

John J. Heldrich Center for Workforce Development

## evaluation report

# Camden County College's Trade Adjustment Assistance for Community College Career Training Grant: Training Outcomes Final Evaluation Report

by William Mabe, Ph.D.

## Introduction

In 2012, Camden County College (CCC) received a U.S. Department of Labor Trade Adjustment and Assistance Community College and Career Training (TAACCCT) grant. CCC's TAACCCT grant focused on building capacity and training displaced workers for careers in the manufacturing and utilities sectors. The ultimate aim of these efforts was to prepare students for the labor market so that they would be able to obtain employment and earn family-sustaining wages after program completion as well as to help employers meet their hiring needs. CCC sought to collaborate with employers in the manufacturing and utilities industries in order to develop programs to train students for precision machining and gas pipeline installation and maintenance occupations.

CCC contracted with the John J. Heldrich Center for Workforce Development at Rutgers, The State University of New Jersey to evaluate the ongoing implementation of its activities as well as to conduct an outcome evaluation at the end of the grant period. The purpose of the evaluation has been to assess the extent to which CCC's TAACCCT-funded programs have addressed the U.S. Department of Labor's intentions for these grants, which are to "ensure that our nation's institutions of higher education are able to help the targeted population succeed in acquiring the skills, degrees, and cre-

dentials needed for high-wage, high-skill employment while also meeting the needs of employers for skilled workers" (USDOL-ETA, 2011).

To date, the Heldrich Center has produced one evaluation design report, which laid out the methodological processes that Heldrich Center researchers would follow to evaluate CCC's TAACCCT programs, and two implementation evaluation reports, which analyzed CCC's implementation of the TAACCCT grant. Throughout the evaluation process, Heldrich Center researchers used a variety of methods to understand how CCC is aligning workforce programs and services to meet the needs of students and employers. Program areas examined included program goals and the occupation/credential selection process; program design and staffing; recruitment, screening, and enrollment; curriculum and teaching strategies; job development; and other support services. The purpose of this report is to address in a systematic and detailed manner the extent to which CCC's TAACCCT program achieved its key programmatic outcomes, namely the placement in employment of its graduates and improvements in their earnings.

## RUTGERS

Edward J. Bloustein School  
of Planning and Public Policy

## Table of Contents

|   |    |
|---|----|
| Introduction.....   | 1  |
| Summary of Results.....   | 2  |
| Research Questions.....   | 3  |
| Quasi-Experimental Evaluation Methodology .....                             | 3  |
| Overview .....  | 3  |
| Comparison Group Design.....  | 3  |
| Difference-in-Differences Design.....                                       | 4  |
| Data .....  | 4  |
| Strengths and Limitations of this Design .....                              | 5  |
| Data Analysis .....   | 6  |
| Treatment Group.....  | 6  |
| Comparison Group .....  | 6  |
| Variables .....   | 6  |
| Labor Market Histories of Treatment Group and Comparison Pool Members ..... | 7  |
| Matching.....   | 8  |
| Statistical Results .....   | 10 |
| Conclusion .....  | 11 |
| References .....  | 11 |
| Acknowledgments.....  | 12 |
| About the Heldrich Center.....  | 12 |
| Appendix A. Detailed Statistical Results.....                               | 13 |

This report proceeds as follows. A brief summary of the results is presented after this introduction. The next section briefly summarizes the research questions on which this study is focused. The report then describes the methodology that Heldrich Center researchers used to conduct a quasi-experimental evaluation of the CCC training programs, the data that the researchers applied to conduct the analysis, and the study limitations. The following section presents the quasi-experimental evaluation data analysis and the results of the analysis. The final section offers some concluding observations.

## Summary of Results

Heldrich Center researchers examined the effect of the CCC programs on graduates’ labor market outcomes by comparing their changes in employment status and earnings before and after training to those of a comparison group of similar individuals who completed comparable training programs during the same time period. The researchers conducted 16 separate statistical tests, which yielded somewhat positive results about the labor market performance of CCC program graduates relative to the comparison group.

The results show that in each of the first two quarters after program completion, exiters from the CCC TAACCCT programs realized \$600 more in earnings gains (from before the program to afterwards) than the comparison group. In the third and fourth quarters after exit, however, there was no difference in the earnings of CCC program graduates and the comparison group. The CCC students' superior earnings performance in the quarters immediately after program exit likely is a result of the fact that they were more likely to be employed in those quarters than the comparison group. Indeed, the data analysis showed that CCC program graduates were more likely to experience an improvement in their employment status (from unemployed to employed) between the pre-program period and the post-program period than the comparison group. Like the earnings gain, the positive employment status results dissipated by the third and fourth quarters after exit. The strong results in the first two quarters probably owe to the program's persistent efforts to engage employers, a finding that the Heldrich Center documented previously in the qualitative evaluation reports.

## Research Questions

This report addresses two research questions.

1. Compared to a group of similar individuals who completed training in the same occupational fields, were CCC graduates more likely to be employed in New Jersey after graduation?
2. Did CCC graduates earn more than similar individuals who completed training in the same occupational fields?

## Quasi-Experimental Evaluation Methodology

### Overview

The primary focus of this report is to answer the question of whether and to what extent CCC's job training programs helped participants become

employed and increase their earnings. Generating a valid answer to the research questions requires that researchers answer the more specific question of how the outcomes of CCC trainees would have been different had they not received training at the college. To answer this question, ideally one would be able to compare the trainee's earnings in the world in which she participated in CCC training with her earnings in the world in which she did not participate. This is, of course, impossible because the researcher observes either the state of the world in which she participated or the state of the world in which she did not participate, but not both. The researcher must, therefore, compare individuals who participated in the CCC programs with individuals who did not participate in these programs, but are otherwise as similar as possible to the participants.

In a perfect world, the only pre-program difference between the CCC trainees and the comparison group individuals who completed non-TAACCCT programs would be that the former participated in the program while the latter did not. Purely from a research standpoint, the ideal way to develop such a control group would be to randomly assign a portion of those interested in training to receive training (treatment group) and a portion to receive some other service (control group), follow both groups as they enter the labor market, and then compare their earnings. With a large sample of prospective trainees, assignment at random would ensure that the only difference between two groups, on average, was participation in training. Unfortunately, such a research design was not feasible for this evaluation, partly because Training Adjustment Assistance recipients, by law, cannot be randomized, and partly for practical reasons — randomization would have shrunk the sample size too much to allow for any analysis to be conducted.

### Comparison Group Design

The next best alternative, and the strategy that Heldrich Center researchers chose to follow, is to use observational data to generate a comparison group. To create a valid comparison group, researchers need to identify individuals who are similar to treatment group members in two significant ways.

First, because the comparison group proxies for the experiences that the treatment group would have had if it had not received the treatment, the former needs to include individuals who received services that are broadly similar to the services that the treatment group received. The greater the similarity, the stronger the comparison group. In this instance, the ideal comparison group would consist of individuals who participated in a non-TAACCCCT-funded certificate program at CCC (or at its partner colleges) in an identical occupational field at the same time that the treatment group was enrolled there. Such a comparison group, unfortunately, does not exist, and it would probably be counterproductive for the colleges to structure their workforce programs in this manner. Instead, Heldrich Center researchers created a comparison group of individuals who participated in certificate programs at private-sector training providers in New Jersey in the same occupational fields at the same time as the treatment group. The sets of services that both the treatment and comparison groups received were similar in terms of the occupational fields in which they were trained, the fact that they pursued this training in a non-degree program, and the time when they participated. The primary difference in service receipt is the difference in the institutions where these individuals received training. The set of individuals who received non-TAACCCCT training is known as the **comparison pool**, and a subset of individuals is selected from this pool to create the **comparison group**.

Second, after identifying the comparison pool, researchers need to select the individuals from that pool who are the most similar to the individuals who received the treatment. It is preferable for treatment and comparison group members to be as similar as possible on measurable characteristics, such as their sex, race, age, education level, and wages they earned before training as well as on characteristics that are extremely difficult to measure, such as their motivation to succeed.

### Difference-in-Differences Design

In order to mitigate the effects of inherent personal attributes, such as race and sex, as well as of characteristics that change very little over short peri-

ods of time, such as educational endowment, on outcomes, Heldrich Center researchers employed a difference-in-differences design. In this design, the dependent variable that the researchers measured for CCC graduates and comparison group members was each person's change in earnings (or employment status) from before participating in training to after completing it. Researchers then conducted statistical tests to determine whether the average of the earnings changes for the treatment group exceeded the average change in earnings for the comparison group. By comparing each person to herself over time, researchers were able to control for time invariant attributes, such as sex and race, of each treatment and comparison group member, giving them the greatest opportunity to isolate the effect of the training program on the participants' outcomes.

### Data

Heldrich Center researchers received detailed data, including demographics, program of study, graduation date, and social security number, on the members of the treatment group of CCC graduates. To create the comparison group, Heldrich Center researchers used data from the New Jersey Consumer Report Card (CRC) of training providers. CRC is the definitive resource for obtaining information on occupational training programs in New Jersey. Training providers upload student record data, including program of study, date of graduation, and social security number. Demographic data on CRC is sparse and, as a result, the Heldrich Center did not have data on key personal attributes, such as age, sex, race, or education for comparison group members. To calculate labor market attachment and earnings histories for treatment and comparison group members, Heldrich Center researchers used the social security numbers from CCC graduates and from CRC data to match them with the New Jersey Unemployment Insurance (UI) wage record data system. UI wage data records the wages of all employees at employers that report wages every quarter in the course of paying their UI taxes, allowing Heldrich Center researchers to determine whether treatment and comparison group members were employed in New Jersey in a particular calendar quarter and how much they earned. The New

Jersey UI wage data do not contain any earnings or employment information on anyone working outside of New Jersey.

## Strengths and Limitations of this Design

The research design that guides this study has a number of strengths as well as some important limitations. One strength of this study is that it uses high-quality, longitudinal wage information from New Jersey's UI wage record database, enabling the researchers to construct a detailed employment and earnings history for each treatment and comparison group member. Prior employment and earnings are incredibly valuable variables to include in the model because they can proxy for some of the characteristics researchers are unable to measure that are correlated with post-program earnings.

Second, the use of a difference-in-differences design enables the researchers to mitigate the problems caused by missing data on some important key variables in the data sources. By employing a fixed effects (difference-in-differences) design, this study compares each person to herself over time, permitting the researchers to control for the time invariant attributes, such as sex and race, and slow-changing characteristics, such as a person's highest level of education, that are not available in the data for the comparison group. Third, most studies of training use as the comparison group individuals who did not participate in training (Andersson, Holzer, Lane, Rosenblum, & Smith, 2013; Holtenbeck & Huang, 2006; 2013; Heinrich, Mueser, Troske, Jeon, & Kahvecioglu, 2011). Such a comparison group may not provide the ideal counterfactual because there are reasons — such as degree of motivation to succeed — why people may select into occupational training as opposed to non-training activities that may be correlated with how well those individuals perform in the labor market afterwards. By comparing the outcomes of CCC training graduates to the graduates of other training programs, this study arguably provides a more realistic assessment of the value of completing a CCC training program. Finally, since the CRC collects data on all training programs throughout New

Jersey, in the matching model, the researchers were able to match CCC graduates to comparison group members who participated in an occupational training program in the same field of study (Classification of Instructional Program) in New Jersey, in the same years.

The study, however, faces a number of important limitations. The first relates to data availability. Researchers had a very limited set of covariates on which to conduct the matching. Because of the incompleteness of many data fields in the CRC data, researchers were not able to include critical demographic factors, such as sex, race, and education, in the matching model. These are important factors that previous research has demonstrated can influence employment and earnings, though the researchers' use of the difference-in-differences design helps to mitigate the negative effects of not having these data. The second key limitation is that the CRC data on the comparison group did not include a sufficient number of training graduates to restrict the comparison group to only the counties that the CCC program and its community college partners served. So the labor market that comparison group members entered after training was the entire state. In a geographically small state such as New Jersey, this is less of an issue than for a larger state, but it is nonetheless a limitation worth mentioning.

A few limitations arise from the use of UI wage record data to calculate the employment and earnings outcomes. Since the New Jersey UI wage data do not contain information on the employment and earnings of anyone outside of the state, the researchers were unable to capture the post-training labor market experiences of anyone who found employment in New York or Pennsylvania (or any other state). This could bias the results of this study to the extent that individuals in the treatment group have a different likelihood of finding work outside of New Jersey than those in the comparison group.

The other limitations concern the sample size available for data analysis and the number of post-training quarters of wage data that could be used to calculate individual labor market outcomes. Many of the students CCC served either completed their programs as late as the end of 2015. Because there is a six-month lag in the wage data used to calcu-

late an individual's employment status and earnings, data on some program exiters were not available for the third or fourth quarters after program completion. In order to keep a sufficiently large sample size, the researchers limited their analysis to only the first four quarters after program exit, allowing them to assess the program's effect on short- and medium-term outcomes but not on their long-term labor market success. It is important to note that the limitations discussed here are common in quasi-experimental studies, and the design that the researchers used seeks to mitigate them to the greatest extent possible.

## Data Analysis

### Treatment Group

In total, the study assessed the labor market experiences of 264 individuals who completed either an advanced manufacturing or a utilities program throughout the course of the grant.

### Comparison Group

Heldrich Center researchers created the comparison pool by selecting all individuals who completed training programs at postsecondary institutions other than CCC or its partner colleges in New Jersey in the same occupational fields (Classification of Instructional Program) at the same time as the CCC graduates. The matching section below describes how Heldrich Center researchers created the comparison group by selecting the individuals from the comparison pool who were the most similar to the treatment group members.

### Variables

For the quasi-experimental evaluation, Heldrich Center researchers constructed a number of different variables from the data. Center researchers constructed two sets of dependent variables, one set for studying an individual's change in employment status, the other for studying his change in earnings. The change in employment status variables measured three conditions:

1. Whether an individual's employment status **changed for the better** from three quarters before training to after completing training,
2. Whether an individual's employment status three quarters before the start of training **stayed the same** after the completion of training (either an unemployed individual remained unemployed or an employed individual remained employed), and
3. Whether an individual's employment status **changed for the worse** from three quarters before training to after completing training.

The researchers measured employment status after training at four different points in time: the first full quarter after training completion, the second full quarter after training completion, the third full quarter after completion, and the fourth full quarter after completion. Employment status in each of these quarters was compared to the individual's employment status three quarters prior to the start of training.

To measure change in earnings, Heldrich Center researchers created three variables by subtracting the average quarterly earnings that treatment and comparison group members received in quarters 3 through 6 before the start of training from the amount they earned in the first, second, third, and fourth quarters, respectively, after training completion.

Heldrich Center researchers created two variables that they used to match treatment group members (i.e., CCC TAACCCT graduates) with individuals in the CRC comparison pool. The **prior earnings** variable measures an individual's total earnings in New Jersey in quarters 3 through 6 prior to the start of training. To get a sense of the trainees' pre-training labor market attachment, Heldrich Center researchers calculated the proportion of the 20 quarters prior to training in which trainees were employed. The **prior labor market attachment** variable measures the number of quarters in the past five years that a person earned wages greater than zero in New Jersey.

## Labor Market Histories of Treatment Group and Comparison Pool Members (Pre-Matching)

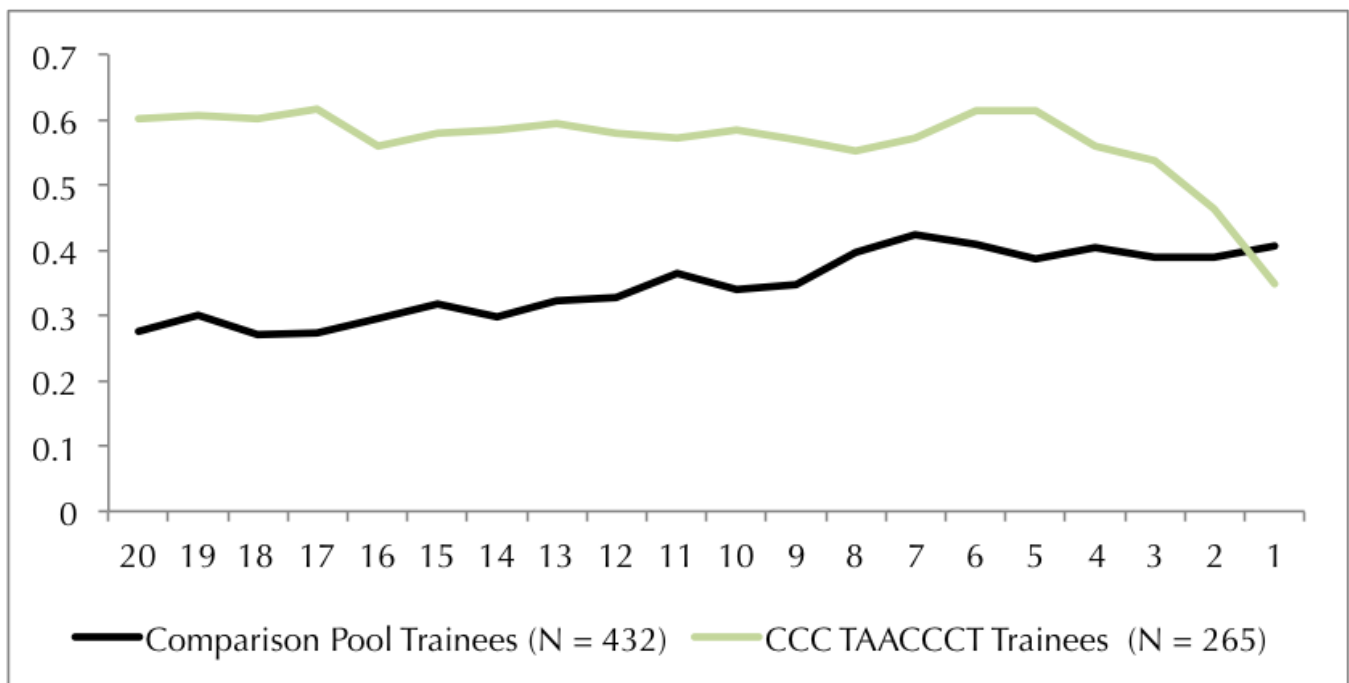
The individuals in the comparison pool have participated in similar training experiences to the CCC TAACCCT students. Although their training experiences may be comparable, it is not necessarily the case that the comparison pool students are truly comparable to the TAACCCT students. It is, therefore, necessary to filter out the individuals in the comparison pool who are very different from the treatment group individuals. The critical filter that the researchers applied is the degree of similarity between the groups' labor market histories. This section, therefore, examines the extent of similarity and dissimilarities between these groups' labor market histories.

The treatment group members (i.e., the CCC TAACCCT grant program trainees) were significantly different from the comparison pool of training

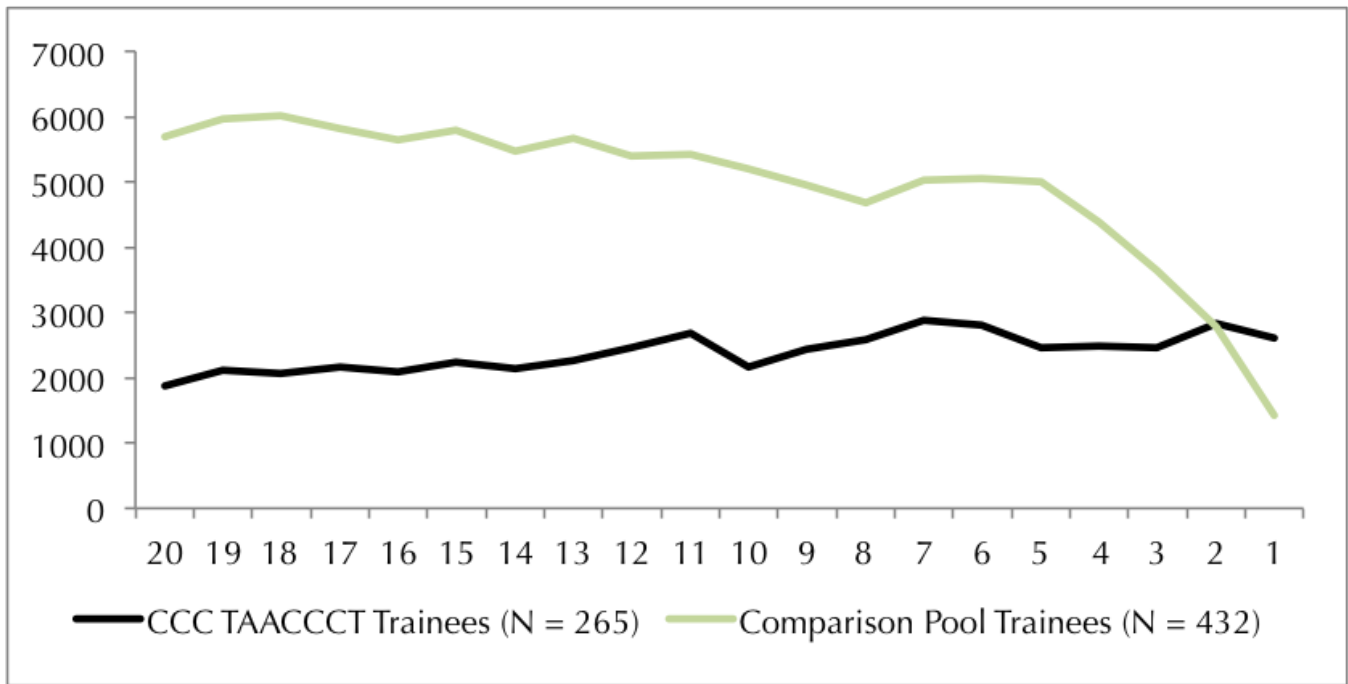
graduates on both dimensions of their labor market histories. Figure 1 displays the divergent degrees of labor market attachment for the comparison pool relative to the treatment group for each of the 20 quarters before training. In general, the treatment group members had much stronger labor market attachment prior to training than the comparison pool, but in the two most recent quarters before training, they were somewhat less likely to be employed than the individuals from whom the comparison group is being drawn.

Figure 2 shows that the average treatment group member earned significantly higher wages per quarter throughout the sample period than the average individual in the comparison pool. Again, the CCC TAACCCT program students showed stronger labor market histories than their counterparts who sought training elsewhere. For most of the period, the CCC TAACCCT trainees earned between \$2,000 and \$4,000 more per quarter than the non-TAACCCT students.

**FIGURE 1. PERCENT OF TREATMENT GROUP AND COMPARISON POOL MEMBERS EMPLOYED BY QUARTER IN THE 20 QUARTERS BEFORE STARTING TRAINING**



**FIGURE 2. QUARTERLY EARNINGS TRAJECTORY OF TREATMENT GROUP AND COMPARISON POOL MEMBERS IN THE 20 QUARTERS BEFORE STARTING TRAINING**



Clearly, there are vast differences between the comparison pool and the treatment group in terms of both labor market attachment and earnings before training. Supporting the trends shown in Figure 2, t-tests comparing mean earnings in quarters 3 through 6 before enrollment in training combined as well as of the mean of the natural log of earnings in quarters 3 through 6 before enrollment combined yields statistically significant differences between the treatment and comparison groups. It is, therefore, necessary to select from the comparison pool those individuals with the most similar employment histories to the individuals that CCC served. The statistical matching methods are, therefore, critical to ensuring only the non-TAACCCT trainees with the most similar labor market histories to the TAACCCT trainees are selected into the comparison group.

### Matching

Heldrich Center researchers used matching methods (described below) to select for the comparison group individuals who are highly similar to the trainees on their pre-training employment and earnings histories. Matching methods are powerful methods for identifying observations that are

as similar to one another as possible in terms of their observable characteristics. In a perfect world, every observation in the treatment group would have a matching observation that was identical in every way except for the receipt of the treatment. Such exact matching is not feasible, so researchers developed propensity score matching (PSM), which calculates for all observations in the treatment group and the comparison pool the probability that each observation received the treatment. Each treatment group observation is then grouped with one (or more observations) from the comparison pool that has (have) the most similar propensity score(s). Although PSM is the most common method used in evaluating training programs, recent discoveries in statistics have found that PSM can lead to biased estimates that misrepresent the true impact of training programs (King & Nielsen, n.d.) and potentially generate worse results than not matching.

Alternative methods, such as genetic matching and Mahalanobis Distance Matching (MDM), and Coarsened Exact Matching, do not suffer from the deficiencies of PSM. Whereas propensity score matching uses a logit model to predict the probability that an individual is in the treatment group and then selects the treatment and comparison



groups comprised of the individuals with the most similar propensity score, MDM measures the distance of a treatment group observation from a set of observations in the comparison pool and matches with the closest comparison observation(s). Likewise, genetic matching has been shown to be an effective method for identifying a comparison group that is very similar to the treatment group (Diamond & Sekhon, 2013). Thus, Heldrich Center researchers used two separate matching procedures: nearest neighbor MDM matching and genetic matching, both of which are not subject to the potential biases of PSM, and evaluated the robustness of the results across all models. For the matching, researchers used the R package MatchIt. Because the results generated by both matching models were substantially similar, this report presents only the results for the nearest neighbor MDM matching. All of the models presented below use nearest neighbor MDM with replacement, meaning that comparison group observations can be matched with more than one treatment group observation.

Because the researchers had only a limited number of variables, they decided to match treatment and comparison pool members on one earnings variable (total earnings in quarters 3 through 6 before training) and one labor market attachment variable (the proportion of quarters out of the last 20 quarters that the individual was employed). Heldrich

Center researchers used a single matching model, which included a variable for average trainee earnings in the third through the sixth quarters before training (log transformed for normality) and the labor market attachment variable.

Table 1 presents the results of the MDM matching, and shows that the statistical matching methods generated a very well-matched sample for the analysis. The individuals that the matching methods selected for inclusion in the comparison group were generally quite similar to the treatment group members in terms of their pre-program labor market histories.

The limitation of any matching strategy is that, unlike an experiment, it is unable to ensure that the **only** difference between treatment and control group members is that the former received the treatment and the latter did not. In quasi-experimental designs, it is possible that individuals who have identical observable characteristics (i.e., in terms of measurable demographic, prior labor market, and ability variables) may differ in important ways from one another in terms of their unobservable traits, such as their motivation to succeed, their family connections, their social networks, etc. Although Center researchers have created a comparison group that seeks to ensure that the treatment and comparison group individuals are as similar as possible to one another on both observ-

**TABLE 1. POST-MATCH DESCRIPTIVE STATISTICS – MAHALANOBIS DISTANCE MATCHING**

| Quarter after Training when Dependent Variable Measured | Matching Variable                                    | Comparison Group Mean Value | Treatment Group Mean Value | Raw (Unlogged Difference) |
|---|--|-----------------------------|----------------------------|---------------------------|
| 1 and 2   | Natural Log of Earnings Quarters 3-6 Before Training | 6.18                        | 6.17                       | \$5                       |
| 1 and 2   | Prior Labor Market Attachment                        | 11.31                       | 11.27                      | 0.04                      |
| 3   | Natural Log of Earnings Quarters 3-6 Before Training | 6.18                        | 6.17                       | \$5                       |
| 3   | Prior Labor Market Attachment                        | 11.29                       | 11.25                      | 0.04                      |
| 4   | Natural Log of Earnings Quarters 3-6 Before Training | 6.21                        | 6.22                       | \$7                       |
| 4   | Prior Labor Market Attachment                        | 11.30                       | 11.24                      | 0.06                      |

able and unobservable characteristics, it is nonetheless likely that their model does not capture all significant variation between the treatment and comparison groups.

## Statistical Results

This section describes statistical models used and analyses conducted to determine whether CCC graduates achieved better labor market outcomes than a comparison group of training completers. As described in the variables section, this study considers two different dependent variables — changes in employment status in New Jersey and quarterly earnings growth after training — each measured in the first, second, third, and fourth quarters after program completion. Do CCC graduates have a higher probability of employment after training than they had before training relative to the comparison group, and do CCC trainees see their earnings rise more from before training to after training completion than the comparison group? The number of treatment group observations included in each analysis varied depending on the quarter after completion being studied. Because of the six-month lag in the UI wage data and in order to maintain a sufficient sample size, Heldrich Center researchers only calculated employment and earnings outcomes for the first four quarters after program completion. Table 2 displays the number of treatment group observations included in each analysis. These sample sizes are large enough to be able to detect statistically meaningful differences in outcomes between treatment and comparison group members.

**TABLE 2. NUMBER OF TREATMENT AND COMPARISON GROUP OBSERVATIONS BY QUARTER AFTER COMPLETION**

| Group      | Quarters 1 and 2 | Quarter 3 | Quarter 4 |
|------------|------------------|-----------|-----------|
| Treatment  | 264              | 255       | 238       |
| Comparison | 152              | 148       | 138       |

Because the researchers used nearest neighbor matching with replacement, which allowed for a single comparison group member to serve as a control for multiple treatment group members, the dataset on which the analyses were conducted consisted of more treatment than comparison group members.

All models estimated the average effect of the treatment on the treated, and all estimates were regression adjusted using all of the control variables in the matching model (Abadie & Imbens, 2011). Heldrich Center researchers used ordinary least squares (linear regression) to estimate the effect of CCC training on earnings, and an ordered logit model to estimate its effect on trainees’ employment status. Center researchers ran 12 statistical models: 4 models comparing the change in the pre-training to post-training employment status of CCC and comparison group trainees in the first, second, third, and fourth quarters after program completion, and 8 models comparing the earnings growth between the pre-training period and the first, second, third, and fourth quarters after completion.

The results of the statistical tests indicated that the programs had a positive effect on the employment and earnings outcomes of CCC graduates relative to the comparison group. CCC TAACCCT graduates experienced an earnings gain that was about \$600 greater than the comparison group members in the first two quarters after program completion. Previous evaluation reports mentioned that CCC established effective collaborations with local employers that not only provide input into the curriculum, but also helped screen applicants for admission. This close connection with employers likely explains why in the first two quarters after program completion, the students who participated in the CCC TAACCCT program were more likely to be employed and more likely to realize an earnings gain than were very similar individuals who completed manufacturing and utilities programs at other training providers in the state. These effects held, however, only for the first two quarters after program completion. In the third and fourth quarters after completion, the CCC TAACCCT trainees’ employment and earnings outcomes were very similar to those of the comparison group. See Appendix A for detailed, quarter-by-quarter statistical results.

## Conclusion

CCC demonstrated strongly positive results both in terms of achieving positive employment and earnings outcomes for students in each of their first two quarters after program completion, though those positive effects tailed off in the third and fourth quarters. This study employed a quasi-experimental evaluation design using matching and difference-in-differences design. The matching was somewhat limited because of a lack of demographic data on comparison group members, including age, race, sex, and level of education. On the other hand, Center researchers were able to create high-quality measures of the labor market attachment and earnings histories of CCC TAACCCT student and comparison group trainees, and to select comparison group members who were very similar to the CCC graduates on these dimensions. To the extent that individuals' labor market histories proxy for the missing demographic variables, the absence of these variables would not adversely affect the results of this analysis. Although it is likely that labor market history proxies for age, sex, race, and education level to a large degree, it is unlikely that it does so completely, meaning that the researchers cannot rule out the possibility that there are systematic, unobserved differences between the treatment and comparison groups. By exact matching on occupational field and selecting comparison group observations from nearly the same labor market as the treatment group, the researchers somewhat mitigated unobservable factors. In addition, the use of the difference-in-differences design allowed the researchers to compare individuals over time and thus control for the demographic factors that either do not change, race and sex; change at a constant rate over time, age; or change very slowly over short periods of time, level of education.

Finally, although Center researchers were able to study program outcomes up to a full year after program completion, there would be benefits to being able to extend the time horizon of the study. In its grant administration, the U.S. Department of Labor might consider whether it would make sense to set up a mechanism to allow for longer evaluation contracts so that evaluators would have access to larger sample sizes and longer-term outcomes could be studied.

## References

- Abadie, A., & Imbens, G. W. (2011). Bias-corrected matching estimators for average treatment effects. *Journal of Business & Economic Statistics*, 29(1), 1-11.
- Andersson, F., Holzer, H. J., Lane, J. I., Rosenblum, D., & Smith, J. (2013). *Does federally-funded job training work? Nonexperimental estimates of WIA training impacts using longitudinal data on workers and firms*. Washington D.C.: National Bureau of Economic Research.
- Diamond, A., & Sekhon, J. S. (2013). Genetic matching for estimating causal effects: A general multivariate matching method for achieving balance in observational studies. *Review of Economics and Statistics*, 95(3), 932-945.
- Heinrich, C., Mueser, P. R., Troske, K. R., Jeon, K. S., & Kahvecioglu, D. (2011). A nonexperimental evaluation of WIA programs. In *The Workforce Investment Act: Implementation Experiences and Evaluation Findings* (pp. 371-404). Kalamazoo, MI: Upjohn Institute.
- Hollenbeck, K., & Huang, W. (2006). *Net impact and benefit-cost estimates of the workforce development system in Washington State* (No. 06-020). Kalamazoo, MI: Upjohn Institute.
- Hollenbeck, K., & Huang, W. (2013). *Net impact and benefit-cost estimates of the workforce development system in Washington State* (No. 13-029). Kalamazoo, MI: Upjohn Institute.
- King, G., & Nielsen, R. (n.d.). *Why propensity scores should not be used for matching* (working paper).

U.S. Department of Labor, Employment and Training Administration (USDOL-ETA). (2011). *Notice of availability of funds and solicitation for grant applications for Trade Adjustment Assistance Community College and Career Training grants program*. Notice of Solicitation for Grant Applications (SGA) Funding Opportunity Number: SGA/DFA PY 10-03, Catalog of Federal Domestic Assistance Number: 17.282. Washington, D.C.: Author.

## Acknowledgments

The author of this report was William Mabe, Ph.D. Robb C. Sewell provided editorial and graphic design assistance.

This report was funded by a grant from the U.S. Department of Labor, Employment and Training Administration. The findings and conclusions in this report do not necessarily represent the positions, policies, or opinions of the funding organization.

## About the Heldrich Center

The John J. Heldrich Center for Workforce Development at Rutgers University is a university-based organization devoted to transforming the workforce development system at the local, state, and federal levels. The Center, located within the Edward J. Bloustein School of Planning and Public Policy, provides an independent source of analysis for reform and innovation in policy-making and employs cutting-edge research and evaluation methods to identify best practices in workforce development, education, and employment policy. It is also engaged in significant partnerships with the private sector, workforce organizations, and educational institutions to design effective education and training programs. It is also deeply committed to assisting job seekers and workers attain the information, education, and skills training they need to move up the economic ladder.

As captured in its slogan, "Solutions at Work," the Heldrich Center is guided by a commitment to translate the strongest research and analysis into practices and programs that companies, communi-

ty-based organizations, philanthropy, and government officials can use to strengthen their workforce and workforce readiness programs, create jobs, and remain competitive. The Center's work strives to build an efficient labor market that matches workers' skills and knowledge with the evolving demands of employers. The Center's projects are grounded in a core set of research priorities:

- > Disability Employment
- > Education and Training
- > Unemployment and Reemployment
- > U.S. Labor Market and Industry
- > Workforce Policy and Practice
- > Work Trends Surveys

Learn more: [www.heldrich.rutgers.edu](http://www.heldrich.rutgers.edu)

Rutgers University is an equal opportunity/affirmative action institution providing access to education and employment without regard to race, religion, color, national origin, ancestry, age, sex, sexual orientation, gender identity and expression, disability, genetic information, atypical hereditary cellular or blood trait, marital status, civil union status, domestic partnership status, military service, veteran status, and any other category protected by law.

## Appendix A. Detailed Statistical Results

**TABLE A1. LOG DIFFERENCE IN EARNINGS IN FIRST QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| variable                             | estimate | std.error | statistic | p.value |
|--------------------------------------|----------|-----------|-----------|---------|
| (Intercept)                          | 3.17     | 0.43      | 7.30      | 0.00    |
| <b>Participation in TAACCCT</b>      | 0.78     | 0.38      | 2.03      | 0.04    |
| Pre-Training Quarterly Wages         | 0.27     | 0.07      | 3.73      | 0.00    |
| Pre-Training Labor Market Attachment | 0.07     | 0.04      | 1.62      | 0.11    |

**TABLE A2. LOG DIFFERENCE IN EARNINGS IN SECOND QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| variable                             | estimate | std.error | statistic | p.value |
|--------------------------------------|----------|-----------|-----------|---------|
| (Intercept)                          | 3.29     | 0.45      | 7.29      | 0.00    |
| <b>Participation in TAACCCT</b>      | 0.66     | 0.40      | 1.65      | 0.10    |
| Pre-Training Quarterly Wages         | 0.26     | 0.08      | 3.48      | 0.00    |
| Pre-Training Labor Market Attachment | 0.07     | 0.04      | 1.57      | 0.12    |

**TABLE A3. LOG DIFFERENCE IN EARNINGS IN THIRD QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 403)**

| variable                             | estimate | std.error | statistic | p.value |
|--------------------------------------|----------|-----------|-----------|---------|
| (Intercept)                          | 2.69     | 0.47      | 5.74      | 0.00    |
| <b>Participation in TAACCCT</b>      | 0.31     | 0.41      | 0.74      | 0.46    |
| Pre-Training Quarterly Wages         | 0.39     | 0.08      | 4.90      | 0.00    |
| Pre-Training Labor Market Attachment | 0.04     | 0.04      | 0.86      | 0.39    |

**TABLE A4. LOG DIFFERENCE IN EARNINGS IN FOURTH QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 376)**

| variable                             | estimate | std.error | statistic | p.value |
|--------------------------------------|----------|-----------|-----------|---------|
| (Intercept)                          | 3.18     | 0.51      | 6.27      | 0.00    |
| <b>Participation in TAACCCT</b>      | -0.14    | 0.44      | -0.31     | 0.75    |
| Pre-Training Quarterly Wages         | 0.25     | 0.09      | 2.88      | 0.00    |
| Pre-Training Labor Market Attachment | 0.10     | 0.05      | 2.03      | 0.04    |

**TABLE A5. LOG DIFFERENCE-IN-DIFFERENCES IN EARNINGS IN FIRST QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | 1.89            | 0.46             | 4.09             | 0.00           |
| <b>Participation in TAACCCT</b>      | 0.92            | 0.43             | 2.16             | 0.03           |
| Pre-Training Labor Market Attachment | -0.23           | 0.03             | -7.38            | 0.00           |

**TABLE A6. LOG DIFFERENCE-IN-DIFFERENCES IN EARNINGS IN SECOND QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | 1.99            | 0.48             | 4.18             | 0.00           |
| <b>Participation in TAACCCT</b>      | 0.79            | 0.44             | 1.81             | 0.07           |
| Pre-Training Labor Market Attachment | -0.23           | 0.03             | -7.23            | 0.00           |

**TABLE A7. LOG DIFFERENCE-IN-DIFFERENCES IN EARNINGS IN THIRD QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 403)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | 1.61            | 0.48             | 3.36             | 0.00           |
| <b>Participation in TAACCCT</b>      | 0.42            | 0.44             | 0.94             | 0.35           |
| Pre-Training Labor Market Attachment | -0.21           | 0.03             | -6.56            | 0.00           |

**TABLE A8. LOG DIFFERENCE-IN-DIFFERENCES IN EARNINGS IN FOURTH QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 376)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | 1.73            | 0.53             | 3.28             | 0.00           |
| <b>Participation in TAACCCT</b>      | 0.11            | 0.48             | 0.23             | 0.82           |
| Pre-Training Labor Market Attachment | -0.21           | 0.04             | -5.95            | 0.00           |

**TABLE A9. DIFFERENCE-IN-DIFFERENCES IN EMPLOYMENT RATES IN FIRST QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | -0.64           | 0.25             | -2.56            | 0.01           |
| <b>Participation in TAACCCT</b>      | 0.51            | 0.23             | 2.17             | 0.03           |
| Pre-Training Quarterly Wages         | 0.14            | 0.04             | 3.30             | 0.00           |
| Pre-Training Labor Market Attachment | 0.04            | 0.02             | 1.66             | 0.10           |

**TABLE A10. DIFFERENCE-IN-DIFFERENCES IN EMPLOYMENT RATES IN SECOND QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 416)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | -0.60           | 0.25             | -2.42            | 0.02           |
| <b>Participation in TAACCCT</b>      | 0.43            | 0.23             | 1.88             | 0.06           |
| Pre-Training Quarterly Wages         | 0.14            | 0.04             | 3.32             | 0.00           |
| Pre-Training Labor Market Attachment | 0.03            | 0.02             | 1.38             | 0.17           |

**TABLE A11. DIFFERENCE-IN-DIFFERENCES IN EMPLOYMENT RATES IN THIRD QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 403)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | -0.81           | 0.26             | -3.15            | 0.00           |
| <b>Participation in TAACCCT</b>      | 0.20            | 0.23             | 0.84             | 0.40           |
| Pre-Training Quarterly Wages         | 0.19            | 0.04             | 4.54             | 0.00           |
| Pre-Training Labor Market Attachment | 0.01            | 0.02             | 0.58             | 0.56           |

**TABLE A12. DIFFERENCE-IN-DIFFERENCES IN EMPLOYMENT RATES IN FOURTH QUARTER AFTER TRAINING BETWEEN TREATMENT AND COMPARISON GROUPS (N = 376)**

| <b>variable</b>                      | <b>estimate</b> | <b>std.error</b> | <b>statistic</b> | <b>p.value</b> |
|--------------------------------------|-----------------|------------------|------------------|----------------|
| (Intercept)                          | -0.54           | 0.26             | -2.05            | 0.04           |
| <b>Participation in TAACCCT</b>      | -0.04           | 0.24             | -0.16            | 0.87           |
| Pre-Training Quarterly Wages         | 0.10            | 0.04             | 2.38             | 0.02           |
| Pre-Training Labor Market Attachment | 0.05            | 0.02             | 2.04             | 0.04           |