collected or recorded against those payments, thus resulting in no official recognition or awareness by government that an economic transaction has occurred. A payment in cash to an unlicensed in-home day care center is an example.

Inflation-adjusted dollars

Inflation-adjusted dollars are monetary quantities that have been adjusted by a price index to reflect their economic value relative to some base period in time.

Logit

Logit is a statistical procedure that enables one to analyze problems that involve choosing between two or more discrete (mutually exclusive) choices or actions. An example of a discrete choice problem could be an unemployed person who makes a choice between taking a job-training course in order to become re-employed or who decides to use some other method to find a job, such as searching for a job online.

Logit statistically relates the choice made by an individual to the characteristics of that person, such as age, education and gender, as well as to the characteristics of the other choice or choices available to the person. For a more detailed discussion, consult *Wikipedia* on the Internet.

Multivariate

The term multivariate refers to a statistical relationship in which a dependent variable, such as earnings, is statistically related to, or explained by, a set of two or more independent or explanatory variables.

Nearest-neighbor matching

Nearest-neighbor matching is a method whereby one attempts to duplicate the conditions that exist in a classical random-assignment experiment. The method uses estimated probabilities from a propensity function that are derived from a set of characteristics considered to affect whether one does, or does not, engage in a particular action, such as enrolling in a job-training course. Estimated probabilities exist for individuals who do and who do not engage in that action. The probability score of a person who engages in the action is matched with the probability score of a comparison group member who does not engage in the action. In this matching process, one attempts to conduct the match so that the probabilities are as close to each other as possible.

Net present value

Net present value is the summed discounted value of a stream of future earnings or income.

North American Industry Classification System (NAICS)

NAICS is the standardized method of classifying industries so that they can be compared in a defined statistical sense.

Ordinary least squares

Ordinary least squares is a statistical procedure that enables one to estimate the statistical relationship between a dependent variable, such as earnings, and a variable or set of variables such as age, gender and education. In this example, the effect on the dependent variable of any one of the explanatory variables, such as education, is estimated while holding constant the simultaneous effect of age and gender. For a more detailed discussion, consult *Wikipedia* on the Internet.

Opportunity costs

An opportunity cost is the cost of choosing to perform some economic action in terms of the forgone value of the next best alternative use of one's time. Thus, the opportunity cost of attending school is the wages or earnings one forgoes because one cannot work while attending school and sitting in a classroom or studying in a laboratory. Opportunity costs can be monetary or nonmonetary.

Participants, "all participants"

The "all participants" group is composed of Training Benefits Program participants who *do* and who *do not* return, as their first job after training, to the employer from which they were most recently laid off. This study group evaluates the Training Benefits Program as the law is written

Participants, "participants who didn't return to their former employers"

The "participants who didn't return to their former employers" group is a subset of all Training Benefits Program participants. These *do not* return, as their first job after training, to the employer from which they were most recently laid off. This study group provides a more stringent test of the net economic benefits of the Training Benefits Program.

Propensity function

A propensity function is a probability function used to predict the probability that one will engage in a particular activity irrespective of whether one has or has not actually engaged in that activity.

Return on investment (ROI)

The return on an investment is the rate of interest that discounts a stream of benefits to the present, such that this discounted stream exactly equals the present costs of generating that income stream over time.

Selection bias

Selection bias is a form of statistical bias which occurs when one incorrectly ascribes as a cause of an event some value which is actually due to some other predetermined cause. Thus, persons who are efficient at learning tend to gain more education. Ascribing the total of extra future earnings as due to one's educational attainment thus attributes causality to the education received when the true causal effect is due, at least in part, to the fact that the person is an efficient learner.

Sensitivity analysis

Sensitivity analysis is a statistical method of selecting plausible values of one or more statistics, such as the cost of providing assistance to re-employ an unemployed worker. One then estimates the effect of each of these plausible values on some other variable of interest, such as the net present value of earnings. The intent is to establish, at the minimum, an upper and lower bound to the reasonable outcome or range of values of the good or service in question net of the different plausible cost estimates.

Statistical significance

Statistical significance is a method that uses the laws of probability to predict whether a given statistical value is equal to or different from some other statistical value. Typically, one can compare the average value (the mean) of two variables to determine if they are equal to or different from each other in a statistical sense, determined by the properties of the samples on which the two means are based. Or, one can compare a given mean value against the alternative value of zero. In either example, the laws of probability allow one to precisely state the actual probability that the two means are equal or different from each other or that the single mean is equal to or different from zero.

Appendix 2. Data and variable definitions and data sources

Introduction

Socio-economic data for Training Benefits Program participants (the treatment group) are taken from the unemployment-insurance records for each applicant. Pre-tax earnings for each individual in the study are taken from the Employment Security Department's tax system, which requires each firm contributing to the state's unemployment-insurance system to declare the quarterly before-tax earnings paid for every employee covered by unemployment insurance. These pre-tax earnings are the outcome variable for the study.

Study time period

In reducing the data to a longitudinal form, the date of the eligibility approval to participate in the Training Benefits Program is the date used to define pre- and post-treatment eligibility periods.

Definition of the treatment and comparison groups

The treatment group is selected based on the administrative record of decisions made on applications for the Training Benefits Program as recorded in the unemployment-insurance database. Only participants who completed their training plan are included in the treatment group for this study.

The comparison group is made up of eligible nonparticipants from the unemployment-insurance database who meet the following eligibility criteria established in the legislation:

- They must have been approved for unemployment benefits. In this case, the effective date of claim for unemployment benefits is used as the trigger date at which the unemployment-benefits claimant could have been approved for the Training Benefits Program.
- They must have been laid off from a "declining industry" as defined by their local workforce development council (WDC), and/or
- They must have been laid off from a "declining occupation" as defined by their local WDC; and
- They cannot have been previously approved for the Training Benefits Program at any time.
- They must have been attached to the labor force (employed or looking for work) for two of the last four years.

Necessary and sufficient definition of Training Benefits Program eligibility

Conditioned on the discussion above, which defines a necessary condition for Training Benefits Program eligibility, the following additional requirements must be met by the Training Benefits Program applicant in order for the applicant to be deemed eligible for the program.

Eligibility conditions specified in RCW 50.22.150[40]

1. The applicant must be a dislocated worker as defined in RCW 50.04.075 This is any individual who:
    a. Has been terminated or received a notice of termination from employment;
    b. Is eligible for or has exhausted entitlement to unemployment compensation benefits; and
    c. Is unlikely to return to employment in the individual's principal occupation or previous industry because of a diminishing demand for their skills in that occupation or industry.
2. The applicant has demonstrated sufficient tenure in an occupation or in work with a particular skill set. The job-tenure requirements do not apply to an exhaustee who has base-year employment in the aerospace, forest products and fishing industries. Sufficient tenure means earning a plurality of wages in a particular occupation or using a particular skill set during the base year and at least two of the four 12-month periods immediately preceding the base year.

An applicant is not eligible for the Training Benefits Program if he or she:

- Is a standby claimant who expects to be recalled by his or her regular employer.
- Has a definite recall date that is within six months after the date he or she was laid off.

The general statement in Senate Bill 6335 Section 6 is consistent with RCW 50.22.150 for claims effective before April 5, 2009, as set forth immediately above.

Note that these characteristics imply a relatively strong attachment to the labor force. This relatively strong attachment to the labor force for both the program participants and their matched comparison group improves the likelihood of estimating valid and reliable net effects of the Training Benefits Program.

[40] See also State of Washington. 56th Legislature. 2000 Regular Session. Senate Bill 6335. New Section. Section 6. In addition, the following legislation is pertinent: 56th Legislature. 2000 Regular Session. Substitute House Bill 3077. Chapter 2, Laws of 2000. Unemployment Insurance. Effective Date: 2/7/00 and 61st Legislature. 2009 Regular Session. Engrossed Substitute House Bill 1906. Certification of Enrollment. Passed by the House Feb. 13, 2009.

Appendix Figure 2-1. Variables and variable definitions

	Variable description	Value definition	Variable name
1	SSN	9-character entry	SSN
2	Gender	M = 1; F = 0	Gender
3	Age	Two-digit age since EDC	Age
		99	Not Ascertained
4	Age squared	Four-digit number	AgeSQ
		9999	Not Ascertained
5	Effective date of claim of participant	YYYY:QQ of effective date of claim	EDC
		9999:99	Not Ascertained
6	Date Training Benefits were approved	YYYY:QQ of decision date	Dcsndate
		9999:99	Not Ascertained
7	Education enrollment date	MMDDYYYY	Date enrolled in classes
		999999999	Not Ascertained
8	Treatment group or comparison group	Treatment = 1; Comparison = 0	D
9	Training withdrawal date	MMDDYYYY	TrainingWithdralDate
		999999999	Not Ascertained
10	Workforce development area		
	Jefferson, Kitsap and Clallam counties	Yes = 1; No = 0	WDA1
	Grays Harbor, Mason, Pacific, Thurston and Lewis counties	Yes = 1; No = 0	WDA2
	Whatcom, Skagit, San Juan and Island counties	Yes = 1; No = 0	WDA3
	Snohomish County	Yes = 1; No = 0	WDA4
	King County	Yes = 1; No = 0	WDA5
	Pierce County	Yes = 1; No = 0	WDA6
	Wahkiakum, Cowlitz and Clark counties	Yes = 1; No = 0	WDA7
	Okanogan and Chelan counties	Yes = 1; No = 0	WDA81
	Douglas, Grant and Adams counties	Yes = 1; No = 0	WDA82
	Kittitas, Skamania, Yakima and Klickitat counties	Yes = 1; No = 0	WDA9
	Ferry, Stevens, Lincoln and Pend Oreille counties	Yes = 1; No = 0	WDA101
	Walla Walla, Whitman, Columbia, Garfield and Asotin counties	Yes = 1; No = 0	WDA102
	Benton and Franklin counties	Yes = 1; No = 0	WDA11
	Spokane County	Yes = 1; No = 0	WDA12
11	Ethnicity		
	White	Yes = 1; No = 0	ETH_White
	Asian or Pacific Islander	Yes = 1; No = 0	ETH_Asia
	African American	Yes = 1; No = 0	ETH_AfAm
	Hispanic	Yes = 1; No = 0	ETH_His
	Other	Yes = 1; No = 0	ETH_Other
	Not ascertained	Yes = 1; No = 0	ETH_NA
12	Education		
	No formal education	Yes = 1; No = 0	EDU_0
	High school/no degree obtained	Yes = 1; No = 0	EDU_NoHS
	GED	Yes = 1; No = 0	EDU_GED
	High school diploma	Yes = 1; No = 0	EDU_HS

	Variable description	Value definition	Variable name
	Some post secondary education/no degree	Yes = 1; No = 0	EDU_PoSec
	Associate degree	Yes = 1; No = 0	EDU_CC
	Bachelor's degree	Yes = 1; No = 0	EDU_BA
	Master's degree	Yes = 1; No = 0	EDU_MA
	Not ascertained	Yes = 1; No = 0	EDU_NA
13	Industry based on two-digit NAICS code		
	Agriculture	Yes = 1; No = 0	IND_AG
	Fishing, forestry or mining	Yes = 1; No = 0	IND_FIS
	Construction	Yes = 1; No = 0	IND_CONST
	Nondurable-goods manufacturing except aerospace	Yes = 1; No = 0	IND_MFG1
	Durable-goods manufacturing	Yes = 1; No = 0	IND_MFG2
	Aerospace	Yes = 1; No = 0	IND_AERO
	Wholesale trade	Yes = 1; No = 0	IND_WHSL
	Retail trade	Yes = 1; No = 0	IND_RETL
	Transportation	Yes = 1; No = 0	IND_TRSP
	Utilities	Yes = 1; No = 0	IND_UTIL
	Information	Yes = 1; No = 0	IND_INFO
	Finance, insurance	Yes = 1; No = 0	IND_FINS
	Professional services	Yes = 1; No = 0	IND_PROF
	Administrative services	Yes = 1; No = 0	IND_ADMIN
	Management of companies	Yes = 1; No = 0	IND_MGMT
	Waste management and recycling	Yes = 1; No = 0	IND_WAST
	Education	Yes = 1; No = 0	IND_EDUC
	Health services	Yes = 1; No = 0	IND_HLTH
	Real estate	Yes = 1; No = 0	IND_REAL
	Leisure and hospitality	Yes = 1; No = 0	IND_LEIS
	Private household	Yes = 1; No = 0	IND_HOUS
	Public administration	Yes = 1; No = 0	IND_PUBL
	Not ascertained	Yes = 1; No = 0	IND_NA
14	Occupation based on two-digit SOC code		
	None	Yes = 1; No = 0	OCC_NONE
	Management	Yes = 1; No = 0	OCC_MGMT
	Business and financial services	Yes = 1; No = 0	OCC_BUSN
	Computer and mathematics	Yes = 1; No = 0	OCC_MATH
	Architecture and engineering	Yes = 1; No = 0	OCC_ENGI
	Life sciences	Yes = 1; No = 0	OCC_LIFE
	Community and social services	Yes = 1; No = 0	OCC_SSVC
	Legal	Yes = 1; No = 0	OCC_LEGL
	Education, training and library	Yes = 1; No = 0	OCC_EDUC
	Arts, design and entertainment	Yes = 1; No = 0	OCC_ARTS
	Healthcare practitioner	Yes = 1; No = 0	OCC_HEAL
	Healthcare support	Yes = 1; No = 0	OCC_HSUP
	Protective services	Yes = 1; No = 0	OCC_PROT
	Food preparation and serving	Yes = 1; No = 0	OCC_FOOD
	Building, grounds maintenance	Yes = 1; No = 0	OCC_MNTN

	Variable description	Value definition	Variable name
	Personal care and services	Yes = 1; No = 0	OCC_PERS
	Sales	Yes = 1; No = 0	OCC_SALE
	Office and administrative services	Yes = 1; No = 0	OCC_OFFC
	Farming, fishing and forestry	Yes = 1; No = 0	OCC_AGRI
	Construction and extraction	Yes = 1; No = 0	OCC_CONST
	Installation, maintenance and repair	Yes = 1; No = 0	OCC_INST
	Production	Yes = 1; No = 0	OCC_PROD
	Transportation and material moving	Yes = 1; No = 0	OCC_TRSP
	Military specific	Yes = 1; No = 0	OCC_MILI
	Not ascertained	Yes = 1; No = 0	OCC_NA
15	Hours worked in a quarter prior to initial unemployment benefits claim		
	Hours worked in quarter 8 quarters prior to initial unemployment benefits claim	value≥0	HOURS_8
	Hours worked in quarter 7 quarters prior to initial unemployment benefits claim	value≥0	HOURS_7
	Hours worked in quarter 6 quarters prior to initial unemployment benefits claim	value≥0	HOURS_6
	Hours worked in quarter 5 quarters prior to initial unemployment benefits claim	value≥0	HOURS_5
	Hours worked in quarter 4 quarters prior to initial unemployment benefits claim	value≥0	HOURS_4
	Hours worked in quarter 3 quarters prior to initial unemployment benefits claim	value≥0	HOURS_3
	Hours worked in quarter 2 quarters prior to initial unemployment benefits claim	value≥0	HOURS_2
	Hours worked in quarter prior to initial unemployment benefits claim	value≥0	HOURS_1
	Hours worked in quarter of initial unemployment benefits claim	value≥0	HOURS0
	Hours worked in quarter after initial unemployment benefits claim	value≥0	HOURS1
	Hours worked 2 quarters after initial unemployment benefits claim	value≥0	HOURS2
	Hours worked 3 quarters after initial unemployment benefits claim	value≥0	HOURS3
	Hours worked4 quarters after initial unemployment benefits claim	value≥0	HOURS4
	Hours worked 5 quarters after initial unemployment benefits claim	value≥0	HOURS5
	Hours worked 6 quarters after initial unemployment benefits claim	value≥0	HOURS6
	Hours worked 7 quarters after initial unemployment benefits claim	value≥0	HOURS7
	Hours worked 8 quarters after initial unemployment benefits claim	value≥0	HOURS8
	Hours worked 9 quarters after initial unemployment benefits claim	value≥0	HOURS9
	Hours worked 10 quarters after initial unemployment benefits claim	value≥0	HOURS10
	Hours worked 11 quarters after initial unemployment benefits claim	value≥0	HOURS11
	Hours worked 12 quarters after initial unemployment benefits claim	value≥0	HOURS12
	Hours worked 13 quarters after initial unemployment benefits claim	value≥0	HOURS13

	Variable description	Value definition	Variable name
	Hours worked 14 quarters after initial unemployment benefits claim	value≥0	HOURS14
	Hours worked 15 quarters after initial unemployment benefits claim	value≥0	HOURS15
	Hours worked 16 quarters after initial unemployment benefits claim	value≥0	HOURS16
	Hours worked 17 quarters after initial unemployment benefits claim	value≥0	HOURS17
	Hours worked 18 quarters after initial unemployment benefits claim	value≥0	HOURS18
	Hours worked 19 quarters after initial unemployment benefits claim	value≥0	HOURS19
	Hours worked 20 quarters after initial unemployment benefits claim	value≥0	HOURS20
	Hours worked 21 quarters after initial unemployment benefits claim	value≥0	HOURS21
	Hours worked 22 quarters after initial unemployment benefits claim	value≥0	HOURS22
	Hours worked 23 quarters after initial unemployment benefits claim	value≥0	HOURS23
	Hours worked 24 quarters after initial unemployment benefits claim	value≥0	HOURS24
	Hours worked 25 quarters after initial unemployment benefits claim	value≥0	HOURS25
	Hours worked 26 quarters after initial unemployment benefits claim	value≥0	HOURS26
	Hours worked 27 quarters after initial unemployment benefits claim	value≥0	HOURS27
	Hours worked 28 quarters after initial unemployment benefits claim	value≥0	HOURS28
	Hours worked 29 quarters after initial unemployment benefits claim	value≥0	HOURS29
16	Before-tax quarterly earnings in any quarter before and after training, in dollars		
	Earnings in quarter 8 quarters prior to initial unemployment benefits claim	value≥0	EARN_8
	Earnings in quarter 7 quarters prior to initial unemployment benefits claim	value≥0	EARN_7
	Earnings in quarter 6 quarters prior to initial unemployment benefits claim	value≥0	EARN_6
	Earnings in quarter 5 quarters prior to initial unemployment benefits claim	value≥0	EARN_5
	Earnings in quarter 4 quarters prior to initial unemployment benefits claim	value≥0	EARN_4
	Earnings in quarter 3 quarters prior to initial unemployment benefits claim	value≥0	EARN_3
	Earnings in quarter 2 quarters prior to initial unemployment benefits claim	value≥0	EARN_2
	Earnings in quarter just prior to initial unemployment benefits claim	value≥0	EARN_1
	Earnings in quarter of initial unemployment benefits claim	value≥0	EARN0
	Earnings in 1st quarter after initial unemployment benefits claim	value≥0	EARN1
	Earnings 2 quarters after initial unemployment benefits claim	value≥0	EARN2
	Earnings 3 quarters after initial unemployment benefits claim	value≥0	EARN3
	Earnings 4 quarters after initial unemployment benefits claim	value≥0	EARN4

	Variable description	Value definition	Variable name
	Earnings 5 quarters after initial unemployment benefits claim	value≥0	EARN5
	Earnings 6 quarters after initial unemployment benefits claim	value≥0	EARN6
	Earnings 7 quarters after initial unemployment benefits claim	value≥0	EARN7
	Earnings 8 quarters after initial unemployment benefits claim	value≥0	EARN8
	Earnings 9 quarters after initial unemployment benefits claim	value≥0	EARN9
	Earnings 10 quarters after initial unemployment benefits claim	value≥0	EARN10
	Earnings 11 quarters after initial unemployment benefits claim	value≥0	EARN11
	Earnings 12 quarters after initial unemployment benefits claim	value≥0	EARN12
	Earnings 13 quarters after initial unemployment benefits claim	value≥0	EARN13
	Earnings 14 quarters after initial unemployment benefits claim	value≥0	EARN14
	Earnings 15 quarters after initial unemployment benefits claim	value≥0	EARN15
	Earnings 16 quarters after initial unemployment benefits claim	value≥0	EARN16
	Earnings 17 quarters after initial unemployment benefits claim	value≥0	EAR N17
	Earnings 18 quarters after initial unemployment benefits claim	value≥0	EARN18
	Earnings 19 quarters after initial unemployment benefits claim	value≥0	EARN19
	Earnings 20 quarters after initial unemployment benefits claim	value≥0	EARN20
	Earnings 21 quarters after initial unemployment benefits claim	value≥0	EARN21
	Earnings 22 quarters after initial unemployment benefits claim	value≥0	EARN22
	Earnings 23 quarters after initial unemployment benefits claim	value≥0	EARN23
	Earnings 24 quarters after initial unemployment benefits claim	value≥0	EARN24
	Earnings 25 quarters after initial unemployment benefits claim	value≥0	EARN25
	Earnings 26 quarters after initial unemployment benefits claim	value≥0	EARN26
	Earnings 27 quarters after initial unemployment benefits claim	value≥0	EARN27
	Earnings 28 quarters after initial unemployment benefits claim	value≥0	EARN28
	Earnings 29 quarters after initial unemployment benefits claim	value≥0	EARN29
17	Work transition in quarters preceding	1, 2, 3, 4	
	and after training, based on wage record.	1 = remained employed	
		2 = unemployed to employed	
		3 = employed to unemployed	
		4 = remained unemployed	
	Work transition status in quarter 8 quarters prior to unemployment benefits claim		WORK_8
	Work transition status in quarter 7 quarters prior to unemployment benefits claim		WORK_7

	Variable description	Value definition	Variable name
	Work transition status in quarter 6 quarters prior to unemployment benefits claim		WORK_6
	Work transition status in quarter 5 quarters prior to unemployment benefits claim		WORK_5
	Work transition status in quarter 4 quarters prior to unemployment benefits claim		WORK_4
	Work transition status in quarter 3 quarters prior to unemployment benefits claim		WORK_3
	Work transition status in quarter 2 quarters prior to unemployment benefits claim		WORK_2
	Work transition status in quarter prior to initial unemployment benefits claim		WORK_1
	Work transition status in quarter of initial unemployment benefits claim		WORK0
	Work transition status in quarter after initial unemployment benefits claim		WORK1
	Work transition status 2 quarters after initial unemployment benefits claim		WORK2
	Work transition status 3 quarters after initial unemployment benefits claim		WORK3
	Work transition status4 quarters after initial unemployment benefits claim		WORK4
	Work transition status 5 quarters after initial unemployment benefits claim		WORK5
	Work transition status 6 quarters after initial unemployment benefits claim		WORK6
	Work transition status 7 quarters after initial unemployment benefits claim		WORK7
	Work transition status 8 quarters after initial unemployment benefits claim		WORK8
	Work transition status 9 quarters after initial unemployment benefits claim		WORK9
	Work transition status 10 quarters after initial unemployment benefits claim		WORK10
	Work transition status 11 quarters after initial unemployment benefits claim		WORK11
	Work transition status 12 quarters after initial unemployment benefits claim		WORK12
	Work transition status 13 quarters after initial unemployment benefits claim		WORK13
	Work transition status 14 quarters after initial unemployment benefits claim		WORK14
	Work transition status 15 quarters after initial unemployment benefits claim		WORK15
	Work transition status 16 quarters after initial unemployment benefits claim		WORK16
	Work transition status 17 quarters after initial unemployment benefits claim		WORK17
	Work transition status 18 quarters after initial unemployment benefits claim		WORK18
	Work transition status 19 quarters after initial unemployment benefits claim		WORK19
	Work transition status 20 quarters after initial unemployment benefits claim		WORK20
	Work transition status 21 quarters after initial unemployment benefits claim		WORK21
	Work transition status 22 quarters after initial unemployment benefits claim		WORK22
	Work transition status 23 quarters after initial unemployment benefits claim		WORK23

	Variable description	Value definition	Variable name
	Work transition status 24 quarters after initial unemployment benefits claim		WORK24
	Work transition status 25 quarters after initial unemployment benefits claim		WORK25
	Work transition status 26 quarters after initial unemployment benefits claim		WORK26
	Work transition status 27 quarters after initial unemployment benefits claim		WORK27
	Work transition status 28 quarters after initial unemployment benefits claim		WORK28
	Work transition status 29 quarters after initial unemployment benefits claim		WORK29
18	Unemployment benefits transition before EDC	1,2,3,4	
		1 = stayed on UI	
		2 = employed to UI	
		3 = off of UI	
		4 = stayed off UI	
	Unemployment benefits transition status in quarter of initial unemployment benefits claim		UI_0
	Unemployment benefits transition status in quarter 8 quarters prior to initial unemployment benefits claim		UI_1
	Unemployment benefits transition status in quarter 7 quarters prior to initial unemployment benefits claim		UI_2
	Unemployment benefits transition status in quarter 6 quarters prior to initial unemployment benefits claim		UI_3
	Unemployment benefits transition status in quarter 5 quarters prior to initial unemployment benefits claim		UI_4
	Unemployment benefits transition status in quarter 4 quarters prior to initial unemployment benefits claim		UI_5
	Unemployment benefits transition status in quarter 3 quarters prior to initial unemployment benefits claim		UI_6
	Unemployment benefits transition status in quarter 2 quarters prior to initial unemployment benefits claim		UI_7
	Unemployment benefits transition status in quarter prior to initial unemployment benefits claim		UI_8
19	Union membership	Yes = 1; No = 0	Union
20	Potential labor market experience		
	If no formal education or less than high school degree	= age - 5 - 10	Mincer
	If high school diploma	= age - 5 - 12	Mincer
	If some post secondary education/no degree	= age - 5 - 14	Mincer
	If associates degree	= age - 5 - 14	Mincer
	If bachelor's degree	= age - 5 - 16	Mincer
	If master's degree	= age - 5 - 18	Mincer
21	Employer Account Number (EAN) of highest recorded hours in a quarter	8-digit number	
	EAN of employer 8 quarters prior to initial claim		EMP_8
	EAN of employer 7 quarters prior to initial claim		EMP_7
	EAN of employer 6 quarters prior to initial claim		EMP_6
	EAN of employer 5 quarters prior to initial claim		EMP_5
	EAN of employer 4 quarters prior to initial claim		EMP_4
	EAN of employer 3 quarters prior to initial claim		EMP_3
	EAN of employer 2 quarters prior to initial claim		EMP_2
	EAN of employer 1 quarter prior to initial claim		EMP_1

	Variable description	Value definition	Variable name
	EAN of employer 1 quarter after initial claim		EMP1
	EAN of employer 2 quarters after initial claim		EMP2
	EAN of employer 3 quarters after initial claim		EMP3
	EAN of employer 4 quarters after initial claim		EMP4
	EAN of employer 5 quarters after initial claim		EMP5
	EAN of employer 6 quarters after initial claim		EMP6
	EAN of employer 7 quarters after initial claim		EMP7
	EAN of employer 8 quarters after initial claim		EMP8
	EAN of employer 9 quarters after initial claim		EMP9
	EAN of employer 10 quarters after initial claim		EMP10
	EAN of employer 11 quarters after initial claim		EMP11
	EAN of employer 12 quarters after initial claim		EMP12
	EAN of employer 13 quarters after initial claim		EMP13
	EAN of employer 14 quarters after initial claim		EMP14
	EAN of employer 15 quarters after initial claim		EMP15
	EAN of employer 16 quarters after initial claim		EMP16
	EAN of employer 17 quarters after initial claim		EMP17
	EAN of employer 18 quarters after initial claim		EMP18
	EAN of employer 19 quarters after initial claim		EMP19
	EAN of employer 20 quarters after initial claim		EMP20
	EAN of employer 21 quarters after initial claim		EMP21
	EAN of employer 22 quarters after initial claim		EMP22
	EAN of employer 23 quarters after initial claim		EMP23
	EAN of employer 24 quarters after initial claim		EMP24
	EAN of employer 25 quarters after initial claim		EMP25
	EAN of employer 26 quarters after initial claim		EMP26
	EAN of employer 27 quarters after initial claim		EMP27
	EAN of Employer 28 quarters after initial claim		EMP28
22	North American Industry Classification System (NAICS) of employer of highest recorded hours in each quarter	6-digit Number	
	NAICS of employer 8 quarters prior to initial claim		IND_8
	NAICS of employer 7 quarters prior to initial claim		IND_7
	NAICS of employer 6 quarters prior to initial claim		IND_6
	NAICS of employer 5 quarters prior to initial claim		IND_5
	NAICS of employer 4 quarters prior to initial claim		IND_4
	NAICS of employer 3 quarters prior to initial claim		IND_3
	NAICS of employer 2 quarters prior to initial claim		IND_2
	NAICS of employer 1 quarter prior to initial claim		IND_1
	NAICS of employer 1 quarter after initial claim		IND1
	NAICS of employer 2 quarters after initial claim		IND2
	NAICS of employer 3 quarters after initial claim		IND3
	NAICS of employer 4 quarters after initial claim		IND4
	NAICS of employer 5 quarters after initial claim		IND5
	NAICS of employer 6 quarters after initial claim		IND6

	Variable description	Value definition	Variable name
	NAICS of employer 7 quarters after initial claim		IND7
	NAICS of employer 8 quarters after initial claim		IND8
	NAICS of employer 9 quarters after initial claim		IND9
	NAICS of employer 10 quarters after initial claim		IND10
	NAICS of employer 11 quarters after initial claim		IND11
	NAICS of employer 12 quarters after initial claim		IND12
	NAICS of employer 13 quarters after initial claim		IND13
	NAICS of employer 14 quarters after initial claim		IND14
	NAICS of employer 15 quarters after initial claim		IND15
	NAICS of employer 16 quarters after initial claim		IND16
	NAICS of employer 17 quarters after initial claim		IND17
	NAICS of employer 18 quarters after initial claim		IND18
	NAICS of employer 19 quarters after initial claim		IND19
	NAICS of employer 20 quarters after initial claim		IND20
	NAICS of employer 21 quarters after initial claim		IND21
	NAICS of employer 22 quarters after initial claim		IND22
	NAICS of employer 23 quarters after initial claim		IND23
	NAICS of employer 24 quarters after initial claim		IND24
	NAICS of employer 25 quarters after initial claim		IND25
	NAICS of employer 26 quarters after initial claim		IND26
	NAICS of employer 27 quarters after initial claim		IND27
	NAICS of employer 28 quarters after initial claim		IND28
23	Propensity score matching identifier with	Number	curctrl
	Sequential numbers for each matched pair		
24	Propensity score	Number	IP_1
25	Post-treatment firm of re-employment – the employer of record[1]		
	Never re-employed by employer of record in any follow-up year	Yes = 1; No = 0	NR
	Re-employed by employer of record, first job after treatment in first follow-up year	Yes = 1; No = 0	FR
	Re-employed by employer of record, first job after treatment in any follow-up year	Yes = 1; No = 0	ER
	Ever re-employed by employer of record, except for first job either in first year of follow up or first job in any follow-up year	Yes = 1; No = 0	AR

[1] The "employer of record" is the firm from which the participant was laid off immediately prior to time that the participant established eligibility for the Training Benefits Program.

Appendix 3. Method of propensity score matching

Introduction

This analysis proceeds on the basis of nonexperimental methods pioneered by Manski (1983), Heckman (1979) and Rosenbaum (1983), among others. This work is, in turn, based on earlier work by Fisher (1932), Neyman (1923) and Rubin (1974) on determining causality in a counterfactual framework. Our main source for the discussion that follows is the two papers by Heckman, Ichimura and Todd (1997 and 1998).

Because government-funded assistance is not easily subjected to randomized treatment in a controlled experiment, the non experimental methods developed by the authors noted above emphasize the use of nonexperimental studies using administrative data to measure the program outcome variable(s) of participants and nonparticipants. These methods rely on a set of assumptions which, when true, provide a conceptual foundation for explaining the net effect(s) of any ongoing social or economic program. This condition is most succinctly given by the Neyman-Rubin criterion,:

$$Y_i = D_i Y_{i1} + (1 - D_i) Y_{i0}$$

Where Y_i is the outcome variable. D_i is the dichotomous selection state, where $D = 1$ for treated and $D = 0$ for untreated. Y_0 is the outcome of nontreatment and Y_1 is the outcome of treatment.

The first assumption is that there are only two states possible within the program population: Treatment or nontreatment. This assumption is referred to as the "stable unit treatment assumption."

The second assumption is that the selection criteria for program treatment receipt must be based on observable variables *other than* those variables that identify actual assignment to the program, such as being a worker in a declining occupation or industry – a requirement for Training Benefits Program eligibility. This assumption is variously called exogeneity, ignorable treatment assignment and unconfoundedness.

$$Y_1 Y_0 \perp D \mid \mathrm{X}$$

Here, X is the vector of variables used as the selection criterion and the symbol $\perp$ is read as "…is independent of…" The statement says that the outcomes for both the treatment and comparison group are independent of assignment to the treatment or comparison group, given the variables used for the selection criteria.

In two papers by Heckman, Ichimura and Todd (H-I-T) (*Review of Economic Studies*, 1997 and 1998) this method is used to determine the effect of treatment on the treated as:

$$E(Y_1 - Y_0 \mid D = 1, \mathrm{X})$$ [41]

Rather than the average treatment effect:

$$E(Y_1 \mid D = 1) - E(Y_0 \mid D = 0)$$

[41] Read this equation as: "The expected difference in outcomes between the treated and untreated, given they were treated and that there are observable reasons for them receiving treatment."

H-I-T (1997) then reject Rubin's "strong ignorability"[42] assumption. By assuming that the function of nonassignment is the same whether someone gets the treatment or not, one can use a "weak ignorability" of nonassignment assumption, as follows:

$$Y_0 \perp D \mid X$$

This statement says that we don't have to know what unobservable variables (U_o) determine the net program outcome for the comparison group Y_0 since:

$$U_0 \perp D \mid X$$

For these unobservable variables U, it is necessary that:

$$E(U_1 \mid X) = 0 \text{ or } E(U_0 \mid X) = 0$$

That is, the unobservable variables don't depend on the observable variables.

In addition to dividing the determinants into observable variables (X) and unobservable variables (U), the **covariates** can also be divided into those variables that determine outcomes (T) and those variables that determine program participation (Z).[43]

Normally we would define Y_0 and Y_1 populations based on matched Xs, but we run into the "curse of dimensionality" in which it becomes increasingly difficult to find matches as the number of matching variables increases and, therefore, the number of cells over which to maintain the match increases.[44] To get around this problem, we estimate a single propensity score as a function of factors affecting program selection and use this single-dimensional index to match program participants with similar nonparticipants. The difference-in-difference (DID) estimation model then becomes:

$$\begin{aligned} & E(U_{ot} - U_{ot'} \mid pr(W = 1 \mid Z), D = 1) \\ & = E(U_{ot} - U_{ot'} \mid pr(W = 1 \mid Z), D = 0) \\ & = 0 \end{aligned}$$

It is the conditional probability $pr(W=1 \mid Z) = P$ that constitutes the propensity score term of this method.

H-I-T allow that "Z and T may contain distinct variables, although they may share some variables in common." What is essential is that there is enough support or common propensity scores among both the treated and the comparison group to allow a meaningful match of treatment and comparison group individuals. The functional form of the distributions, then, becomes important. The overlap of the matched distributions is then

$$F(y_0 \mid X, D = 1) = F(y_0 \mid X, D = 0)$$

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[42] Rubin, Donald B., Matched Sampling for Causal Effects. Cambridge University Press. 2008. pp. 172.

[43] In the current literature these are called Heckman's separability and exclusion restrictions (Guo, 2010, pp 247) the separability depends on whether the distributions for:

$$\Pr(A \cup B) = \Pr(A) + \Pr(B)$$

[44] Consider a cross-classification of categorical variables for a sample based on 20 occupation categories and 18 industry categories. Such a figure has 360 cells over which the treatment and comparison group samples must be matched. If one's analysis sample is only a few hundred or a few thousand observations, one to one matching becomes difficult to achieve. Add gender to the mix and the figure expands to 720 cells. Then, add five more cells for education level. The practical difficulty is clear cut.

Where F defines the functional form of the distribution. If this distribution has a mean, then it implies that

$$E(Y_0 \mid X, D=1) = E(Y_0 \mid X, D=0) = E(Y_0 \mid X)$$

As a practical matter, the weak treatment assignment ignorability assumption means that the better the conditioning variables are at separating participants from nonparticipants, the larger the necessary sample size in order to have sufficient overlap of matched cases. Where this sufficiency in overlap is not possible, many researchers use the propensity score to weight the impact analysis covariates or else they apply various curve-smoothing algorithms using nonparametric methods or caliper-based matching. In the case of this study, the sample size and the functional form of selection are dictated by the Training Benefits Program legislation for selection criteria. We also obtain sufficient overlap if we sample the eligible nonparticipants with replacement.

Propensity score matching

The scientific rationale of matching, whether on propensity scores or covariates of the population, or both, as in our present study, is straightforward: Matching removes bias and makes the comparison more like a random experiment. The art of matching is less straightforward.

In cases where the treatment selection criteria are well defined on a finite subset of observables, which happens to be the case for the Training Benefits Program, the propensity scores can be built from observables not used for selection into the program. These scores are more likely to exhibit a random distribution in both the treatment and comparison groups. This common distribution is key because it allows the maximum number of matches to be obtained while reducing the number of observable criteria to be matched to a single vector. Much of the literature over the past 20 years has emphasized the need to understand the probability distributions of selection and nonselection in developing propensity scores. In cases where there is no clear overlap in the distribution of propensity scores, matching can actually lead to increased bias in the results [Heckman, Ichimura and Todd (1997 and 1998)].

Estimation of the propensity function for this net-impact analysis

For the Training Benefits Program, the immediate selection criteria are specified in the law, so that, for instance, the use of occupation and industry are immediately ruled out as variables to statistically identify the propensity function.

In addition, the treatment and comparison groups were exactly matched on gender, unemployment benefits eligibility and Training Benefits Program eligibility. These variables, it turns out, were strongly correlated with education level, which then ruled out education as a variable candidate. Finally, eligibility and actual participation were highly correlated with annual before-tax earnings, ruling out this variable, too. Earnings, instead, was used as an exact-matching variable, where before-tax earnings summed over eight pre-eligibility quarters was defined to the nearest $1,000.

Conditioned on the exact matching described above, after considerable experimentation, two variables were used to estimate the propensity function. Age and age squared (as one nonlinear variable) and workforce development area, comprising 14 regressors, were used to identify the propensity function.

Adding other available regressors resulted in two problems: Many fitted propensity score values equaled either one (1.0), perfect prediction to be in the treatment group, or zero (0.0), perfect prediction to be out of the treatment group. Significant numbers of individuals in either group indicate a mis-specified propensity function. Second, the distribution of fitted propensity scores

tended to be either skewed or U-shaped. Based on the specification using age and the single categorical variable, a 1:1 match was achieved with replacement to the potential matching sample. Education, industry attachment at point of program eligibility, age and age squared, ethnicity and a labor-force transition variable were used to statistically identify the program's net effect on annual before-tax earnings.

Additional aspects of the analysis design that help to reduce bias

Heckman, Ichimura and Todd (1997) note several additional factors that are crucial to reducing bias in the estimating of net effects in a nonexperimental study. These are:

1. Treatment and comparison groups should have the same distribution of observable attributes.
2. Treatment and comparison group individuals should come from the same local labor markets.
3. Variables used to measure economic behavior should be defined in exactly the same way for the treatment and the comparison groups.

Quantitatively, when these three conditions are not met, the bias in net-effect estimates may be greater than that contributed by the fact that the treatment and comparison groups do not have the same distributions of unobserved attributes. Our study samples do in fact come from the same labor markets. The variables used in this study are defined identically and come from the same sources for the treatment and comparison groups. The figures in *Appendix 8* show the distribution of observable attributes for the matched sample of treatment and comparison group individuals.

Finally, as mentioned above, we difference the before-tax earnings variable, the measure of program impact, which removes any time-invariant unmeasured and unmeasureable effects on earnings.

Fitted values of the propensity scores

Appendix 3 displays the histograms of the fitted propensity scores for men and women separately for the 2002 through 2008 cohorts. The data are shown for all participants and for the participants who didn't return to their former employers.

Weighting of first-differenced values due to resampling of comparison individuals for the matched propensity scores

This analysis is done separately for each cohort by gender beginning in the year in which Training Benefits Program eligibility is identified. This results in up to 14 separate panels and 14 separate regressions on first-differenced wages for each of the seven cohorts. The size of each panel has been restricted to a level where, despite not having sufficient support over the distributions of treated and comparison cases, eliminating any cases from the study would compromise the study results. This shortage of 1:1 matched cases leads to using a random sampling-with-replacement of comparison cases during the propensity score matching phase of the analysis. When this step is made, we no longer have standard errors that are representative of the underlying study population and we must adjust the regression analysis to account for the repeated sampling of comparison group cases.

The standard literature on sampling weights considers this a "design effect" in which the use of anything more complicated than a simple random sample needs to account for the separate variances that are created for each proportion (cluster, strata, or in this case the resampled propensity score group).

The traditional way of correcting for standard error bias introduced by using repeated samples that are not random is to apply weights which reflect the inverse of the probability for nonrandom

selection. But this is only useful if trying to produce accurate descriptive statistics. In this case, what's important is ensuring that the variance in the outcomes of the resampled cases is adjusted to reflect the variances (used in computing significance) that would have been achieved in a simple random sample of the underlying frame.

Computing the weights uses variance from three sources in the model. The first source is the variance that comes from multiple treated cases that use the same comparison case. Because unexplained variance has been interjected into the error term of the model, the impact regression is first run without weights in order to produce the vector of residuals. These residuals are then used as the variance:

$$V_1 = \frac{(Resid_{Treated\ Case} - Average\ Resid_{Set\ of\ all\ common\ pairs})^2}{Number\ of\ cases\ in\ the\ current\ set\ of\ matches - 1}$$

The second source of variance comes from the pool of comparison cases with the same propensity score that could have been selected. This variance is computed by averaging the residuals from all of the comparison observations that are in the pool of singly or multiply matched comparison observations with the same propensity score as $Average\ Resid_{Control\ Group}$. This variance is used in the same equation as V_1 as:

$$V_2 = \frac{(Resid_{treated\ Case} - Average\ Resid_{Control\ Group})^2}{Number\ in\ control\ group - 1}$$

And the third source of variance is the effect these two have on the mean square error (MSE) from the original regression as:

$$MSE = \frac{Sum\ of\ the\ Squared\ Errors}{\sum weights - Degrees\ of\ Freedom}$$

The variance attributable to this is computed by

$$V_3 = MSE - V_1 - V_2$$

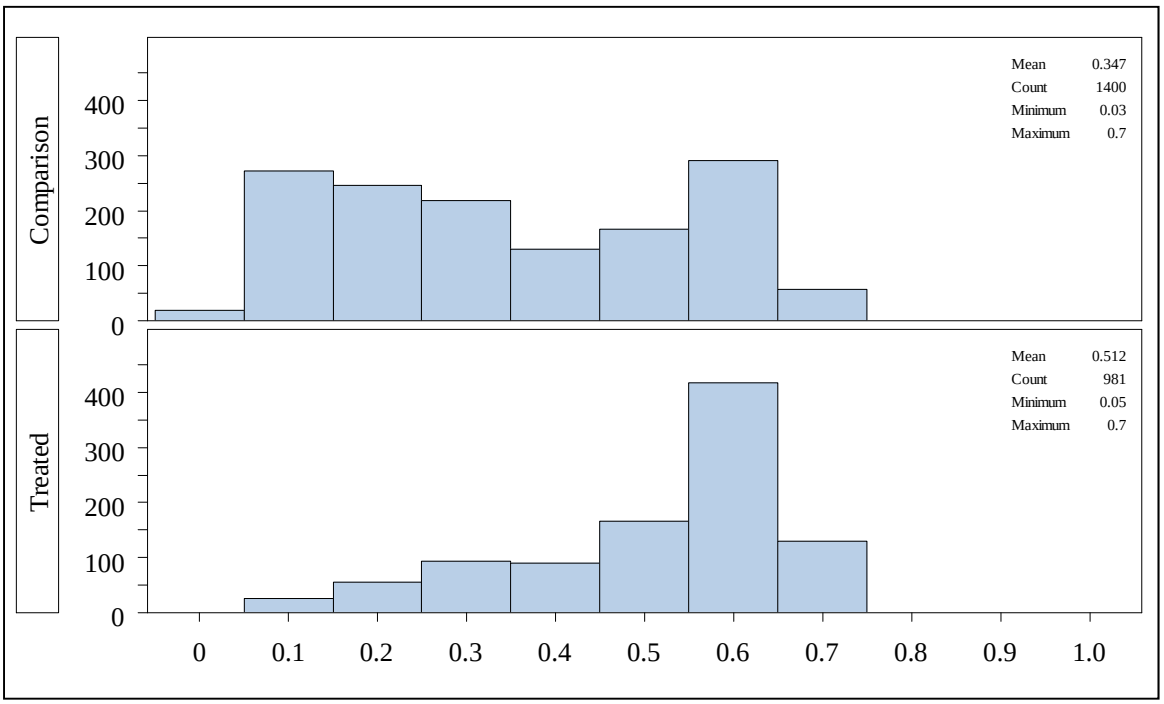
For each set of cases that are used N times, then, we compute weights

$$W_{(i)} = \frac{V_1 + V_2 + V_3}{V_1 + (N * V_2) + V_3}$$

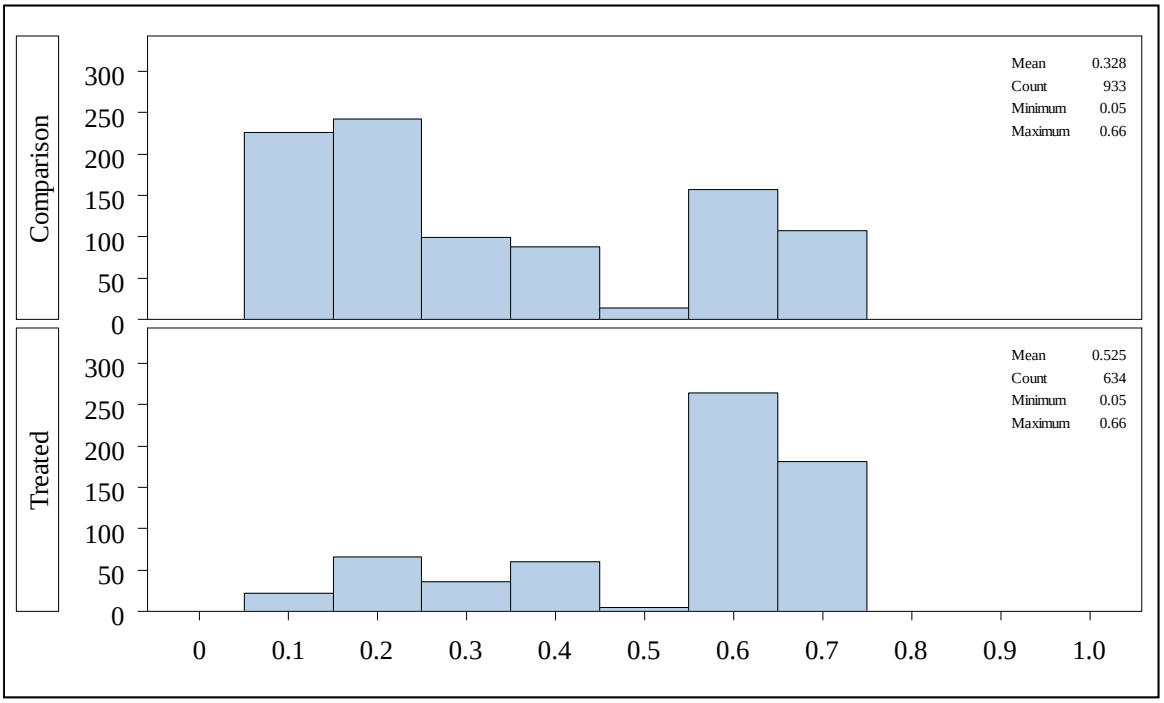
Once these weights are applied to the original regression, the tests of significance for each covariate of the model are adjusted to reflect the error introduced in the multiple matching of cases on propensity score.

Histograms of fitted propensity scores, all participants, by cohort and gender

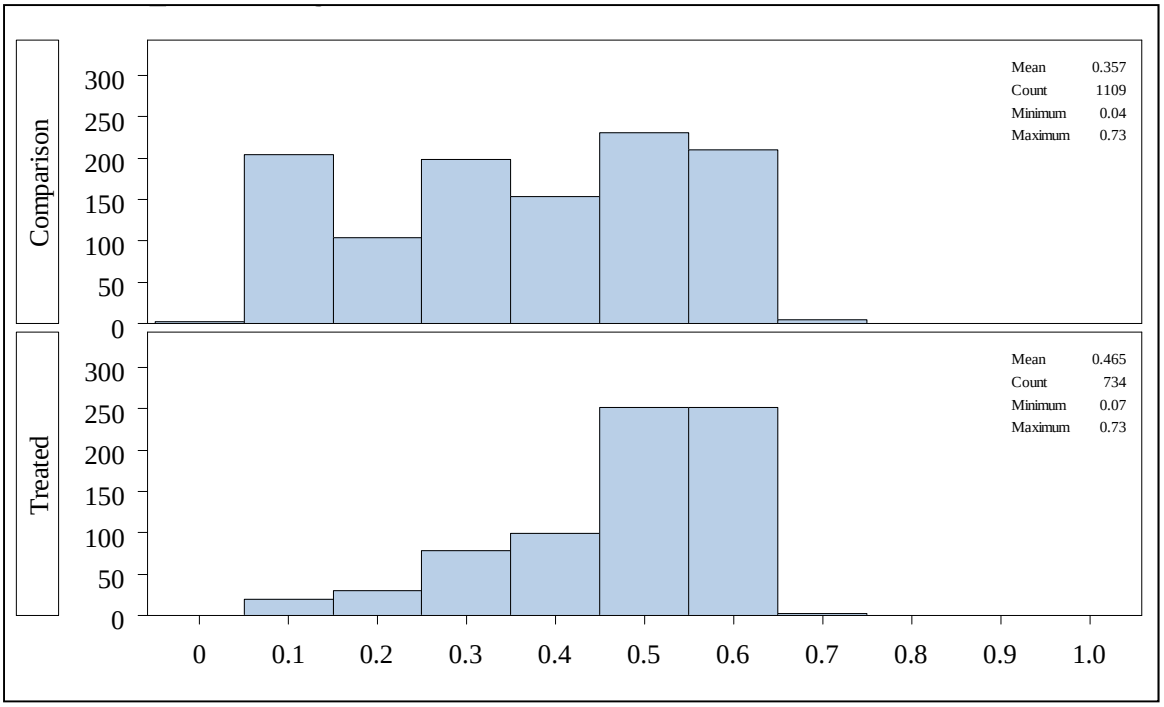
Propensity score, matched 2002 men



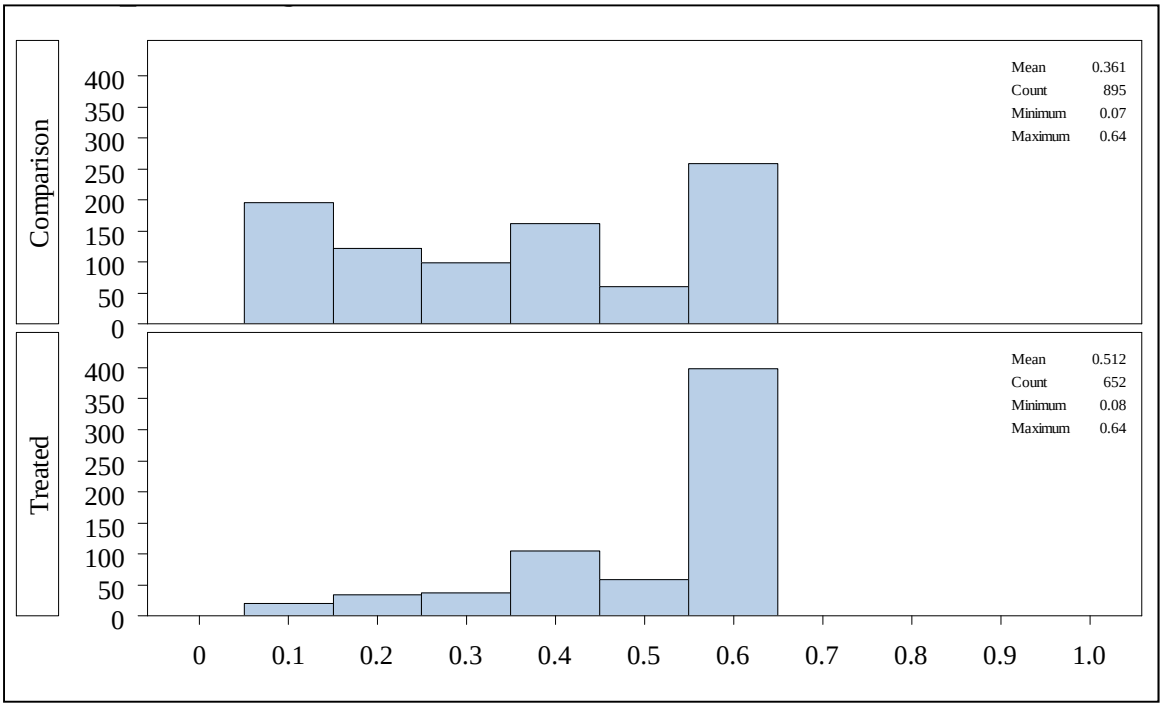
Propensity score, matched 2002 women



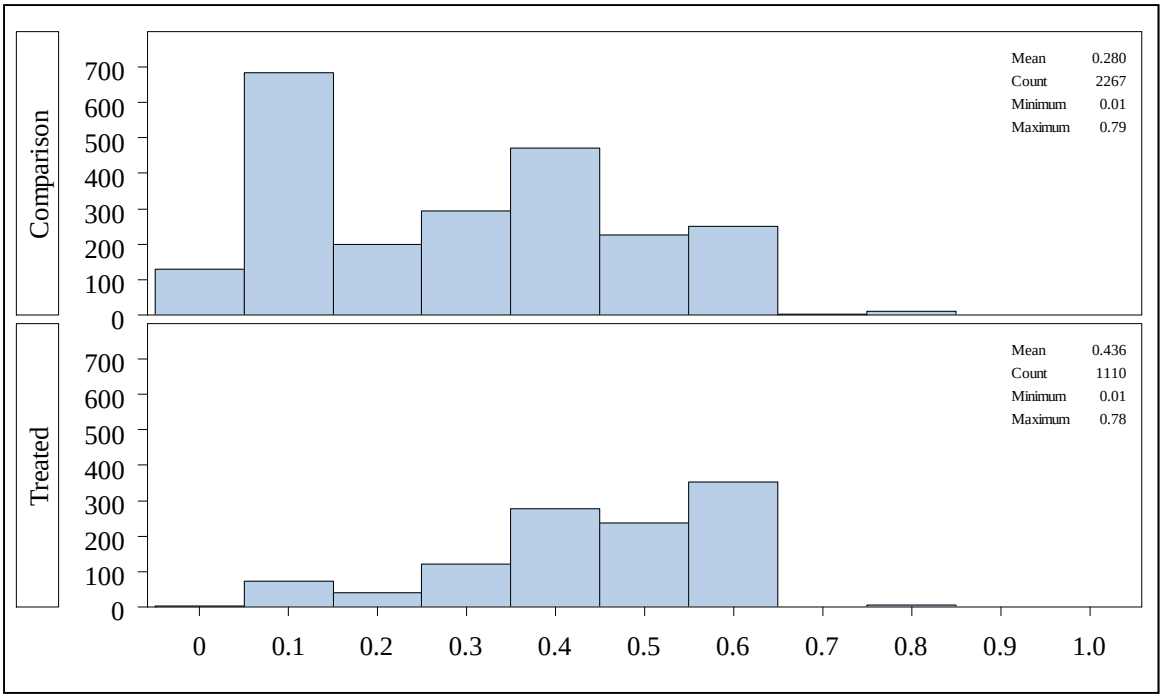
Propensity score, matched 2003 men



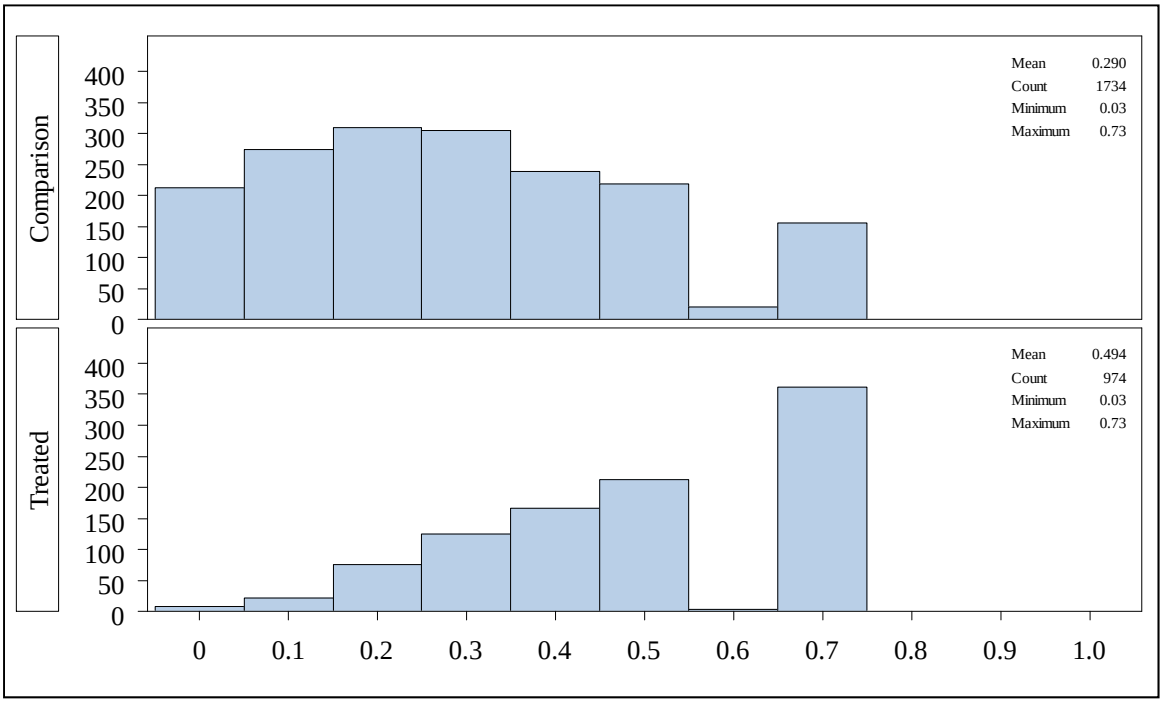
Propensity score, matched 2003 women



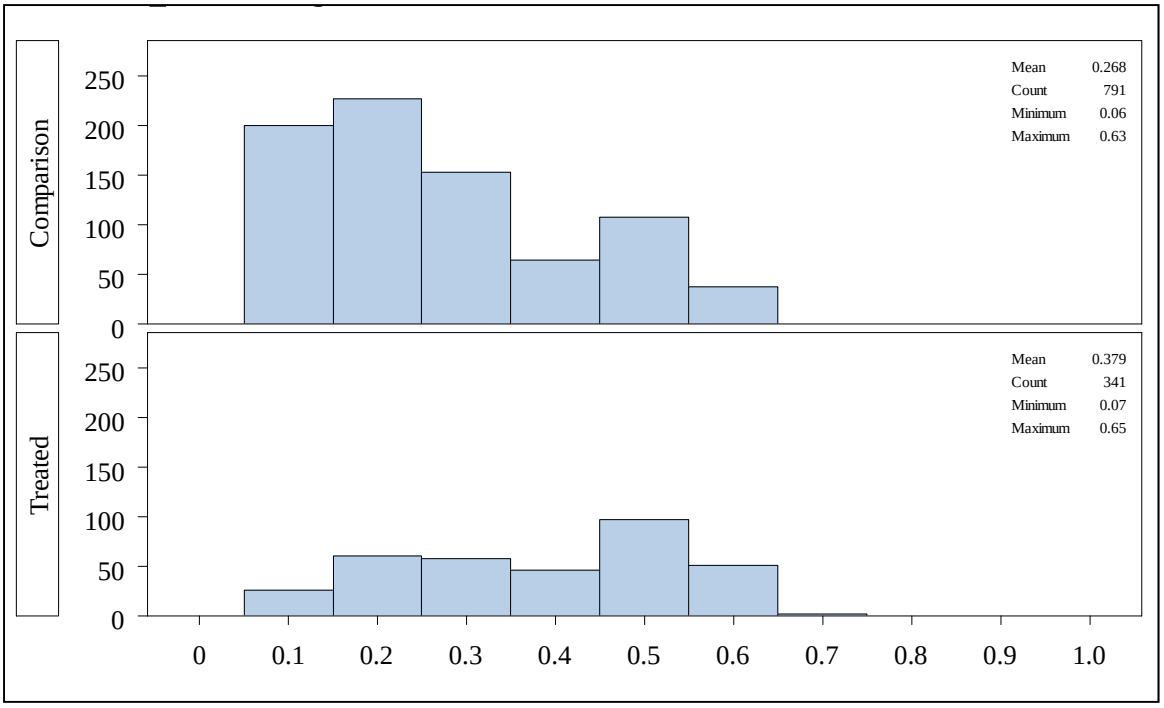
Propensity score, matched 2004 men



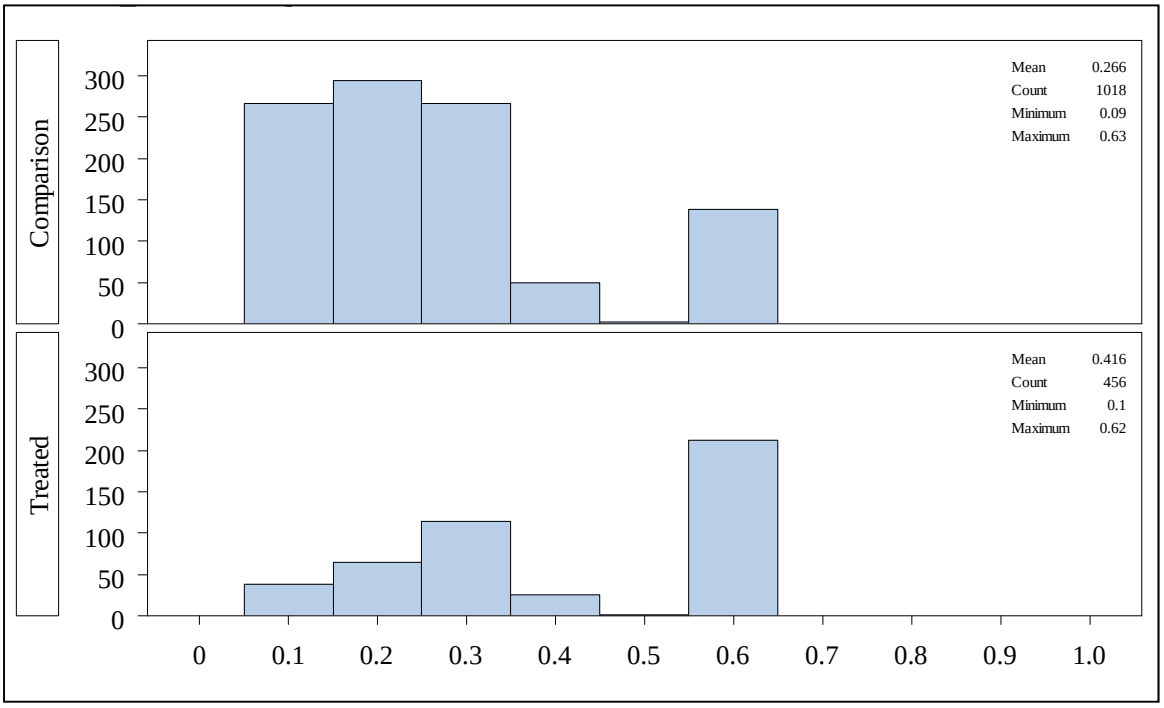
Propensity score, matched 2004 women



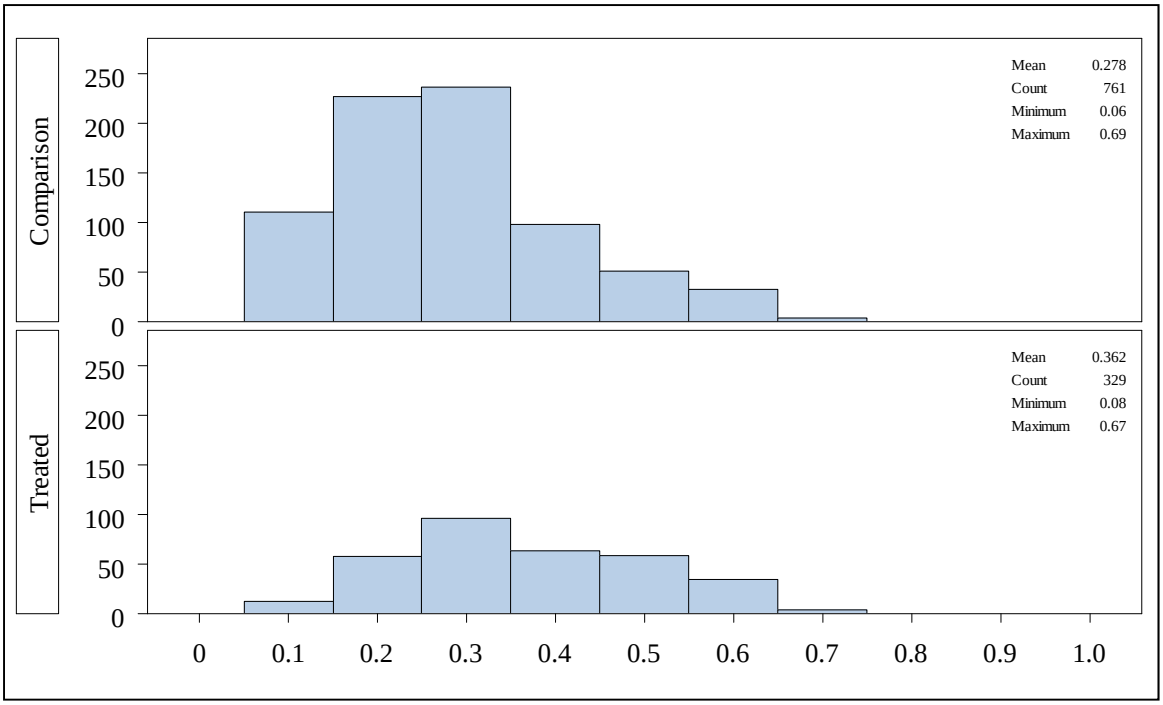
Propensity score, matched 2005 men



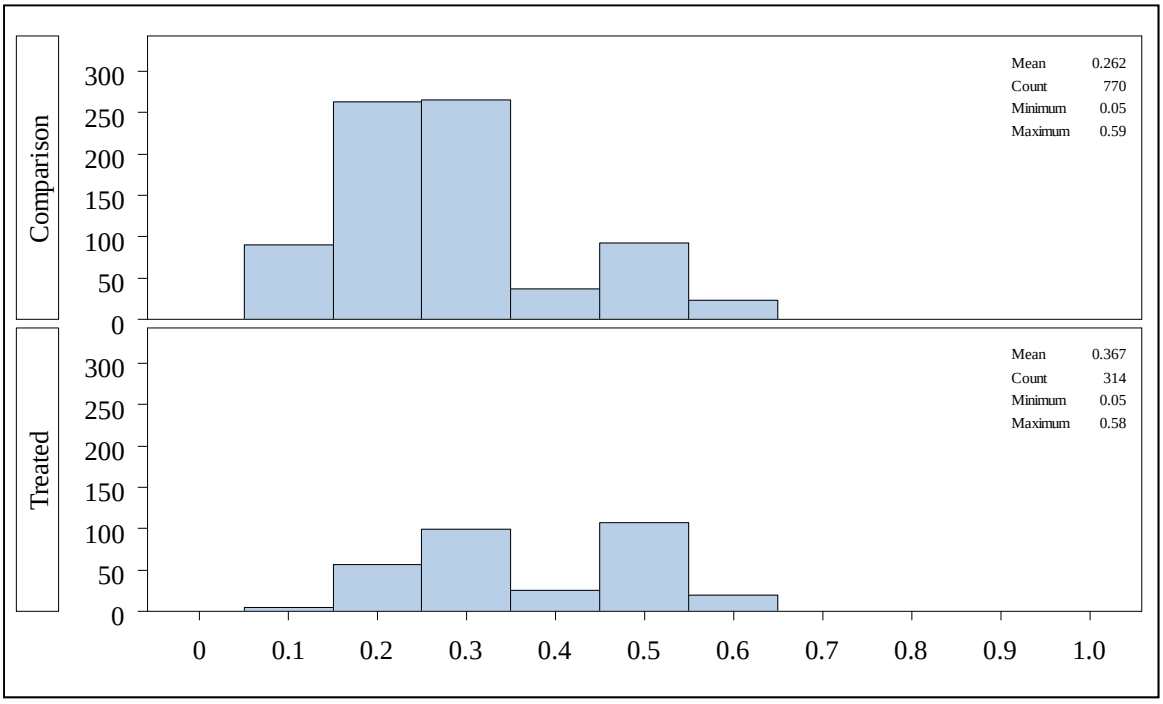
Propensity score, matched 2005 women



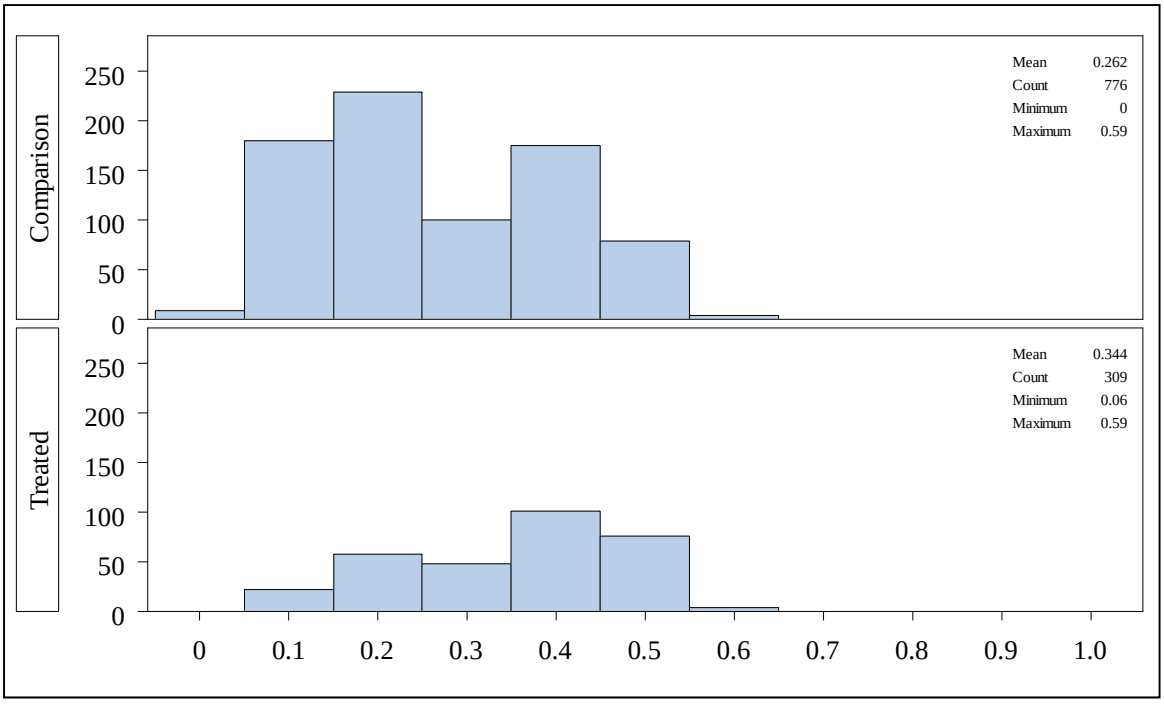
Propensity score, matched 2006 men



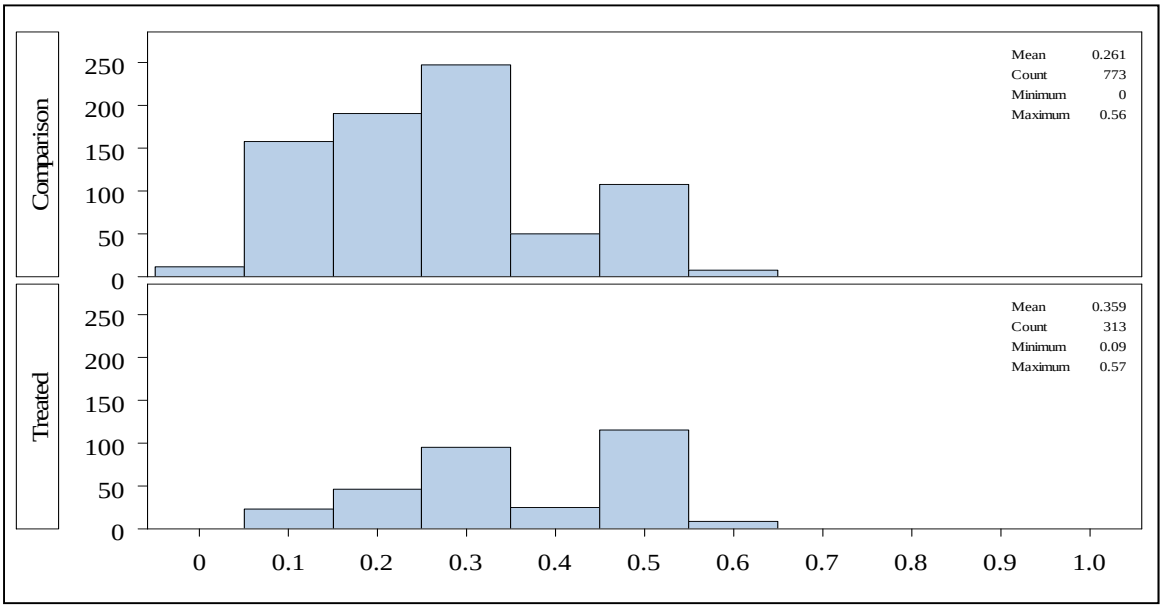
Propensity score, matched 2006 women



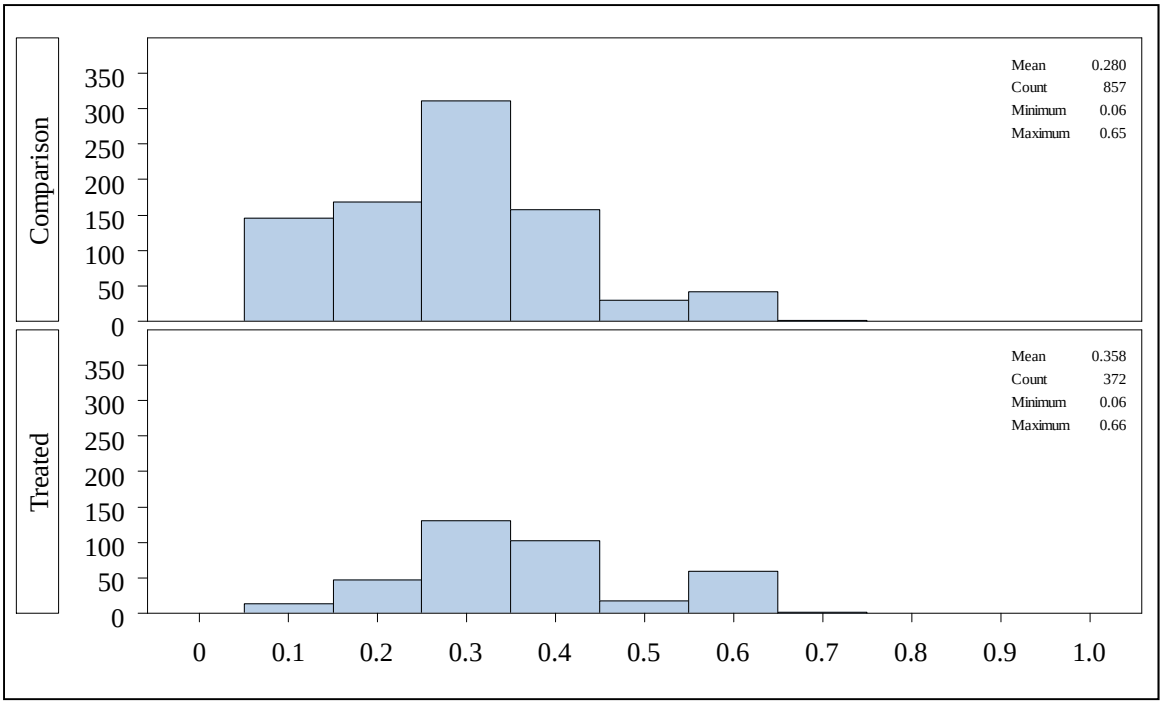
Propensity score, matched 2007 men



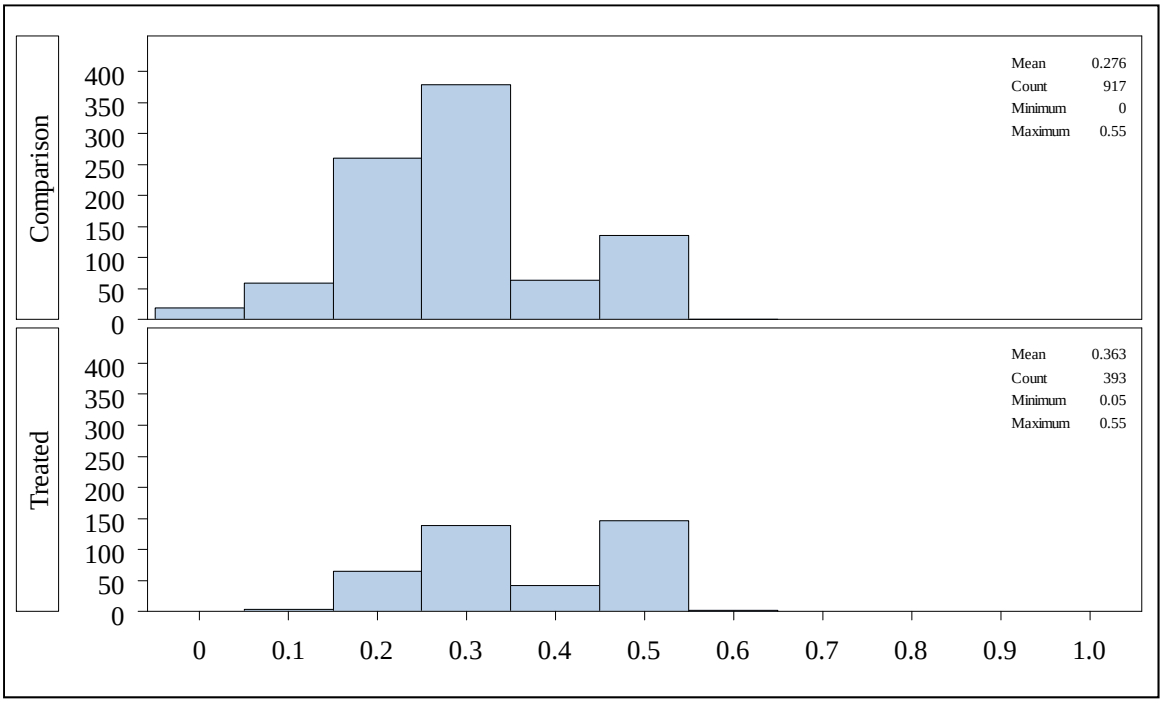
Propensity score, matched 2007 women



Propensity score, matched 2008 men

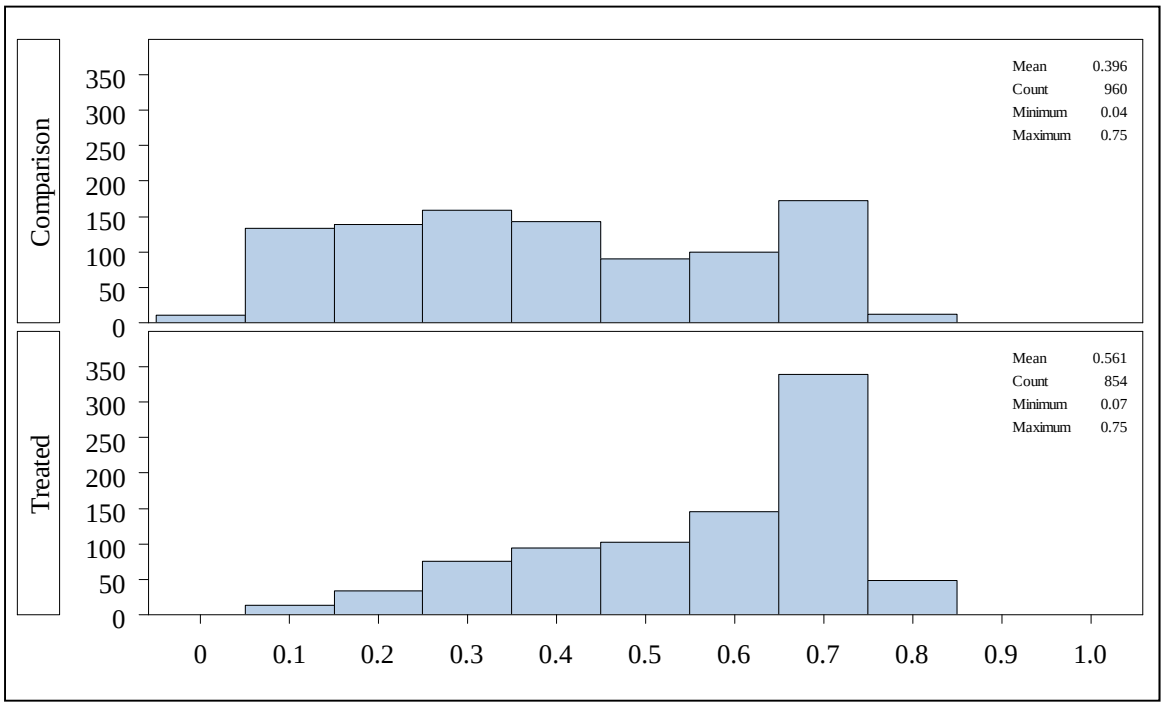


Propensity score, matched 2008 women

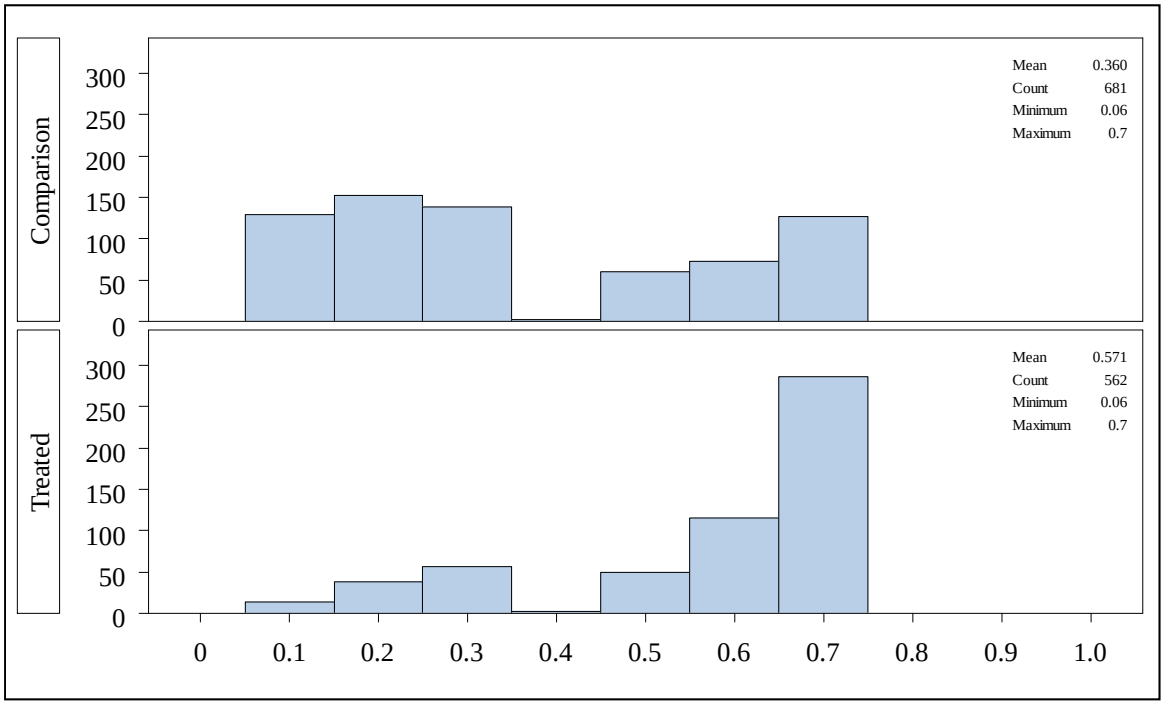


Histograms of fitted propensity scores, participants who didn't return to their former employers, by cohort and gender

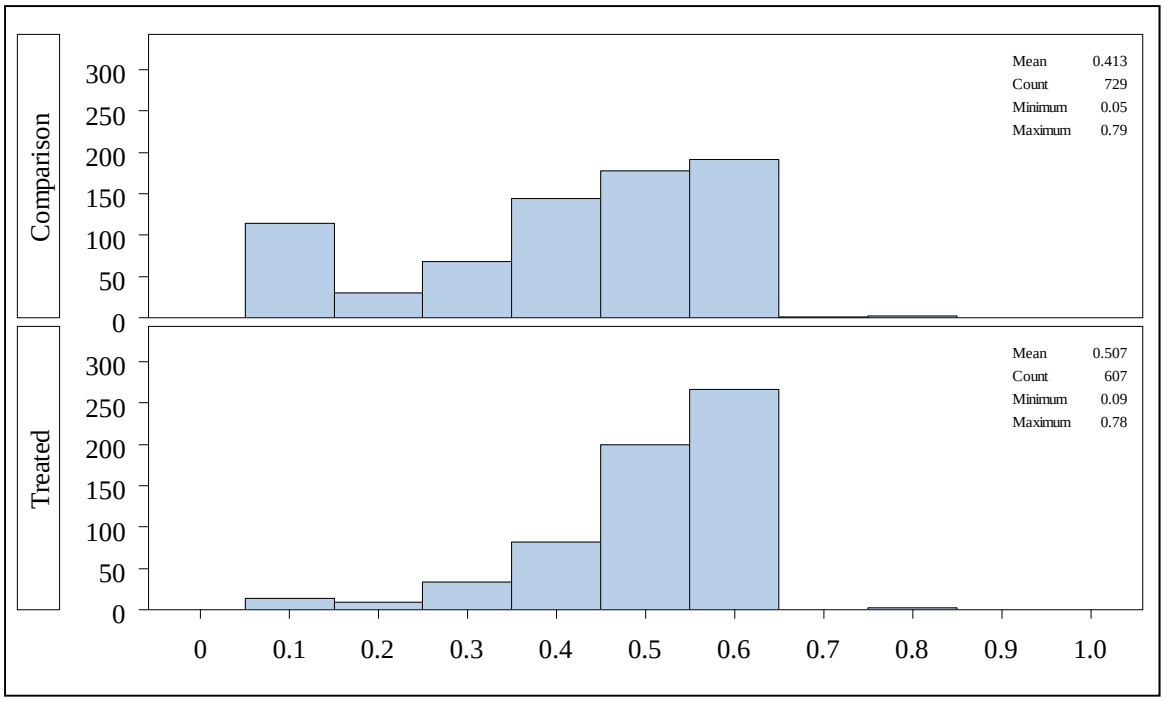
Propensity score, matched 2002 men



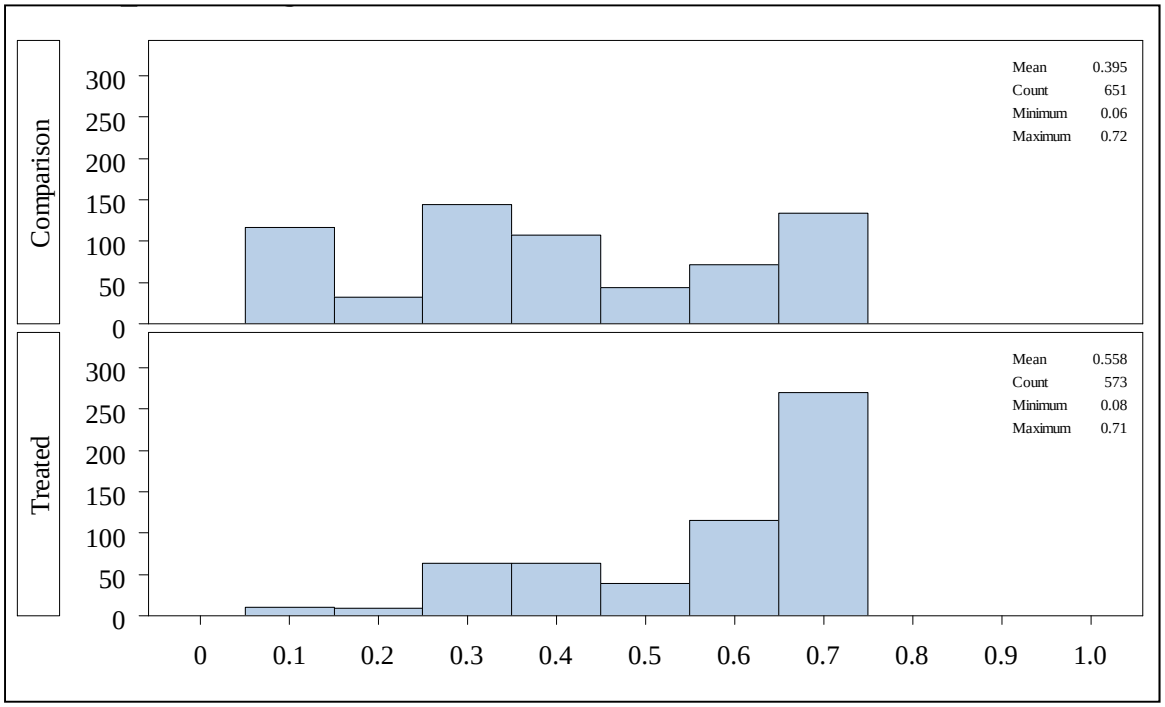
Propensity score, matched 2002 women



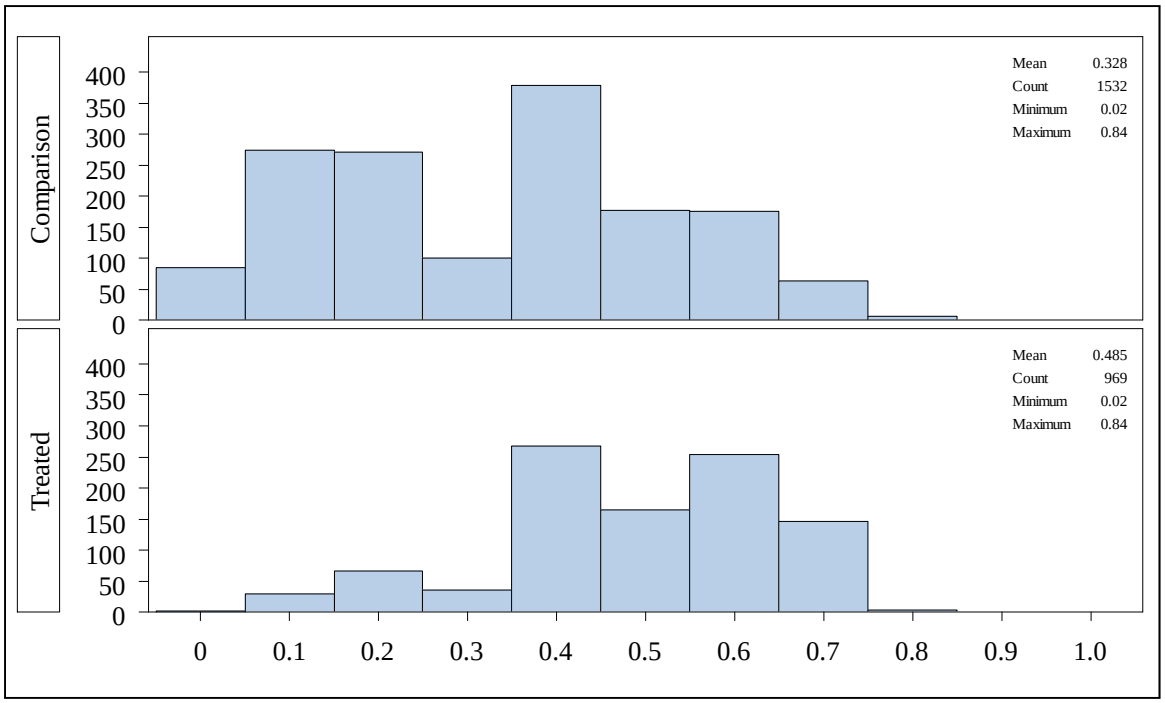
Propensity score, matched 2003 men



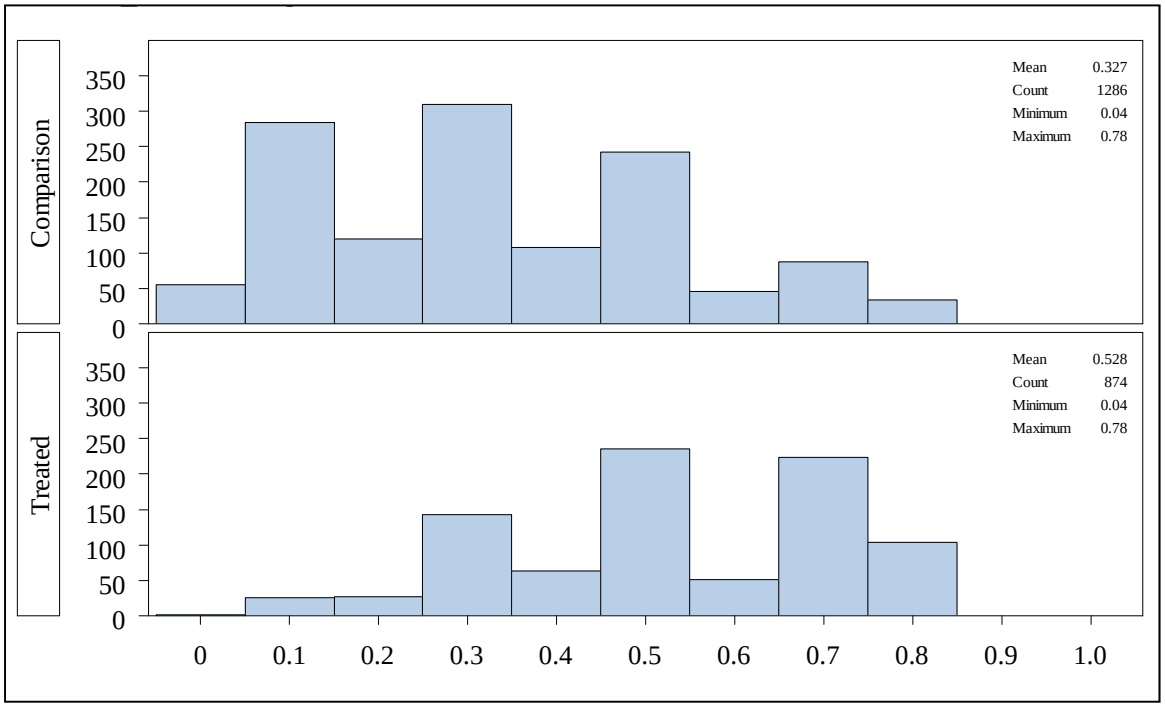
Propensity score, matched 2003 women



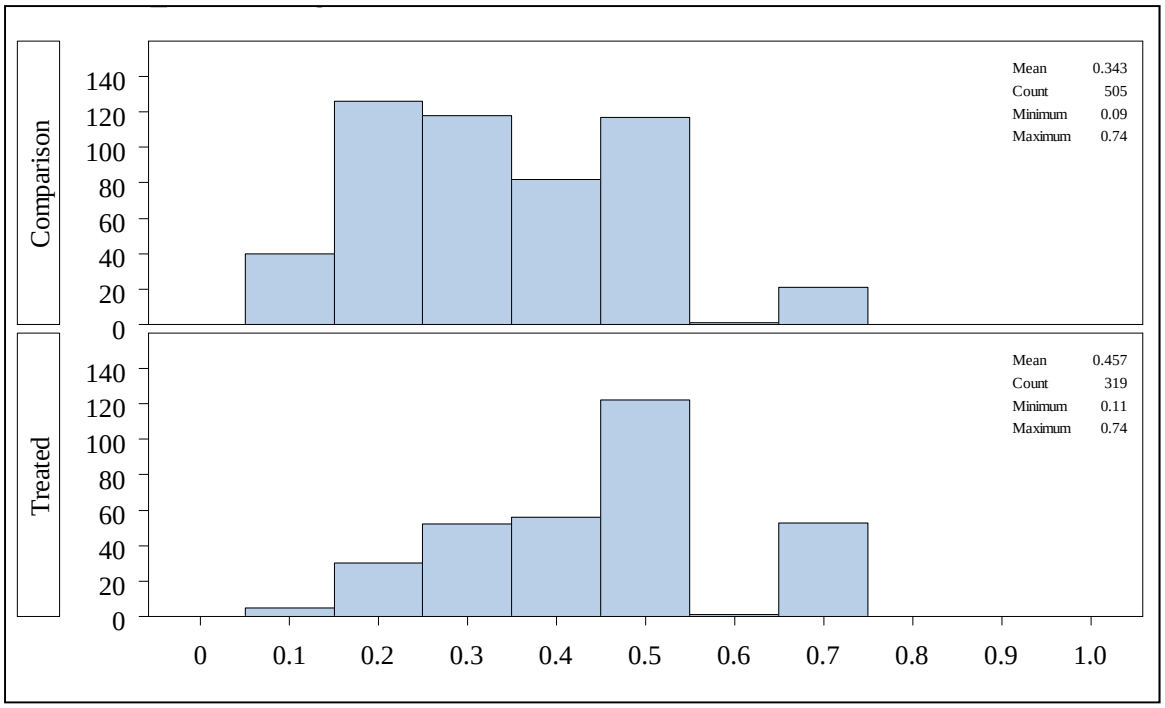
Propensity score, matched 2004 men



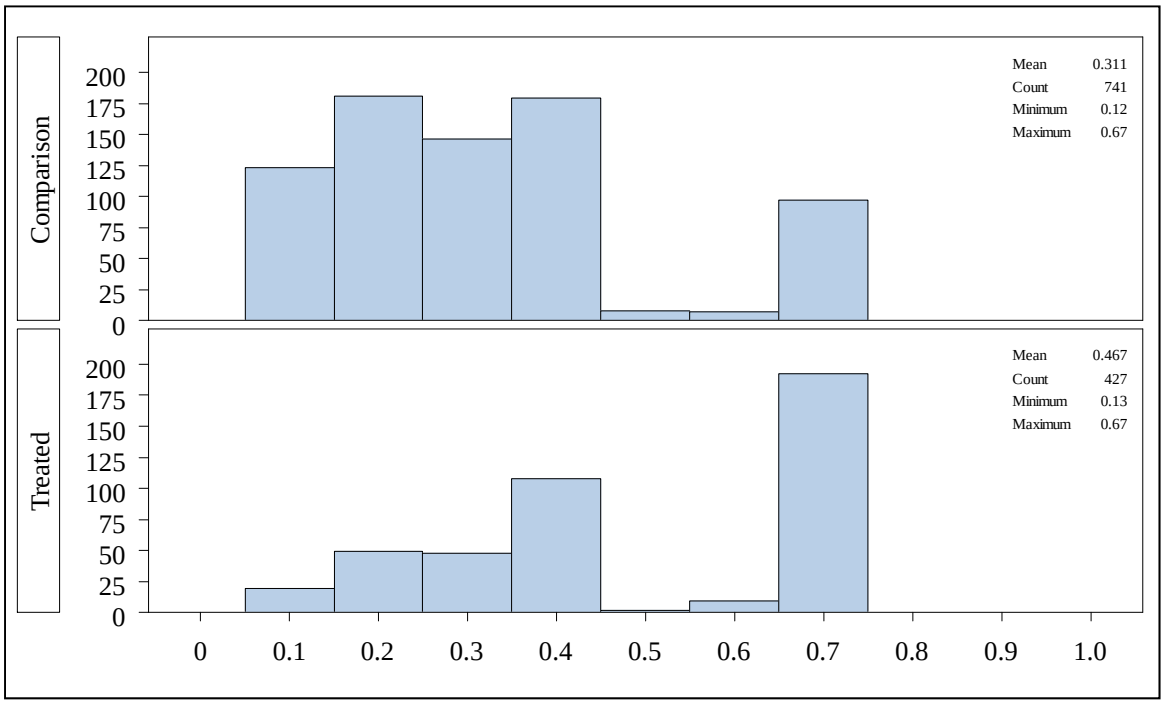
Propensity score, matched 2004 women



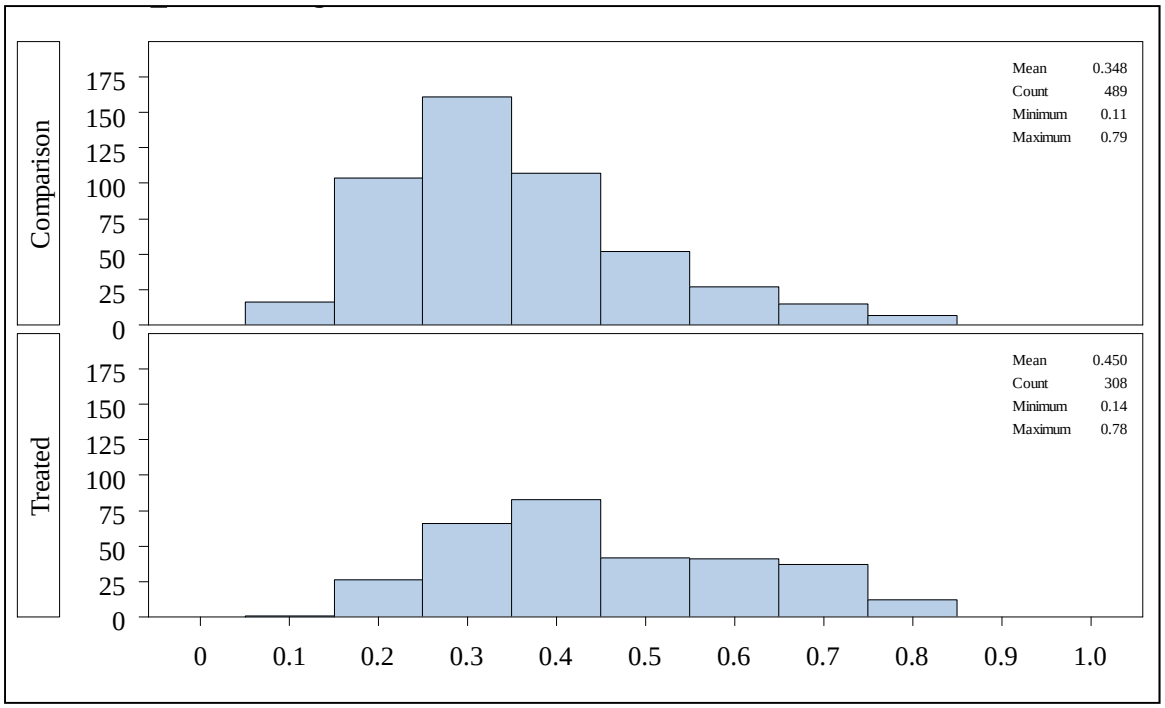
Propensity score, matched 2005 men



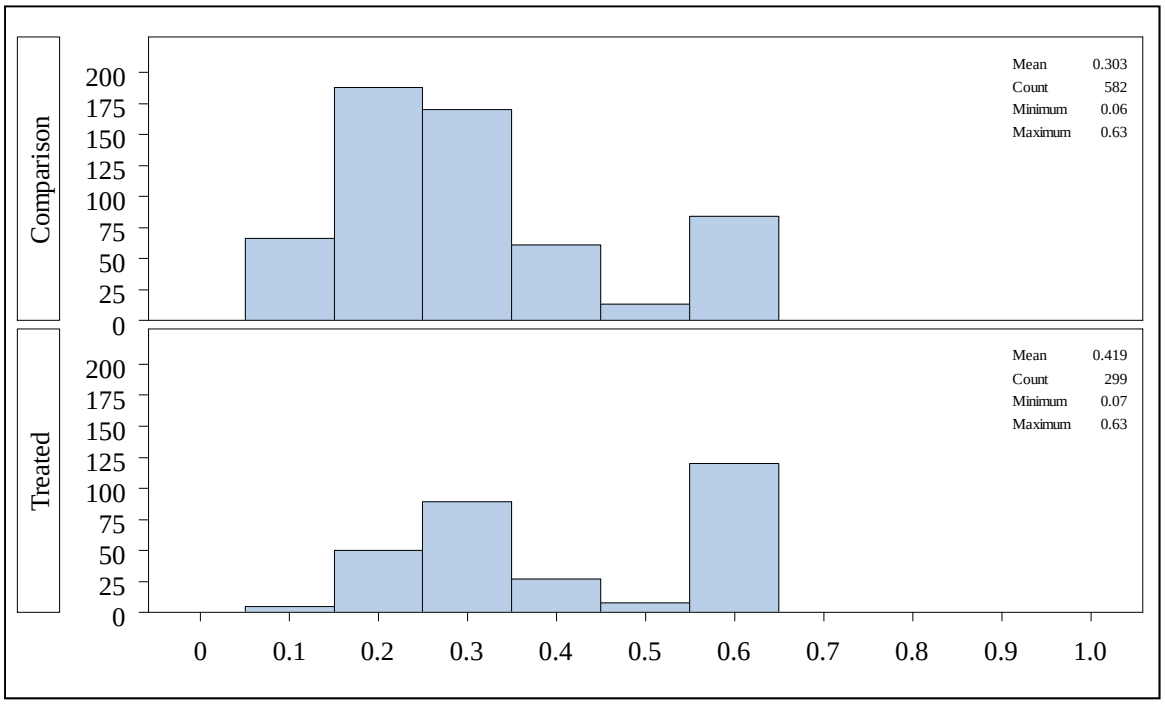
Propensity score, matched 2005 women



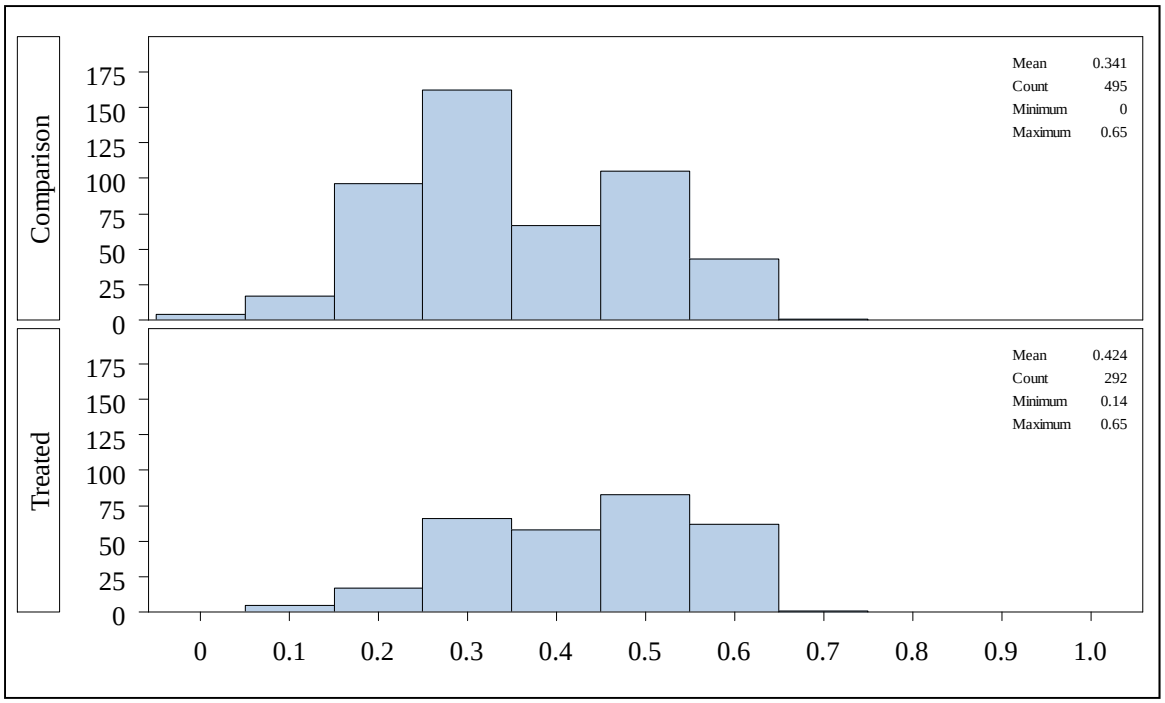
Propensity score, matched 2006 men



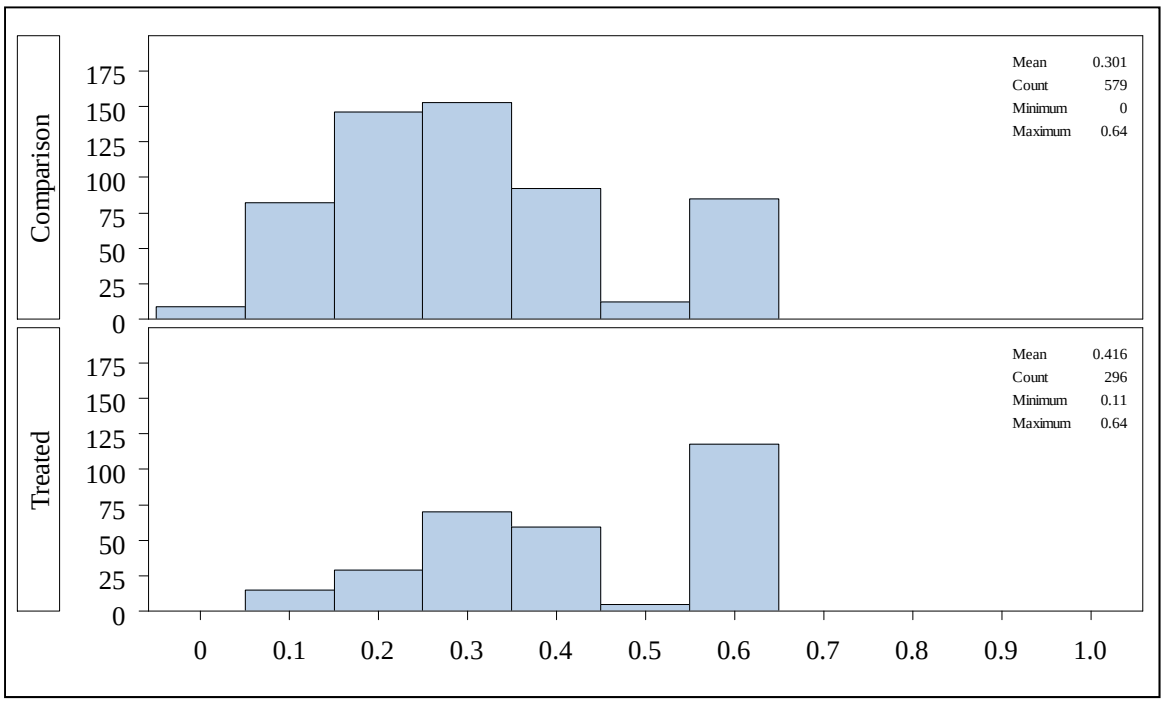
Propensity score, matched 2006 women



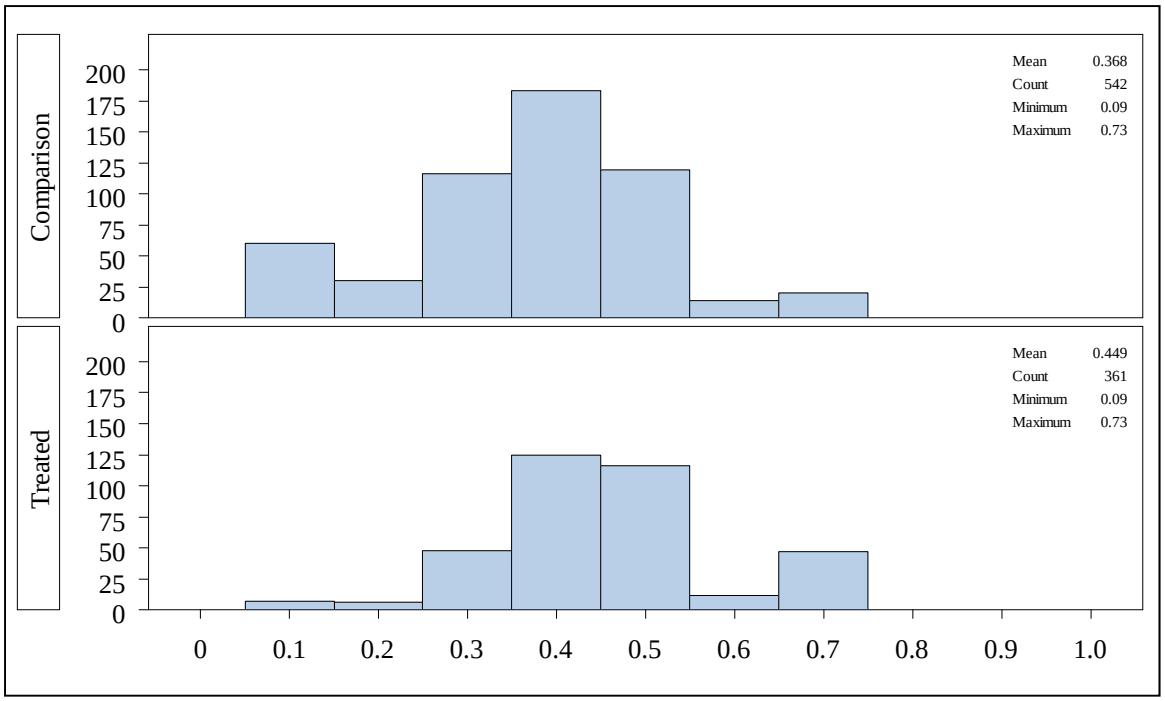
Propensity score, matched 2007 men



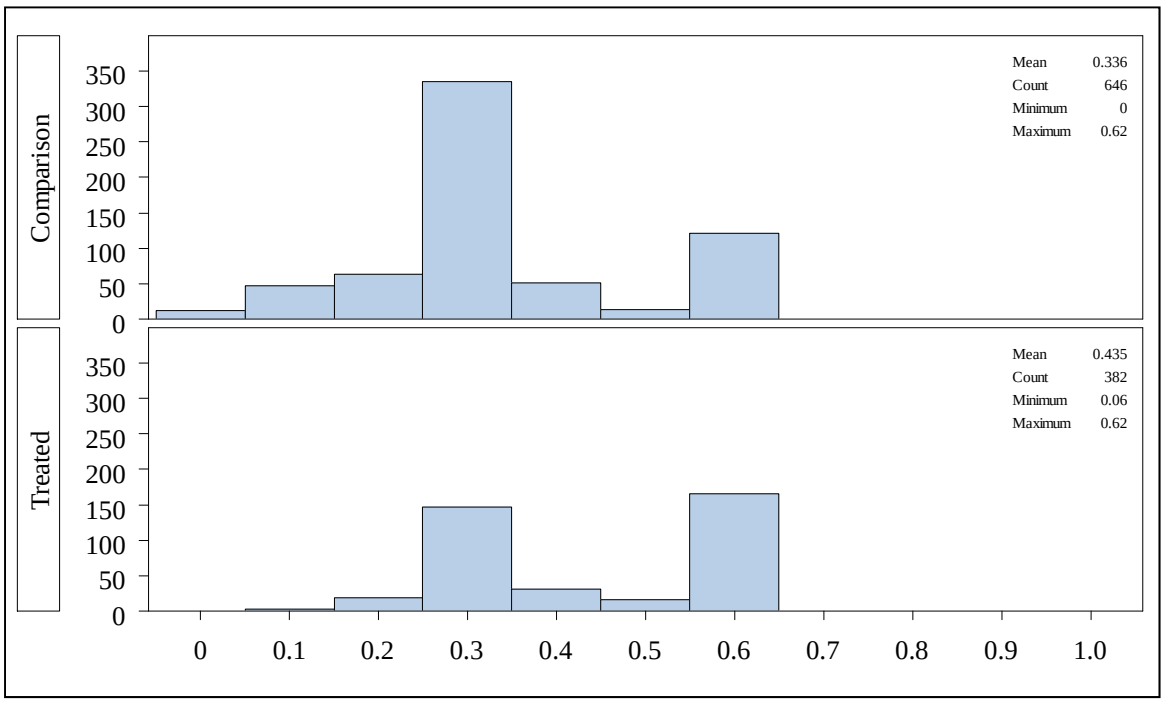
Propensity score, matched 2007 women



Propensity score, matched 2008 men



Propensity score, matched 2008 women



Appendix 4. Legislative implementation of the Training Benefits Program

Training Benefits Program background

In 2000, the Washington State Legislature passed Senate Bill 6335, creating the Training Benefits Program. This program allows for funds from the Unemployment Insurance Trust Fund to be spent on providing extended unemployment benefits to dislocated workers whose occupations are in decline and who need training to obtain a new job. The Training Benefits Program provides temporary income support while eligible dislocated workers are in training. It thus recognizes that forgone earnings are a significant cost of education and training.

The Training Benefits Program provides up to 52 weeks of unemployment benefits (including up to 26 weeks of regular unemployment benefits), while the worker is undergoing training. During this time, the worker does not have to look for work. However, the direct costs of training such as tuition, books and transportation must be funded through other sources, including the participant's own resources.

The Economic Security Act (The Act) established the following criteria for an applicant to qualify for these benefits. The prospective participant must:

- Have exhausted all previous unemployment benefits, including extended benefits;
- Have been unemployed from a declining industry;
- Select training or skills that are in demand;
- Qualify for exemption from the work-search requirements for unemployment insurance;
- Have a "long-term attachment" to the labor force, defined as "working at least two of the four twelve-month periods immediately preceding the base year";
- Select training that enhances the individual's earnings;
- Be a dislocated worker, as defined in RCW 50.04.075;
- Have a training plan on file within 60 days after being notified about the availability of the program (e.g., within 60 days after receiving the Unemployment Claims Kit);
- Enter a training program within 90 days after being notified about the availability of the program (if the training course doesn't start within that period, the applicant is required to "enter training as soon as it is available");
- Be enrolled as a full-time student; and
- The participant cannot participate in the Training Benefits Program again for five years after completing the program.

In addition, the Legislature made special provisions for workers from the aerospace industry (North American Industry Classification System (NAICS) 372 and 336411), logging and timber trades (NAICS 24 or 26) and fishing industry (NAICS 0912) who apply for Training Benefits Program. Applicants from these industries were exempt from the tenure requirements designed to establish a "long-term attachment to the labor force."

The Training Benefits Program has been the subject of intense scrutiny by the legislature and Employment Security Department management. The result has been a much clearer understanding of the administrative processes and decision-making within the program over its history. The

program was originally created as a retraining program for people affected by the reduction in the forestry industry in Washington state in 2000. When Boeing announced large lay-offs in 2001, the program was expanded to include aerospace workers.

Over time, the program's criteria became increasingly focused on the needs of industries and occupations in cyclic decline as well as structural job destruction. These changing criteria to fit the immediate needs of the unemployed stand in sharp contrast to training programs like the federal Workforce Investment Act, which are consistent over time with federally mandated eligibility criteria with regular audits and sanctions for noncompliance.

Appendix 5. Study timeline

The Training Benefits Program began in 2001. We begin our analysis with the 2002 training cohort and end with the 2008 training cohort. This provides us with seven cohorts for analysis, with a maximum of eight follow-up years for the 2002 cohort and one follow-up year for 2008 cohort.

We estimate each cohort over time, by follow-up year.

We estimate separate outcomes for men and women.

Appendix 6. A note on the unemployment insurance population from which the study sample is drawn

"The inability to find comparable comparison group members for programme participants is a major source of bias…" An incomparable comparison group implies that the observed variables on which the propensity function depends are incomparable. For example, the distribution of individuals in the treatment group for observed education may be different from the distribution of the same variable for the treatment group. This incomparability for the observed variables results in the propensity functions for the treatment and comparison groups being estimated based on differently defined and estimated parameters [Heckman, Ichimura and Todd (1997) P. 611].

The treatment and comparison groups for the present study come from the same population that is eligible to receive unemployment insurance benefits. These individuals have a common set of characteristics that make them eligible for the receipt of unemployment benefits and for eligibility for the Training Benefits Program. These characteristics, in general, indicate a relatively strong and consistent attachment to the labor force and to employment. These characteristics are:

1. The individual is able to work and is available for work in any trade, occupation, profession or business to which he or she is reasonably suited.
2. The individual must be ready, able and willing, immediately to accept any suitable work which may be offered to him or her.
3. The individual must be actively seeking work pursuant to customary trade practices and through other methods when so directed by the commissioner (of the Employment Security Department) or the commissioner's agents. If a labor agreement or dispatch rules apply, customary trade practices must be in accordance with the applicable agreement or rules.
4. The individual has been unemployed for a waiting period of one week.
5. The individual participates in reemployment services if he or she has been referred to reemployment services pursuant to the *Worker Profiling and Reemployment System*, unless:
    a. The individual has completed such services; or
    b. The individual has justifiable cause to not participate in such services.

All of the above are conditioned on the following:

1. The benefit-year definition: This equals the 52-consecutive week period beginning with the first day of the calendar week in which the individual files an application for an initial determination of eligibility for unemployment benefits. Thereafter, the 52-consecutive-week period beginning with the first day of the calendar week in which the individual next files an application for an initial determination after the expiration of the preceding benefit year.
2. The benefit-year determination is further conditioned on the requirement that the individual has earned wages in "employment" in not less than 680 hours of the individual's base year. These 680 hours of employment cannot have been used to establish some prior benefit year.

Summary implications:

- All individuals in the study sample have a minimum, similar work history in terms of hours of employment prior to becoming eligible for and receiving unemployment benefits for a given benefit year.
- All individuals are receiving unemployment benefits for their most recent eligible benefit year. The minimum 680 hours of employment is recent.

Sources: RCW 50.20.010. Benefit Eligibility Conditions and RCW 50.04.030. Benefit Year Washington State.

Appendix 7. Descriptive statistics for the total sample after the nearest-neighbor match

Appendix Figure 7-1. A comparison of selected Training Benefits Program participants to all unemployment-insurance recipients, by calendar year, Washington state, current dollars

Year	Total annual unemployment recipients	Count of Training Benefits program approvals	Training Benefits participants as a percent of total unemployed	Total Training Benefits expenditure, for first payment claimants, in current dollars
2002	227,700	1,614	0.71%	$510,979
2003	232,900	1,617	0.69%	$598,354
2004	199,700	2,508	1.26%	$949,688
2005	179,600	1,020	0.57%	$367,061
2006	163,000	857	0.53%	$326,790
2007	154,500	869	0.56%	$355,053
2008	186,300	1,001	0.54%	$433,976

Appendix Figure 7.2. Sample used to estimate the propensity function for all participants and participants who didn't return to their former employers

Gender and treatment group [1, 2,.3]		Cohort							
		2002	2003	2004	2005	2006	2007	2008	Total
All participants									
Men	TBP	981	734	1,110	341	329	309	372	4,176
	ENP	1,400	1,109	2,267	791	761	776	857	7,961
Women	TBP	634	652	974	456	314	313	393	3,736
	ENP	933	895	1,734	1,018	770	773	917	7,040
Total	TBP	1,615	1,386	2,084	797	643	622	765	7,912
	ENP	2,333	2,004	4,001	1,809	1,531	1,549	1,774	15,001
	Total	7,896	6,780	12,170	5,212	4,348	4,342	5,078	45,826
Participants who didn't return to their former employers									
Men	TBP	854	607	969	319	308	292	361	3,710
	ENP	960	729	1,532	505	489	495	542	5,252
Women	TBP	562	573	874	427	299	296	382	3,413
	ENP	681	651	1,286	741	582	579	646	5,166
Total	TBP	1,416	1,180	1,843	746	607	588	743	7,123
	ENP	1,641	1,380	2,818	1,246	1,071	1,074	1,188	10,418
	Total	6,114	5,120	9,322	3,984	3,356	3,324	3,862	35,082

[1] People younger than 20 or older than 60 at time of Training Benefits Program eligibility were omitted from the study, as are people with a Ph.D. or its equivalent and any professional degree.

[2] TBP = Participants (the treatment group); ENP = Eligible nonparticipants (the comparison group)

[3] These samples are edited as follows. First, for a given quarter of earnings and hours data, individuals reporting more than 1,040 hours worked per quarter (the person is working an 80-hour week) are dropped from the sample. Second, anyone reporting less than the nominal adult minimum wage in a given quarter when total before-tax earnings are reported as positive is dropped from the sample. Finally, anyone reporting more than $100 dollars in average hourly before-tax earnings is dropped from the sample. In some cases, employers report quarterly before-tax earnings but no hours. These cases also were dropped from the study.

Appendix Figure 7-3. Age and education at time of program eligibility, treatment (all participants) and matched comparison groups

Characteristic	Men				Women			
	Treatment		Comparison		Treatment		Comparison	
	Average	Std. dev.	Average	Std. dev.	Average	Std. dev.	Average	Std. dev.
Age in years at unemployment	40.65	9.37	40.11	9.91	41.56	9.58	41.03	10.23
Education	N	%	N	%	N	%	N	%
Less than high school	138	3.3%	259	6.2%	150	3.6%	165	4.2%
GED	195	4.7%	185	4.5%	145	3.5%	139	2.8%
High school graduate	1,416	34.1%	1,313	31.6%	1,197	28.8%	811	21.4%
Some college, no degree	1,473	35.4%	1,076	25.9%	1,364	32.8%	970	25.5%
Associate degree	439	10.6%	367	8.8%	332	8.0%	332	9.3%
BA or BS degree	430	10.3%	726	17.5%	411	9.9%	846	24.7%
Master's degree	66	1.6%	231	5.6%	79	1.9%	415	12.1%
Total sample	4,157		4,157		3,678		3,678	
Race/ethnicity	N	%	N	%	N	%	N	%
Asian/Pacific Islander	338	8.1%	195	4.7%	397	9.6%	227	5.5%
African American	167	4.0%	238	5.7%	157	3.8%	179	4.3%
Hispanic	210	5.1%	139	3.3%	207	5.0%	95	2.3%
Native American	46	1.1%	56	1.3%	60	1.4%	32	0.8%
White	3,087	74.3%	3,314	79.7%	2,618	63.0%	2,961	71.2%
Other/INA	309	7.4%	215	5.2%	239	5.7%	184	4.4%
Total sample	4,157		4,157		3,678		3,678	

Appendix Figure 7-4. Total sample – workforce development area at time of program eligibility, matched treatment and comparison group individuals

Workforce development area	Men				Women			
	Treatment		Comparison		Treatment		Comparison	
	N	%	N	%	N	%	N	%
01 Olympic WDA (Jefferson, Kitsap and Clallam counties)	152	3.2%	154	3.2%	156	4.1%	190	4.2%
02 Pacific Mountain WDA (Grays Harbor, Mason, Pacific, Thurston and Lewis counties)	325	6.7%	322	6.5%	165	4.1%	172	4.2%
03 Northwest WDA (Whatcom, Skagit, San Juan and Island counties)	261	4.8%	267	4.7%	174	3.7%	171	3.6%
04 Snohomish WDA (Snohomish County)	688	14.4%	697	14.3%	617	14.7%	624	14.5%
05 Seattle-King WDA (King County)	1297	25.9%	1281	25.9%	1376	33.0%	1364	32.5%
06 Tacoma-Pierce WDA (Pierce County)	531	10.7%	583	11.3%	381	9.0%	416	9.1%
07 Southwest WDA (Wahkiakum, Cowlitz and Clark counties)	384	7.0%	371	6.6%	359	8.2%	337	8.5%
08a North Central WDA (Okanogan and Chelan counties)	68	1.2%	33	1.4%	70	1.6%	72	1.6%
08b North Central WDA (Douglas, Grant and Adams counties)	34	0.6%	219	1.0%	47	1.1%	45	1.3%
09 South Central WDA (Kittitas, Skamania, Yakima and Klickitat counties)	243	4.9%	41	4.9%	138	3.3%	118	3.3%
10a Eastern WDA (Ferry, Stevens, Lincoln and Pend Oreille counties)	27	0.6%	84	0.7%	31	0.7%	23	0.8%
10b Eastern WDA (Walla Walla, Whitman, Columbia, Garfield and Asotin counties)	28	0.6%	60	0.6%	35	0.8%	33	0.8%
11 Benton-Franklin WDA (Benton and Franklin counties)	50	1.1%	30	1.0%	57	1.4%	40	1.3%
12 Spokane WDA (Spokane County)	69	1.4%	15	1.3%	72	1.7%	73	1.7%

Appendix Figure 7-5. Occupation of longest attachment in the two-year period prior to program eligibility, treatment and matched comparison groups

Occupation	Men				Women			
	Treatment		Comparison		Treatment		Comparison	
	N	%	N	%	N	%	N	%
Management	218	5.2%	247	5.9%	368	10.0%	315	8.6%
Architectural and engineering	284	6.8%	251	6.0%	133	3.6%	61	1.7%
Arts, entertainment	51	1.2%	142	3.4%	118	3.2%	184	5.0%
Building and grounds maintenance	27	0.6%	79	1.9%	26	0.7%	43	1.2%
Business and finance	98	2.4%	140	3.4%	247	6.7%	242	6.6%
Community and social service	23	0.6%	46	1.1%	42	1.1%	142	3.9%
Computer and mathematics	279	6.7%	112	2.7%	142	3.9%	65	1.8%
Construction	271	6.5%	587	14.1%	52	1.4%	38	1.0%
Education and training	18	0.4%	73	1.8%	41	1.1%	249	6.8%
Farming, fishing and forestry	60	1.4%	74	1.8%	20	0.5%	32	0.9%
Food preparation	14	0.3%	112	2.7%	49	1.3%	169	4.6%
Healthcare practitioners	11	0.3%	124	3.0%	56	1.5%	287	7.8%
Healthcare support	7	0.2%	22	0.5%	48	1.3%	151	4.1%
Installation and maintenance	492	11.8%	442	10.6%	69	1.9%	40	1.1%
Legal	4	0.1%	21	0.5%	31	0.8%	42	1.1%
Life and physical sciences	36	0.9%	140	3.4%	25	0.7%	139	3.8%
Military	43	1.0%	33	0.8%	8	0.2%	9	0.2%
Miscellaneous	55	1.3%	3	0.1%	32	0.9%	2	0.1%
Office and administrative services	259	6.2%	235	5.7%	991	26.9%	625	17.0%
Personal care	35	0.8%	82	2.0%	56	1.5%	191	5.2%
Production	1,451	34.9%	608	14.6%	695	18.9%	300	8.2%
Professional services	87	2.1%	5	0.1%	67	1.8%	0	0.0%
Protective services	15	0.4%	95	2.3%	14	0.4%	54	1.5%
Sales	111	2.7%	171	4.1%	256	7.0%	216	5.9%
Transportation	208	5.0%	313	7.5%	92	2.5%	82	2.2%
Total	4,157		4,157		3,678		3,678	

Appendix Figure 7-6. Industry of longest attachment in the two-year period prior to program eligibility, treatment and matched comparison groups

Industry	Men				Women			
	Treatment		Comparison		Treatment		Comparison	
	N	%	N	%	N	%	N	%
Administrative and support services	322	7.8%	404	9.7%	321	8.7%	316	8.6%
Aerospace	890	21.4%	164	4.0%	425	11.6%	57	1.6%
Agriculture and forestry	21	0.5%	15	0.4%	15	0.4%	14	0.5%
Construction	215	5.2%	717	17.3%	73	2.0%	127	3.5%
Durable-goods manufacturing, except aerospace	601	14.5%	435	10.5%	259	7.0%	152	4.1%
Educational services	170	4.1%	161	3.9%	217	5.9%	353	9.6%
Finance and insurance	63	1.5%	72	1.7%	202	5.5%	168	4.6%
Fishing and hunting	5	0.1%	11	0.3%	0	0.0%	0	0.0%
Healthcare and social assistance	302	7.3%	200	4.8%	757	20.6%	745	20.3%
Information	130	3.1%	143	3.4%	107	2.9%	114	3.1%
Leisure and hospitality	93	2.2%	288	6.9%	136	3.7%	348	9.5%
Management of companies	36	0.9%	12	0.3%	11	0.3%	3	0.1%
Nondurable-goods manufacturing	56	1.4%	89	2.1%	65	1.8%	53	1.4%
Other services except public administration	89	2.1%	124	3.0%	101	2.8%	123	3.3%
Private households	15	0.4%	17	0.4%	40	1.1%	46	1.3%
Professional and technical services	288	6.9%	292	7.0%	210	5.7%	266	7.2%
Public administration	202	4.9%	179	4.3%	165	4.5%	191	5.2%
Real estate and rental	40	1.0%	84	2.0%	63	1.7%	85	2.3%
Retail trade	248	6.0%	314	7.6%	274	7.5%	302	8.2%
Support activities	13	0.3%	10	0.2%	10	0.4%	7	0.2%
Transportation	144	3.5%	183	4.4%	110	3.0%	81	2.2%
Utilities	28	0. 7%	12	0.3%	11	0.3%	7	0.2%
Waste management and recycling	27	0.7%	17	0.4%	10	0.3%	6	0.2%
Wholesale trade	139	3.3%	198	4.8%	95	2.6%	114	3.1%
Not ascertained	20	0.5%	16	0.4%	1	0.0%	0	0.0%

Appendix Figure 7-7. Pre- and post industry of employment for all participants

	Agriculture	Timber	Fishing and hunting	Support activities for agriculture and forestry	Utilities	Construction	Nondurable-goods manufacturing	Durable-goods manufacturing	Aerospace	Wholesale trade	Retail trade	Transportation and warehousing	Information	Finance and insurance	Real estate and rental leasing	Professional and technical services	Management of companies and enterprises	Administrative and support services	Waste management and remediation	Educational services	Healthcare and social assistance	Leisure and hospitality	Other services, except public administration	Private households	Public administration	Not ascertained	Total
Agriculture	12	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0	0	1	0	2	0	0	13	34
	0.15	0	0	0.01	0	0	0	0	0	0	0.04	0	0	0	0	0	0	0.03	0	0	0.01	0	0.03	0	0	0.17	0.43
	35.29	0	0	2.94	0	0	0	0	0	0	8.82	0	0	0	0	0	0	5.88	0	0	2.94	0	5.88	0	0	38.24	
	32.43	0	0	4.76	0	0	0	0	0	0	0.55	0	0	0	0	0	0	0.21	0	0	0.1	0	0.97	0	0	0.74	
Timber	0	4	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	3	13
	0	0.05	0	0	0	0.01	0	0.03	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0.01	0	0	0.04	0.17
	0	30.77	0	0	0	7.69	0	15.38	0	0	0	0	0	0	0	7.69	0	7.69	0	0	0	0	7.69	0	0	23.08	
	0	28.57	0	0	0	0.37	0	0.38	0	0	0	0	0	0	0	0.24	0	0.1	0	0	0	0	0.49	0	0	0.17	
Fishing and hunting	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5
	0	0	0.03	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.06
	0	0	40	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	
	0	0	100	0	0	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	
Support activities for agriculture and forestry	3	4	0	7	0	1	1	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	1	23
	0.04	0.05	0	0.09	0	0.01	0.01	0	0	0.03	0	0	0	0	0	0	0	0.01	0	0	0	0	0.01	0	0.03	0.01	0.29
	13.04	17.39	0	30.43	0	4.35	4.35	0	0	8.7	0	0	0	0	0	0	0	4.35	0	0	0	0	4.35	0	8.7	4.35	
	8.11	28.57	0	33.33	0	0.37	1.23	0	0	1.15	0	0	0	0	0	0	0	0.1	0	0	0	0	0.49	0	0.97	0.06	
Utilities	0	0	0	0	11	0	0	2	0	0	3	1	1	0	0	1	0	6	0	0	0	0	0	0	4	10	39
	0	0	0	0	0.14	0	0	0.03	0	0	0.04	0.01	0.01	0	0	0.01	0	0.08	0	0	0	0	0	0	0.05	0.13	0.5
	0	0	0	0	28.21	0	0	5.13	0	0	7.69	2.56	2.56	0	0	2.56	0	15.38	0	0	0	0	0	0	10.26	25.64	
	0	0	0	0	64.71	0	0	0.38	0	0	0.55	0.49	0.68	0	0	0.24	0	0.63	0	0	0	0	0	0	1.94	0.57	
Construction	0	0	0	3	0	118	4	11	1	8	6	6	3	1	3	8	0	35	0	1	8	5	1	0	4	62	288
	0	0	0	0.04	0	1.51	0.05	0.14	0.01	0.1	0.08	0.08	0.04	0.01	0.04	0.1	0	0.45	0	0.01	0.1	0.06	0.01	0	0.05	0.79	3.68
	0	0	0	1.04	0	40.97	1.39	3.82	0.35	2.78	2.08	2.08	1.04	0.35	1.04	2.78	0	12.15	0	0.35	2.78	1.74	0.35	0	1.39	21.53	
	0	0	0	14.29	0	43.87	4.94	2.11	0.25	4.6	1.09	2.93	2.05	0.85	4.17	1.89	0	3.65	0	0.28	0.8	2.07	0.49	0	1.94	3.53	
Nondurable-goods manufacturing	5	0	0	5	0	2	36	3	0	4	3	1	1	0	2	2	0	9	0	3	1	0	1	0	1	42	121
	0.06	0	0	0.06	0	0.03	0.46	0.04	0	0.05	0.04	0.01	0.01	0	0.03	0.03	0	0.11	0	0.04	0.01	0	0.01	0	0.01	0.54	1.54
	4.13	0	0	4.13	0	1.65	29.75	2.48	0	3.31	2.48	0.83	0.83	0	1.65	1.65	0	7.44	0	2.48	0.83	0	0.83	0	0.83	34.71	
	13.51	0	0	23.81	0	0.74	44.44	0.58	0	2.3	0.55	0.49	0.68	0	2.78	0.47	0	0.94	0	0.83	0.1	0	0.49	0	0.49	2.39	

Appendix Figure 7-7. Pre- and post industry of employment for all participants (continued)

	Agriculture	Timber	Fishing and hunting	Support activities for agriculture and forestry	Utilities	Construction	Nondurable-goods manufacturing	Durable-goods manufacturing	Aerospace	Wholesale trade	Retail trade	Transportation and warehousing	Information	Finance and insurance	Real estate and rental leasing	Professional and technical services	Management of companies and enterprises	Administrative and support services	Waste management and remediation	Educational services	Healthcare and social assistance	Leisure and hospitality	Other services, except public administration	Private households	Public administration	Not ascertained	Total
Durable-goods manufacturing	2	3	0	0	1	18	6	263	1	12	33	16	5	1	2	14	6	127	3	5	19	15	11	0	10	405	978
	0.03	0.04	0	0	0.01	0.23	0.08	3.36	0.01	0.15	0.42	0.2	0.06	0.01	0.03	0.18	0.08	1.62	0.04	0.06	0.24	0.19	0.14	0	0.13	5.17	12.48
	0.2	0.31	0	0	0.1	1.84	0.61	26.89	0.1	1.23	3.37	1.64	0.51	0.1	0.2	1.43	0.61	12.99	0.31	0.51	1.94	1.53	1.12	0	1.02	41.41	
	5.41	21.43	0	0	5.88	6.69	7.41	50.48	0.25	6.9	6	7.8	3.42	0.85	2.78	3.31	35.29	13.24	10.34	1.38	1.9	6.2	5.34	0	4.85	23.08	
Aerospace	3	0	0	0	1	45	10	98	388	24	79	38	15	6	8	45	1	144	5	33	75	21	29	0	23	106	1197
	0.04	0	0	0	0.01	0.57	0.13	1.25	4.95	0.31	1.01	0.49	0.19	0.08	0.1	0.57	0.01	1.84	0.06	0.42	0.96	0.27	0.37	0	0.29	1.35	15.28
	0.25	0	0	0	0.08	3.76	0.84	8.19	32.41	2.01	6.6	3.17	1.25	0.5	0.67	3.76	0.08	12.03	0.42	2.76	6.27	1.75	2.42	0	1.92	8.86	
	8.11	0	0	0	5.88	16.73	12.35	18.81	97.49	13.79	14.36	18.54	10.27	5.08	11.11	10.64	5.88	15.02	17.24	9.09	7.51	8.68	14.08	0	11.17	6.04	
Wholesale trade	2	0	0	0	0	5	0	9	0	66	17	6	2	4	0	7	1	25	2	2	11	2	2	0	3	68	234
	0.03	0	0	0	0	0.06	0	0.11	0	0.84	0.22	0.08	0.03	0.05	0	0.09	0.01	0.32	0.03	0.03	0.14	0.03	0.03	0	0.04	0.87	2.99
	0.85	0	0	0	0	2.14	0	3.85	0	28.21	7.26	2.56	0.85	1.71	0	2.99	0.43	10.68	0.85	0.85	4.7	0.85	0.85	0	1.28	29.06	
	5.41	0	0	0	0	1.86	0	1.73	0	37.93	3.09	2.93	1.37	3.39	0	1.65	5.88	2.61	6.9	0.55	1.1	0.83	0.97	0	1.46	3.87	
Retail trade	2	0	0	0	1	15	4	13	0	10	207	7	7	3	4	17	0	50	1	14	17	15	12	0	8	115	522
	0.03	0	0	0	0.01	0.19	0.05	0.17	0	0.13	2.64	0.09	0.09	0.04	0.05	0.22	0	0.64	0.01	0.18	0.22	0.19	0.15	0	0.1	1.47	6.66
	0.38	0	0	0	0.19	2.87	0.77	2.49	0	1.92	39.66	1.34	1.34	0.57	0.77	3.26	0	9.58	0.19	2.68	3.26	2.87	2.3	0	1.53	22.03	
	5.41	0	0	0	5.88	5.58	4.94	2.5	0	5.75	37.64	3.41	4.79	2.54	5.56	4.02	0	5.21	3.45	3.86	1.7	6.2	5.83	0	3.88	6.55	
Transportation and warehousing	0	2	0	0	0	6	0	10	1	4	12	76	1	8	2	4	1	20	1	4	6	3	6	0	5	82	254
	0	0.03	0	0	0	0.08	0	0.13	0.01	0.05	0.15	0.97	0.01	0.1	0.03	0.05	0.01	0.26	0.01	0.05	0.08	0.04	0.08	0	0.06	1.05	3.24
	0	0.79	0	0	0	2.36	0	3.94	0.39	1.57	4.72	29.92	0.39	3.15	0.79	1.57	0.39	7.87	0.39	1.57	2.36	1.18	2.36	0	1.97	32.28	
	0	14.29	0	0	0	2.23	0	1.92	0.25	2.3	2.18	37.07	0.68	6.78	2.78	0.95	5.88	2.09	3.45	1.1	0.6	1.24	2.91	0	2.43	4.67	
Information	0	0	0	0	0	4	0	4	0	5	9	4	64	3	6	14	0	21	0	9	9	3	0	0	0	82	237
	0	0	0	0	0	0.05	0	0.05	0	0.06	0.11	0.05	0.82	0.04	0.08	0.18	0	0.27	0	0.11	0.11	0.04	0	0	0	1.05	3.02
	0	0	0	0	0	1.69	0	1.69	0	2.11	3.8	1.69	27	1.27	2.53	5.91	0	8.86	0	3.8	3.8	1.27	0	0	0	34.6	
	0	0	0	0	0	1.49	0	0.77	0	2.87	1.64	1.95	43.84	2.54	8.33	3.31	0	2.19	0	2.48	0.9	1.24	0	0	0	4.67	
Finance and insurance	0	0	0	0	0	2	0	6	0	2	6	2	2	60	3	7	0	25	0	6	7	1	3	0	4	129	265
	0	0	0	0	0	0.03	0	0.08	0	0.03	0.08	0.03	0.03	0.77	0.04	0.09	0	0.32	0	0.08	0.09	0.01	0.04	0	0.05	1.65	3.38
	0	0	0	0	0	0.75	0	2.26	0	0.75	2.26	0.75	0.75	22.64	1.13	2.64	0	9.43	0	2.26	2.64	0.38	1.13	0	1.51	48.68	
	0	0	0	0	0	0.74	0	1.15	0	1.15	1.09	0.98	1.37	50.85	4.17	1.65	0	2.61	0	1.65	0.7	0.41	1.46	0	1.94	7.35	
Real estate and rental and leasing	0	0	0	0	0	1	1	3	0	2	7	0	3	4	23	5	0	16	0	0	8	2	0	0	1	27	103
	0	0	0	0	0	0.01	0.01	0.04	0	0.03	0.09	0	0.04	0.05	0.29	0.06	0	0.2	0	0	0.1	0.03	0	0	0.01	0.34	1.31
	0	0	0	0	0	0.97	0.97	2.91	0	1.94	6.8	0	2.91	3.88	22.33	4.85	0	15.53	0	0	7.77	1.94	0	0	0.97	26.21	
	0	0	0	0	0	0.37	1.23	0.58	0	1.15	1.27	0	2.05	3.39	31.94	1.18	0	1.67	0	0	0.8	0.83	0	0	0.49	1.54	

Appendix Figure 7-7. Pre- and post industry of employment for all participants (continued)

	Agriculture	Timber	Fishing and hunting	Support activities for agriculture and forestry	Utilities	Construction	Nondurable-goods manufacturing	Durable-goods manufacturing	Aerospace	Wholesale trade	Retail trade	Transportation and warehousing	Information	Finance and insurance	Real estate and rental leasing	Professional and technical services	Management of companies and enterprises	Administrative and support services	Waste management and remediation	Educational services	Healthcare and social assistance	Leisure and hospitality	Other services, except public administration	Private households	Public administration	Not ascertained	Total
Professional and technical services	0	0	0	0	1	9	1	17	4	5	10	7	10	5	4	202	0	82	0	12	24	7	7	0	4	87	498
	0	0	0	0	0.01	0.11	0.01	0.22	0.05	0.06	0.13	0.09	0.13	0.06	0.05	2.58	0	1.05	0	0.15	0.31	0.09	0.09	0	0.05	1.11	6.36
	0	0	0	0	0.2	1.81	0.2	3.41	0.8	1	2.01	1.41	2.01	1	0.8	40.56	0	16.47	0	2.41	4.82	1.41	1.41	0	0.8	17.47	
	0	0	0	0	5.88	3.35	1.23	3.26	1.01	2.87	1.82	3.41	6.85	4.24	5.56	47.75	0	8.55	0	3.31	2.4	2.89	3.4	0	1.94	4.96	
Management of companies and enterprises	0	0	0	0	0	1	0	2	0	0	0	0	2	0	0	1	4	4	0	0	0	1	0	0	0	32	47
	0	0	0	0	0	0.01	0	0.03	0	0	0	0	0.03	0	0	0.01	0.05	0.05	0	0	0	0.01	0	0	0	0.41	0.6
	0	0	0	0	0	2.13	0	4.26	0	0	0	0	4.26	0	0	2.13	8.51	8.51	0	0	0	2.13	0	0	0	68.09	
	0	0	0	0	0	0.37	0	0.38	0	0	0	0	1.37	0	0	0.24	23.53	0.42	0	0	0	0.41	0	0	0	1.82	
Administrative and support services	0	0	0	2	0	6	4	26	1	5	45	9	13	8	4	25	2	243	2	12	86	12	13	0	9	116	643
	0	0	0	0.03	0	0.08	0.05	0.33	0.01	0.06	0.57	0.11	0.17	0.1	0.05	0.32	0.03	3.1	0.03	0.15	1.1	0.15	0.17	0	0.11	1.48	8.21
	0	0	0	0.31	0	0.93	0.62	4.04	0.16	0.78	7	1.4	2.02	1.24	0.62	3.89	0.31	37.79	0.31	1.87	13.37	1.87	2.02	0	1.4	18.04	
	0	0	0	9.52	0	2.23	4.94	4.99	0.25	2.87	8.18	4.39	8.9	6.78	5.56	5.91	11.76	25.34	6.9	3.31	8.61	4.96	6.31	0	4.37	6.61	
Waste management and remediation	1	0	0	0	0	2	1	1	0	2	1	0	0	0	0	4	0	6	11	1	0	0	2	0	0	5	37
	0.01	0	0	0	0	0.03	0.01	0.01	0	0.03	0.01	0	0	0	0	0.05	0	0.08	0.14	0.01	0	0	0.03	0	0	0.06	0.47
	2.7	0	0	0	0	5.41	2.7	2.7	0	5.41	2.7	0	0	0	0	10.81	0	16.22	29.73	2.7	0	0	5.41	0	0	13.51	
	2.7	0	0	0	0	0.74	1.23	0.19	0	1.15	0.18	0	0	0	0	0.95	0	0.63	37.93	0.28	0	0	0.97	0	0	0.28	
Educational services	3	0	0	0	0	12	3	9	0	1	14	6	5	2	2	12	0	24	0	196	28	14	1	0	3	52	387
	0.04	0	0	0	0	0.15	0.04	0.11	0	0.01	0.18	0.08	0.06	0.03	0.03	0.15	0	0.31	0	2.5	0.36	0.18	0.01	0	0.04	0.66	4.94
	0.78	0	0	0	0	3.1	0.78	2.33	0	0.26	3.62	1.55	1.29	0.52	0.52	3.1	0	6.2	0	50.65	7.24	3.62	0.26	0	0.78	13.44	
	8.11	0	0	0	0	4.46	3.7	1.73	0	0.57	2.55	2.93	3.42	1.69	2.78	2.84	0	2.5	0	53.99	2.8	5.79	0.49	0	1.46	2.96	
Healthcare and social assistance	2	0	0	1	1	1	5	19	0	10	53	14	5	7	7	27	2	75	0	32	640	32	24	4	8	90	1,059
	0.03	0	0	0.01	0.01	0.01	0.06	0.24	0	0.13	0.68	0.18	0.06	0.09	0.09	0.34	0.03	0.96	0	0.41	8.17	0.41	0.31	0.05	0.1	1.15	13.52
	0.19	0	0	0.09	0.09	0.09	0.47	1.79	0	0.94	5	1.32	0.47	0.66	0.66	2.55	0.19	7.08	0	3.02	60.43	3.02	2.27	0.38	0.76	8.5	
	5.41	0	0	4.76	5.88	0.37	6.17	3.65	0	5.75	9.64	6.83	3.42	5.93	9.72	6.38	11.76	7.82	0	8.82	64.06	13.22	11.65	36.36	3.88	5.13	
Leisure and hospitality	1	0	0	0	0	3	1	5	0	4	8	1	1	4	0	6	0	12	0	9	13	88	10	0	2	61	229
	0.01	0	0	0	0	0.04	0.01	0.06	0	0.05	0.1	0.01	0.01	0.05	0	0.08	0	0.15	0	0.11	0.17	1.12	0.13	0	0.03	0.78	2.92
	0.44	0	0	0	0	1.31	0.44	2.18	0	1.75	3.49	0.44	0.44	1.75	0	2.62	0	5.24	0	3.93	5.68	38.43	4.37	0	0.87	26.64	
	2.7	0	0	0	0	1.12	1.23	0.96	0	2.3	1.45	0.49	0.68	3.39	0	1.42	0	1.25	0	2.48	1.3	36.36	4.85	0	0.97	3.48	
Other services except public administration	0	0	0	0	0	5	2	2	0	2	14	2	1	1	2	2	0	8	1	9	8	4	75	0	1	51	190
	0	0	0	0	0	0.06	0.03	0.03	0	0.03	0.18	0.03	0.01	0.01	0.03	0.03	0	0.1	0.01	0.11	0.1	0.05	0.96	0	0.01	0.65	2.43
	0	0	0	0	0	2.63	1.05	1.05	0	1.05	7.37	1.05	0.53	0.53	1.05	1.05	0	4.21	0.53	4.74	4.21	2.11	39.47	0	0.53	26.84	
	0	0	0	0	0	1.86	2.47	0.38	0	1.15	2.55	0.98	0.68	0.85	2.78	0.47	0	0.83	3.45	2.48	0.8	1.65	36.41	0	0.49	2.91	

Appendix 8. Quarterly before-tax earnings net-impact estimates, 2002 through 2008 cohorts, all participants

Appendix Figure 8-1. Net before-tax annual earnings effects, all participants, genders combined

		Follow-up year						
Statistic		1	2	3	4	5	6	7
2002	Parameter estimate	($3,642)	($2,986)	($859)	$517	$1,581	$1,980	$2,216
	Sample size	3,118	3,118	3,118	3,118	3,118	3,118	3,118
	Corrected standard error	179.64	192.95	201.43	212.85	223.21	229.63	230.75
	Pr > |t|	<.0001	<.0001	<.0001	0.0152	<.0001	<.0001	<.0001
	Adjusted R-squared	0.23	0.18	0.09	0.07	0.08	0.1	0.12
2003	Parameter estimate	($3,813)	($2,342)	($145)	$1,040	$1,582	$1,736	
	Sample size	2,770	2,770	2,770	2,770	2,770	2,770	
	Corrected standard error	192.89	214.09	229.03	236.59	239.24	241.2	
	Pr > |t|	<.0001	<.0001	0.5268	<.0001	<.0001	<.0001	
	Adjusted R-squared	0.23	0.1	0.04	0.06	0.08	0.09	
2004	Parameter estimate	($2,867)	($1,241)	$842	$1,993	$2,690		
	Sample size	4,168	4,168	4,168	4,168	4,168		
	Corrected standard error	141.86	164.88	176.67	187.89	194.06		
	Pr > |t|	<.0001	<.0001	<.0001	<.0001	<.0001		
	Adjusted R-squared	0.13	0.05	0.08	0.12	0.14		
2005	Parameter estimate	($4,191)	($2,864)	($1,570)	($743)			
	Sample size	1,582	1,582	1,582	1,582			
	Corrected standard error	233.2	259.08	274.05	282.41			
	Pr > |t|	<.0001	<.0001	<.0001	0.0086			
	Adjusted R-squared	0.22	0.13	0.08	0.08			
2006	Parameter estimate	($4,280)	($3,070)	($1,703)				
	Sample size	1,272	1,272	1,272				
	Corrected standard error	263.8	290.42	302.84				
	Pr > |t|	<.0001	<.0001	<.0001				
	Adjusted R-squared	0.26	0.18	0.12				
2007	Parameter estimate	($4,788)	($3,636)					
	Sample size	1,240	1,240					
	Corrected standard error	264.56	293.56					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.3	0.21					
2008	Parameter estimate	($4,389)						
	Sample size	1,520						
	Corrected standard error	232.79						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.28						

Appendix Figure 8-2. Net before-tax annual earnings impacts, all participants, men

Statistic		Follow-up year						
		1	2	3	4	5	6	7
2002	Parameter estimate	($4,119)	($3,424)	$1,006	$449	$1,860	$2,331	$2,645
	Sample size	1,962	1,962	1,962	1,962	1,962	1,962	1,962
	Corrected standard error	239.31	260.5	271.88	288.62	301.45	309.22	308.89
	Pr > |t|	<.0001	<.0001	0.0002	0.1202	<.0001	<.0001	<.0001
	Adjusted R-squared	0.27	0.22	0.12	0.09	0.1	0.12	0.14
2003	Parameter estimate	($4,480)	($2,715)	($128)	$1,387	$1,792	$1,975	
	Sample size	1,466	1,466	1,466	1,466	1,466	1,466	
	Corrected standard error	290.2	323.39	346.35	360.59	367.08	363.95	
	Pr > |t|	<.0001	<.0001	0.7127	0.0001	<.0001	<.0001	
	Adjusted R-squared	0.25	0.12	0.06	0.08	0.08	0.1	
2004	Parameter estimate	($3,139)	($1,207)	$1,404	$2,900	$3,716		
	Sample size	2,220	2,220	2,220	2,220	2,220		
	Corrected standard error	215.23	249.06	266.88	285.55	293.18		
	Pr > |t|	<.0001	<.0001	<.0001	<.0001	<.0001		
	Adjusted R-squared	0.14	0.06	0.12	0.15	0.17		
2005	Parameter estimate	($4,325)	($2,871)	($1,023)	($182)			
	Sample size	670	670	670	670			
	Corrected standard error	385.69	438.45	466.9	482.93			
	Pr > |t|	<.0001	<.0001	0.0288	0.7065			
	Adjusted R-squared	0.26	0.17	0.14	0.14			
2006	Parameter estimate	($4,955)	($3,624)	($1,998)				
	Sample size	646	646	646				
	Corrected standard error	410.04	457.35	483.07				
	Pr > |t|	<.0001	<.0001	<.0001				
	Adjusted R-squared	0.33	0.23	0.17				
2007	Parameter estimate	($5,609)	($4,324)					
	Sample size	616	616					
	Corrected standard error	397.51	438.34					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.39	0.3					
2008	Parameter estimate	($4,945)						
	Sample size	734						
	Corrected standard error	350.43						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.31						

Appendix Figure 8-3. Net before-tax annual earnings impacts, all participants, women

Statistic		Follow-up year						
		1	2	3	4	5	6	7
2002	Parameter estimate	($2,745)	($1,296)	$315	$1,426	$1,686	$1,779	$1,809
	Sample size	1,156	1,156	1,156	1,156	1,156	1,156	1,156
	Corrected standard error	253.46	306.04	323.28	343.16	359.83	378.58	385.72
	Pr > |t|	<.0001	<.0001	0.3309	<.0001	<.0001	<.0001	<.0001
	Adjusted R-squared	0.22	0.13	0.09	0.11	0.12	0.14	0.15
2003	Parameter estimate	($3,112)	($1,974)	($161)	$675	$1,320	$1,459	
	Sample size	1,304	1,304	1,304	1,304	1,304	1,304	
	Corrected standard error	243.08	272.38	294.31	300.36	302.49	314.6	
	Pr > |t|	<.0001	<.0001	0.585	0.0248	<.0001	<.0001	
	Adjusted R-squared	0.21	0.1	0.06	0.07	0.1	0.1	
2004	Parameter estimate	($2,420)	($1,177)	$326	$1,078	$1,628		
	Sample size	1,948	1,948	1,948	1,948	1,948		
	Corrected standard error	177.86	209.85	223.86	235.19	245.09		
	Pr > |t|	<.0001	<.0001	0.1456	<.0001	<.0001		
	Adjusted R-squared	0.15	0.06	0.06	0.09	0.13		
2005	Parameter estimate	($3,948)	($2,750)	($1,852)	($1,100)			
	Sample size	912	912	912	912			
	Corrected standard error	291.3	318.85	331.27	340.11			
	Pr > |t|	<.0001	<.0001	<.0001	0.0013			
	Adjusted R-squared	0.25	0.15	0.1	0.09			
2006	Parameter estimate	($3,551)	($2,417)	($1,360)				
	Sample size	626	626	626				
	Corrected standard error	345.13	374.14	380.94				
	Pr > |t|	<.0001	<.0001	0.0004				
	Adjusted R-squared	0.22	0.16	0.13				
2007	Parameter estimate	($4,098)	($3,147)					
	Sample size	624	624					
	Corrected standard error	355.8	397.45					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.26	0.18					
2008	Parameter estimate	($3,763)						
	Sample size	786						
	Corrected standard error	317.99						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.29						

Appendix 9. Quarterly before-tax earnings net-impact estimates, 2002 through 2008 cohorts, participants who didn't return to their former employers

Appendix Figure 9-1. Before-tax annual earnings net effects, participants who didn't return to their former employers, genders combined

Statistic		Follow-up year						
		1	2	3	4	5	6	7
2002	Parameter estimate	($2,429)	($1,723)	$0	$1,196	$2,034	$2,334	$2,397
	Sample size	2,828	2,828	2,828	2,828	2,828	2,828	2,828
	Corrected standard error	181.58	202.05	211.85	224.73	235.13	242.51	243.51
	Pr > |t|	<.0001	<.0001	0.228	<.0001	<.0001	<.0001	<.0001
	Adjusted R-squared	0.19	0.13	0.08	0.08	0.1	0.12	0.13
2003	Parameter estimate	($2,864)	($1,853)	$0	$1,156	$1,683	$1,896	
	Sample size	2,356	2,356	2,356	2,356	2,356	2,356	
	Corrected standard error	204.87	232.13	249.47	258	264.5	266.16	
	Pr > |t|	<.0001	<.0001	0.962	<.0001	<.0001	<.0001	
	Adjusted R-squared	0.17	0.09	0.05	0.07	0.08	0.09	
2004	Parameter estimate	($2,175)	($740)	$986	$1,929	$2,639		
	Sample size	3,678	3,678	3,678	3,678	3,678		
	Corrected standard error	149.51	175.89	187.28	198.27	203.54		
	Pr > |t|	<.0001	<.0001	<.0001	<.0001	<.0001		
	Adjusted R-squared	0.1	0.04	0.08	0.11	0.13		
2005	Parameter estimate	($3,610)	($2,415)	($1,218)	$0			
	Sample size	1,476	1,476	1,476	1,476			
	Corrected standard error	237.83	267.49	283.05	286.9			
	Pr > |t|	<.0001	<.0001	<.0001	0.107			
	Adjusted R-squared	0.2	0.11	0.07	0.06			
2006	Parameter estimate	($3,883)	($2,694)	($1,403)				
	Sample size	1,160	1,160	1,160				
	Corrected standard error	271.55	306.54	322.77				
	Pr > |t|	<.0001	<.0001	<.0001				
	Adjusted R-squared	0.24	0.18	0.14				
2007	Parameter estimate	($4,133)	($3,093)					
	Sample size	1,152	1,152					
	Corrected standard error	278.31	310.57					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.27	0.19					
2008	Parameter estimate	($3,445)						
	Sample size	1,462						
	Corrected standard error	241.6493						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.2389						

Appendix Figure 9-2. Before-tax annual earnings net effects, participants who didn't return to their former employers, men

Statistic		Follow-up year						
		1	2	3	4	5	6	7
2002	Parameter estimate	($2,845)	($2,195)	$202	$1,166	$2,398	$2,783	$2,823
	Sample size	1,704	1,704	1,704	1,704	1,704	1,704	1,704
	Corrected standard error	247.1	279.59	295.073	314.882	330.502	338.941	338.819
	Pr > |t|	<.0001	<.0001	0.4947	0.0002	<.0001	<.0001	<.0001
	Adjusted R-squared	0.21	0.16	0.1	0.11	0.13	0.14	0.15
2003	Parameter estimate	($3,112)	($1,902)	$231	$1,636	$1,906	$2,120	
	Sample size	1,212	1,212	1,212	1,212	1,212	1,212	
	Corrected standard error	309.6	351.78	380.88	397.83	409.53	404.48	
	Pr > |t|	<.0001	<.0001	0.5444	<.0001	<.0001	<.0001	
	Adjusted R-squared	0.2	0.11	0.07	0.09	0.1	0.1	
2004	Parameter estimate	($2,241)	($492)	$1,715	$2,822	$3,584		
	Sample size	1,936	1,936	1,936	1,936	1,936		
	Corrected standard error	230.71	271.88	289.04	306.06	313.16		
	Pr > |t|	<.0001	0.0703	<.0001	<.0001	<.0001		
	Adjusted R-squared	0.11	0.06	0.11	0.14	0.16		
2005	Parameter estimate	($3,735)	($2,302)	($941)	($63)			
	Sample size	622	622	622	622			
	Corrected standard error	399.04	453.14	481.22	484.51			
	Pr > |t|	<.0001	<.0001	0.0509	0.8964			
	Adjusted R-squared	0.25	0.15	0.13	0.12			
2006	Parameter estimate	($4,140)	($3,117)	($1,754)				
	Sample size	574	574	574				
	Corrected standard error	440.27	504.55	530.53				
	Pr > |t|	<.0001	<.0001	0.001				
	Adjusted R-squared	0.3	0.23	0.2				
2007	Parameter estimate	($4,669)	($3,490)					
	Sample size	570	570					
	Corrected standard error	435.46	484.03					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.33	0.26					
2008	Parameter estimate	($3,956)						
	Sample size	712						
	Corrected standard error	369.56						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.26						

Appendix Figure 9-3. Net before-tax annual earnings impacts, participants who didn't return to their former employers, women

Statistic		Follow-up year						
		1	2	3	4	5	6	7
2002	Parameter estimate	($1,866)	($925)	$0	$1,379	$1,566	$1,653	$1,708
	Sample size	1,124	1,124	1,124	1,124	1,124	1,124	1,124
	Corrected standard error	249.21	274.56	290.66	305.49	318.36	333.97	340.88
	Pr > |t|	<.0001	0.0004	0.1302	<.0001	<.0001	<.0001	<.0001
	Adjusted R-squared	0.18	0.13	0.09	0.1	0.11	0.13	0.14
2003	Parameter estimate	($2,619)	($1,839)	($275)	$629	$1,403	$1,622	
	Sample size	1,114	1,114	1,114	1,114	1,114	1,114	
	Corrected standard error	254.16	294.59	316.62	323.92	331.97	345.78	
	Pr > |t|	<.0001	<.0001	0.3857	0.0525	<.0001	<.0001	
	Adjusted R-squared	0.18	0.11	0.08	0.08	0.1	0.09	
2004	Parameter estimate	($2,004)	($944)	$287	$1,050	$1,725		
	Sample size	1,742	1,742	1,742	1,742	1,742		
	Corrected standard error	183.65	215.69	230.52	243.69	251.72		
	Pr > |t|	<.0001	<.0001	0.2133	<.0001	<.0001		
	Adjusted R-squared	0.13	0.05	0.06	0.08	0.12		
2005	Parameter estimate	($3,378)	($2,361)	($1,307)	($740)			
	Sample size	854	854	854	854			
	Corrected standard error	296.49	333.83	350.17	356.2			
	Pr > |t|	<.0001	<.0001	0.0002	0.0381			
	Adjusted R-squared	0.22	0.12	0.07	0.08			
2006	Parameter estimate	($3,403)	($2,161)	($1,105)				
	Sample size	586	586	586				
	Corrected standard error	347.08	375.47	396.36				
	Pr > |t|	<.0001	<.0001	0.0055				
	Adjusted R-squared	0.24	0.19	0.13				
2007	Parameter estimate	($3,648)	($2,799)					
	Sample size	582	582					
	Corrected standard error	360.88	403.95					
	Pr > |t|	<.0001	<.0001					
	Adjusted R-squared	0.26	0.17					
2008	Parameter estimate	($2,835)						
	Sample size	750						
	Corrected standard error	323.36						
	Pr > |t|	<.0001						
	Adjusted R-squared	0.26						