

Online Appendix: Way Station or Launching Pad? Unpacking the Returns to Adult Technical Education*

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This appendix contains supplementary figures and results referenced in the text.

Figure A1 is a Sankey diagram comprehensively depicting the set of industrial transitions that students made following TCAT enrollment. The left side of the figure tabulates student representation in each broad industry class prior to TCAT enrollment, and the right side tabulates their post-TCAT industries. The diagram illustrates a large net increase in the number of students working in the health industry, a smaller increase in education workers, a net decrease in manufacturing employment, and a net decrease in food service, accommodation, and retail industries.

As we show in Section 4.1 and Figure 2 of the main text, our preferred specification of Equation 2 does not tend to find effects of TCAT credentials where there should be none, namely, in quarters prior to enrolling. This model is quite flexible, allowing individuals' inherent productivity levels and trends to be correlated with their educational attainment. Nevertheless, Equation 2 may be vulnerable to non-linear underlying trends in student productivity. Table A1 in this appendix considers non-linear heterogeneity in the context of a linear specification.

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Specifically, we estimate Equation 2, limiting the sample to student-quarters prior to enrollment, and in lieu of post-enrollment certificate or diploma receipt, we interact a quadratic trend with indicators of future attainment. Table A1 shows that completers exhibited small, negative, second-order patterns of earnings and employment prior to enrolling in a TCAT. It could be that inherently upwardly mobile students are *less* apt to complete a TCAT program, perhaps because they are better able to find work without technical education. Or it could be the case that higher-ability individuals need a particularly disruptive unemployment or underemployment spell to invest time in postsecondary education. The net direction and magnitude of bias is unclear, particularly since reversion to the mean may benefit students who experienced a steep pre-enrollment decline in employment and earnings. Matching designs discussed in the main text help to allay this concern by pairing students with donors who followed a quantitatively similar path of earnings prior to enrolling. Later in this appendix, we present results under a specification of Equation 2 that allows for quadratic individual time trends ($\delta_{1i}t + \delta_{2i}t^2$). Under both alternatives, returns to completion are attenuated but remain positive and statistically significant for diplomas.

Figure A2 replicates the pre-enrollment permutation test discussed in Section 4.1 of the main text. Panels I-II are identical to Figure 2, with the addition of a solid vertical line signifying point estimates from our main linear results in the top panel of Table 2. Three salient conclusions emerge. First, fixed effects specifications of Equation 2 are much less balanced than specifications with fixed effects and time trends, in a way that does not favor completers. Earnings and employment placebo distributions of treatment effects for the former are centered at negative point estimates, whereas distributions for iterations with time trends are centered at or close to zero. Second, Panels III-IV show that these models are both relatively balanced for $\ln(\text{earnings})$,

with a larger spread of false point estimates arising from placebo certificate completion. And third, “true” treatment effect estimates for diploma receipt are more exceptional and farther out in the right tail of their respective placebo distributions than estimated returns to certificates.

Tables A2-A4 list results from our preferred, most flexible parametric specification of Equations 2 and 3 alongside four alternative sample constructions. Specification checks for earnings are reported in Table A2, Table A3 has results for log earnings, and Table A4 has results for employment, i.e., having any non-zero, non-missing earnings in a particular quarter. Baseline results from Tables 2 and 4 are repeated in Columns 1 and 6 of each table.

Columns 2 and 7 of Tables A2-A4 report results when we exclude students who completed a certificate within one quarter or a diploma within two. The empirical concern with particularly fast completers is that they may have been enrolled prior to 2004, understating their counterfactual earnings in the absence of TCAT credentials and potentially overstating the estimated effect of those credentials on later earnings. But Columns 2 and 7 across Appendix Tables A2-A4 do not support such a story; on the contrary, estimated returns tend to grow when we omit students who complete a TCAT diploma or certificate within one or two quarters. Columns 3 and 8 results are derived from samples without younger TCAT entrants who enrolled when they were age 20-24. Results are similar to the baseline model, with some notable attenuation in the effect of TCAT diplomas and industrial mobility on $\ln(\text{earnings})$. Columns 4 and 9 represent balanced samples where, for each student, we include an equal number of pre-enrollment and post-enrollment quarters, with that number equal to the minimum number of quarters in the earnings data on either side of enrolling. This is not our preferred characterization since it conditions the sample on post-enrollment outcomes. Baseline results are similar but typically more conservative than those from a balanced panel. Finally, Columns 5 and 10 of Tables A2-A4 condition the sample on

having at least eight quarters of earnings prior to enrollment. We lose 14% of individuals from the main analytical sample, but results are largely unaffected.

Tables A5-A7 test the sensitivity of Equation 2-3 results to alternative specifications of the model itself. First, we replicate Equations 2 and 3 with standard errors clustered by school rather than student (Columns 2 and 9). Standard errors grow, but not to the point that statistical significance changes. Next, we control for quadratic functions of age interacted with time-invariant demographics (race, gender, and the incidence of missing data on these features) rather than third-degree polynomial interactions (Columns 3 and 10). Columns 4 and 11 omit these interactions altogether. Our conclusion from these modifications is that the age-by-demographic profile is not critical to our main results, which is also true for the matching design inherent to Figure 3 of the main text. Columns 5 and 12 of Tables A5-A7 control for quadratic rather than linear individual time trends. We find that employment (A7), and therefore earnings including zeros (A5), are most affected by this change, with quarterly returns to diploma receipt falling from \$1,034 to \$638. Columns 6 and 13 of this series of specification checks substitute lagged and leading enrollment indicators with $1/k_{it}$, where k_{it} is the number of quarters until or since TCAT entry. Results are not sensitive to how we control for short-term, enrollment-driven deviations from long-term trends.

Columns 7 and 14 of Tables A5-A7 list estimates when we control for second certificate attainment. This has little bearing on estimated returns to first certificates and diplomas, but there are significantly negative earnings and $\ln(\text{earnings})$ returns to second certificates. Again, we note that “stacking” certificates was less common in 2004-2008 TCATs than in later years and other settings, and that these data archive highest attained credentials rather than the sequence of every certificate or diploma. Second certificates are rare in the panel, affecting less than one

percent of students (second diplomas are even rarer). Second credentials likely signal completion of a second and distinct certificate program, in which case negative yields are consistent with survey evidence that degree completers are penalized for spending more time enrolled (Flores-Lagunes & Light, 2010).

Tables A8-A10 study the importance of different levels of controls in shaping Equation 2 and 3 results. Baseline models are represented in Columns 4 and 10, with more restrictive specifications (with fewer controls) to the left and more flexible specifications to the right. Columns 1 and 7 report versions of these linear models with attainment indicators and student fixed effects alone. Columns 2 and 8 add linear student time trends, and much like Dynarski et al. (2017), we find them to be important to inferences about the return to sub-associate credentials. Focusing on the top panel of Table A8, the addition of student time trends turn a \$195 penalty from certificate receipt to a \$232 premium and nearly doubles the corresponding diploma premium to \$1,346. Recalling Figure A1 in this appendix, our conclusion is that fixed effects specifications appear to perpetuate negative pre-existing trends among Tennessee's certificate and diploma completers. Columns 3 and 9 add third-degree polynomial functions of age interacted with demographics, and Columns 4 and 10 add a vector of lagged and leading indicators around enrollment, bringing us to our baseline Equation 2 and 3 specifications. These additions have minor consequences for point estimates when compared to the effect of adding student-specific time trends. Controls for enrollment proximity and age-by-demographic profiles explain away a negative $\ln(\text{earnings})$ return to TCAT certificates for students who do not change industries (Table A9), increase and sharpen the estimate of $\ln(\text{earnings})$ returns to TCAT diplomas paired with industrial mobility (also Table A9), and notably decrease the employment return to a TCAT diploma in Table A10.

Columns 5 and 11 represent a model with controls for Pell eligibility, which may be endogenous to TCAT enrollment. Students – particularly completers – may become Pell eligible as they substitute school for work. Main results attenuate somewhat, but not to a point where we would consider Pell a strong mediating factor in TCAT premia. The last variant of Tables A8-A10, found in Columns 6 and 12, is a model where we add industry fixed effects. Industry fixed effects are left out of our preferred model because we find evidence to suggest that industrial choice is an outcome of technical college participation. Industry fixed effects attenuate the estimated return to TCAT certificates and diplomas by a large degree. This is to be expected since we showed in Table 4 of the main text that portions of the returns to these credentials are attributable to industrial mobility. Earnings gains from diplomas remain significantly positive at \$630, suggesting that returns to diplomas are not operating exclusively through choice of industry, although that may be the case for TCAT certificates. These insights are consistent with what we report from Table 4 in Section 5.3.

Appendix Tables A11-A13 compare baseline Equation 2 and 3 results for earnings and employment returns (Columns 1 and 9 in each table) to returns for particular subgroups of interest: women, men, white students, non-white students, students less than 36 years old at entry, students 36 and over, and students who filed for financial aid using the Free Application for Federal Student Aid (FAFSA). A few patterns stand out across these subgroup analyses. First, women tend to derive larger earnings returns to diplomas than men, and women who earn a TCAT credential and change industries benefit more than their male counterparts in terms of earnings and employment. Second, white students accrue larger returns to TCAT credentials than non-white students, both with and without industrial mobility. Third, while older completers realize larger earnings and employment gains from TCAT credentials, younger completers tends

to fare better with respect to log-earnings and they tend to have more success with a TCAT certificate or diploma in a new industry. One last insight from Tables A11-A13 is that FAFSA completers (just under half of TCAT students) experience weaker returns to TCAT certificates and diplomas.

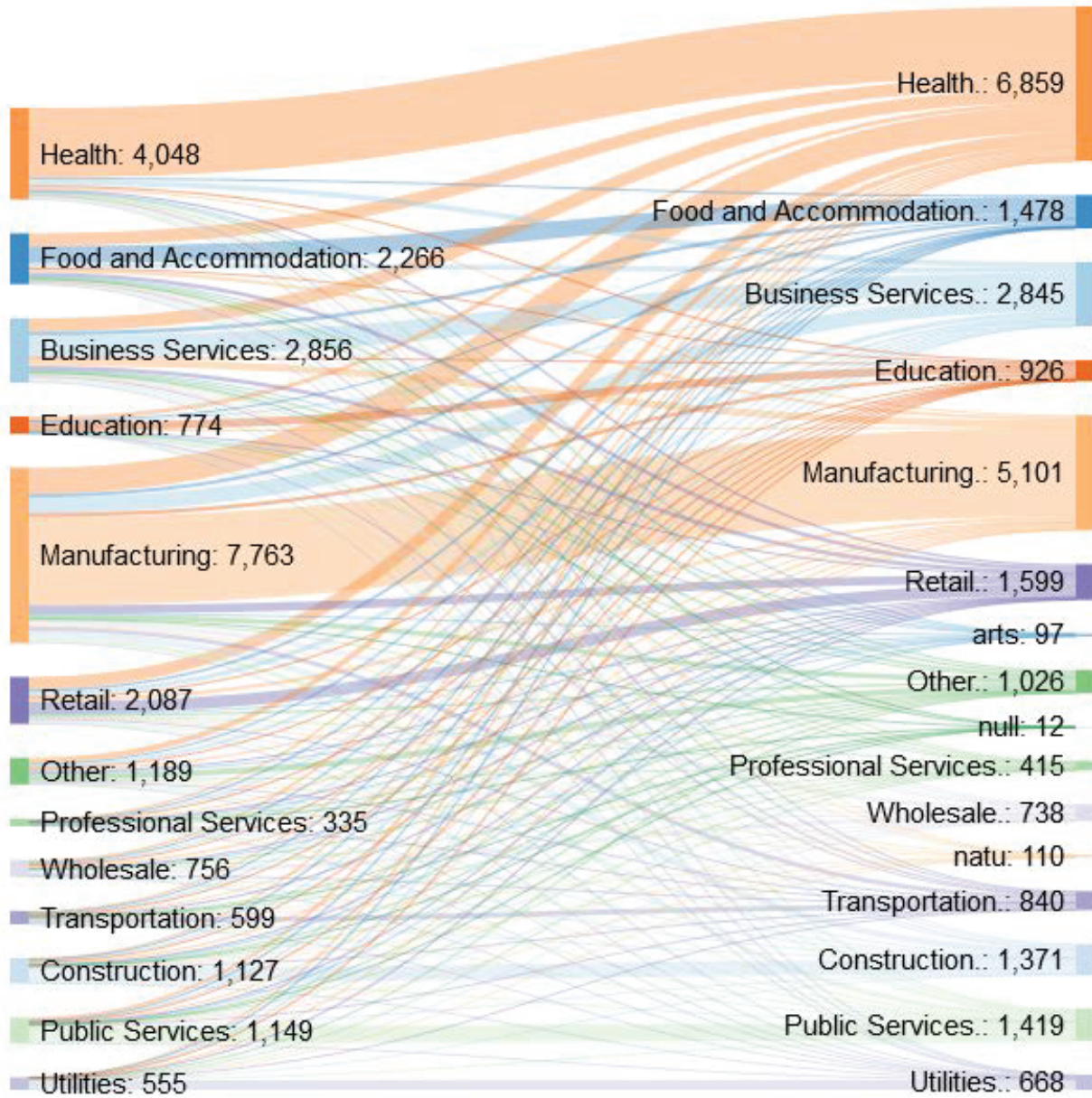
Appendix Figure A3 plots matching results under four variants of our main approach. Baseline results, plotted in Figure 4 of the main text, define the weighting matrix W to include eighteen components: earnings lagged six quarters, seven quarter-to-quarter lagged changes in earnings, contemporaneous full-time employment and six lagged full-time employment indicators, tenure in the earnings data prior to enrolling, contemporaneous industrial score, and a six-quarter-lagged industrial score. Here, the “fewer lags” model compresses the scope of earnings and full-time employment lags to four quarters rather than six. The “earning pattern only” model omits full-time indicators, tenure, and industrial score data from W . The “fewer lags, long difference” model includes six-quarter lagged earnings, the change in earnings from six lagged quarters to the present quarter, one- and six-quarter lagged full-time employment, tenure, contemporaneous industrial score, and six-quarter-lagged industrial score. And the fourth variant omits the industrial score. Statistically significant average treatment effects are noted with markers. As in Figure 4, we find that matched pre-enrollment earnings are subjectively close to zero and that post-enrollment earnings climb relative to those of matched non-students. Three to four years after enrolling, earnings gaps measure \$600 - \$1,100 under these alternative models, versus \$800 - \$1,000 under our preferred set of matching covariates.

References

Dynarski, S., Jacob, B., & Kreisman, D. (2017). How Important Are Fixed Effects and Time Trends in Estimating Returns to Schooling? Evidence From A Replication of Jacobson, Lalonde and Sullivan, 2005. Working Paper.

Flores-Lagunes, A., & Light, A. (2010). Interpreting degree effects in the returns to education. *Journal of Human Resources*, 45(2), 439–467.

Figure A1. Industrial mobility: modal industries of employment before and after enrollment, by sector



NOTES: $N_i = 33,522$ TCAT students with known industries of occupation before and after enrollment.

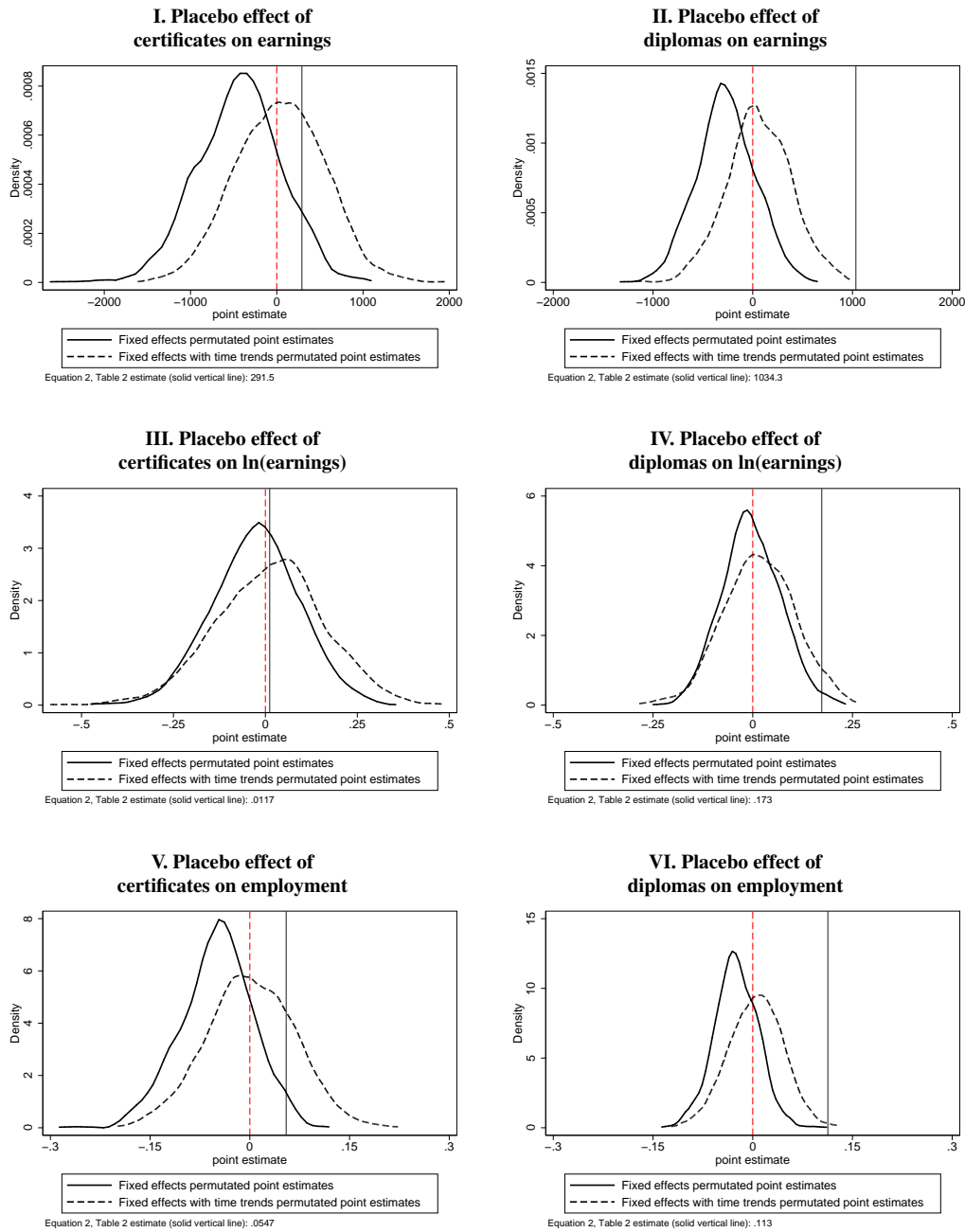
Table A1. Pre-enrollment quadratic trends in earnings, by eventual attainment

	(1)	(2)	(3)
Outcome (quarterly)	Earnings	ln(Earnings)	Any earnings (0,1)
$t^2 \times$ certificate earner	-3.871*** (0.522)	-0.000865*** (0.000130)	-0.000236*** (0.0000575)
$t^2 \times$ diploma earner	-4.187*** (0.339)	-0.000795*** (0.0000784)	-0.000353*** (0.0000364)
N_{it} (student-quarters)	773,105	636,048	773,105
N_i (students)	39,877	39,877	39,877

NOTES: The table lists results of Equation 2 for quarters prior to initial enrollment, without the E_{it} vector of time-varying attainment, but with interactions $t^2 \times \bar{E}_i$, where t^2 is a quadratic trend and \bar{E}_i represents a pair of indicators for future certificate or diploma receipt.

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure A2. Permuted point estimates: false returns to pre-enrollment TCAT certificates and diplomas



NOTES: Figures plot the distribution of point estimates from 1,000 iterations of Equation 2 for random one percent samples of students, limited to pre-enrollment quarters, with placebo attainment assigned to random quarters for those who later attained TCAT diplomas or certificates. Solid-line densities represent permutation results for specifications without individual time trends, and dashed-line densities represent permutation results for specifications with individual time trends. Solid vertical lines correspond with estimates of true Equation 2 estimates reported in Table 2 of the main text.

Table A2. Alternative sample constructions for Equations 2 and 3 - earnings returns to TCAT certificates and diplomas

Equation 2 sample	(1)	(2)	(3)	(4)	(5)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	291.5*** (59.23)	387.5*** (80.48)	300.0*** (74.92)	322.2*** (56.05)	267.4*** (67.69)
TCAT diploma	1034.3*** (36.88)	1237.9*** (40.92)	1076.9*** (44.85)	1085.3*** (35.53)	1045.1*** (40.46)
N_{it} (student-quarters)	1,447,619	1,282,652	1,173,829	1,211,495	1,280,221
N_i (students)	39,877	35,236	30,967	39,877	34,150
Adjusted R^2	0.720	0.727	0.713	0.731	0.710
Equation 3 sample	(6)	(7)	(8)	(9)	(10)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	135.9 (103.8)	179.7 (148.4)	212.4 (132.0)	239.7** (94.75)	154.2 (115.4)
TCAT diploma	1041.2*** (62.77)	1277.0*** (70.54)	1129.0*** (75.22)	1005.6*** (60.90)	1086.5*** (66.60)
TCAT certificate \times ind mobility	459.2*** (128.0)	495.8*** (185.4)	424.8*** (163.8)	366.1*** (119.2)	424.5*** (143.3)
TCAT diploma \times ind mobility	192.7** (75.36)	190.1** (84.70)	160.1* (91.03)	286.5*** (72.98)	136.7* (80.49)
N_{it} (student-quarters)	1,220,031	1,071,572	973,820	1,015,192	1,088,893
N_i (students)	33,522	29,341	25,504	33,522	28,939
Adjusted R^2	0.704	0.712	0.697	0.712	0.697

NOTES: The dependent variable in each column is quarterly inflation-adjusted earnings, with zero assumed for missing earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 1 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 9 and also in Column 1 of Table 4 of the main text. Columns 2-5 and 7-10 deviate from the baseline Equation 2 or Equation 3 specification in four different ways. Column 2 and 7 specifications omit students who attain a certificate within one quarter of enrolling or attain a diploma within two quarters. Column 3 and 8 report results excluding younger students who enter a TCAT between the ages of 20 and 24. Column 4 and 9 results are from a balanced panel with the same number of quarters before and after initial TCAT enrollment. The number of quarters included for each student is equal to the minimum of her non-censored quarters before or after enrollment. Last, Column 5 and 10 specifications limit the sample to students with at least eight quarters of earnings prior to TCAT enrollment. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A3. Alternative sample constructions for Equations 2 and 3 - $\ln(\text{earnings})$ returns to TCAT certificates and diplomas

Equation 2 sample	(1)	(2)	(3)	(4)	(5)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	0.0117 (0.0165)	0.0106 (0.0238)	-0.000245 (0.0195)	0.00237 (0.0173)	-0.00125 (0.0172)
TCAT diploma	0.173*** (0.0105)	0.202*** (0.0120)	0.156*** (0.0124)	0.174*** (0.0111)	0.169*** (0.0110)
N_{it} (student-quarters)	1,110,763	988,731	910,911	914,760	1,027,671
N_i (students)	39,877	35,236	30,967	39,652	34,150
Adjusted R^2	0.594	0.604	0.588	0.609	0.585
Equation 3 sample	(6)	(7)	(8)	(9)	(10)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	-0.0379 (0.0240)	-0.0233 (0.0326)	-0.0240 (0.0280)	-0.0246 (0.0248)	-0.0397 (0.0247)
TCAT diploma	0.142*** (0.0155)	0.162*** (0.0176)	0.148*** (0.0176)	0.132*** (0.0162)	0.145*** (0.0160)
TCAT certificate \times ind mobility	0.105*** (0.0324)	0.0681 (0.0469)	0.0670* (0.0385)	0.0775** (0.0339)	0.0873*** (0.0338)
TCAT diploma \times ind mobility	0.0640*** (0.0202)	0.0771*** (0.0233)	0.0303 (0.0236)	0.0859*** (0.0216)	0.0526** (0.0210)
N_{it} (student-quarters)	970,555	856,212	784,563	797,187	897,021
N_i (students)	33,522	29,341	25,504	33,513	28,939
Adjusted R^2	0.573	0.582	0.566	0.586	0.565

NOTES: The dependent variable in each column is the natural log of non-missing quarterly inflation-adjusted earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 2 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 9 and also in Column 2 of Table 4 of the main text. Columns 2-5 and 7-10 deviate from the baseline Equation 2 or Equation 3 specification in four different ways. Column 2 and 7 specifications omit students who attain a certificate within one quarter of enrolling or attain a diploma within two quarters. Column 3 and 8 report results excluding younger students who enter a TCAT between the ages of 20 and 24. Column 4 and 9 results are from a balanced panel with the same number of quarters before and after initial TCAT enrollment. The number of quarters included for each student is equal to the minimum of her non-censored quarters before or after enrollment. Last, Column 5 and 10 specifications limit the sample to students with at least eight quarters of earnings prior to TCAT enrollment. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A4. Alternative sample constructions for Equations 2 and 3 - employment returns to TCAT certificates and diplomas

Equation 2 sample	(1)	(2)	(3)	(4)	(5)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	0.0547*** (0.00680)	0.0651*** (0.00966)	0.0629*** (0.00807)	0.0663*** (0.00703)	0.0486*** (0.00731)
TCAT diploma	0.113*** (0.00434)	0.136*** (0.00495)	0.126*** (0.00503)	0.128*** (0.00444)	0.113*** (0.00455)
N_{it} (student-quarters)	1,447,619	1,282,652	1,173,829	1,211,495	1,280,221
N_i (students)	39,877	35,236	30,967	39,877	34,150
Adjusted R^2	0.430	0.436	0.449	0.460	0.402
Equation 3 sample	(6)	(7)	(8)	(9)	(10)
Baseline model	✓				
Exclude early completers		✓			
Exclude age 20-24 entrants			✓		
Balanced panel				✓	
With ≥ 8 quarters pre-TCAT earnings					✓
TCAT certificate	0.0319*** (0.0107)	0.0436*** (0.0161)	0.0477*** (0.0126)	0.0482*** (0.0111)	0.0340*** (0.0110)
TCAT diploma	0.0644*** (0.00731)	0.0843*** (0.00849)	0.0744*** (0.00844)	0.0693*** (0.00768)	0.0728*** (0.00753)
TCAT certificate \times ind mobility	0.0716*** (0.0141)	0.0814*** (0.0211)	0.0725*** (0.0168)	0.0633*** (0.0147)	0.0623*** (0.0147)
TCAT diploma \times ind mobility	0.0923*** (0.00904)	0.102*** (0.0105)	0.104*** (0.0105)	0.104*** (0.00957)	0.0802*** (0.00937)
N_{it} (student-quarters)	1,220,031	1,071,572	973,820	1,015,192	1,088,893
N_i (students)	33,522	29,341	25,504	33,522	28,939
Adjusted R^2	0.355	0.359	0.368	0.382	0.328

NOTES: The dependent variable in each column is the binary existence of non-zero earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 3 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 9 and also in Column 3 of Table 4 of the main text. Columns 2-5 and 7-10 deviate from the baseline Equation 2 or Equation 3 specification in four different ways. Column 2 and 7 specifications omit students who attain a certificate within one quarter of enrolling or attain a diploma within two quarters. Column 3 and 8 report results excluding younger students who enter a TCAT between the ages of 20 and 24. Column 4 and 9 results are from a balanced panel with the same number of quarters before and after initial TCAT enrollment. The number of quarters included for each student is equal to the minimum of her non-censored quarters before or after enrollment. Last, Column 5 and 10 specifications limit the sample to students with at least eight quarters of earnings prior to TCAT enrollment. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A5. Other specifications of Equations 2 and 3 - earnings returns to TCAT certificates and diplomas

Equation 2 specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline	✓	.					
St. err clustered by campus		✓					
Quadratic $f(age_{it} \times X_i)$			✓				
Omitted $f(age_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	291.5*** (59.23)	291.5*** (97.60)	294.3*** (59.30)	310.8*** (59.41)	177.6*** (57.08)	237.5*** (58.77)	311.7*** (59.57)
TCAT diploma	1034.3*** (36.88)	1034.3*** (124.2)	1046.6*** (37.05)	1081.6*** (37.29)	637.7*** (34.99)	1065.6*** (35.57)	1033.9*** (36.87)
2 nd TCAT certificate							-740.0*** (268.3)
N_{it} (student-quarters)	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.720	0.720	0.719	0.719	0.870	0.719	0.720
<u>Equation 3 specification</u>	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Baseline	✓	.					
St. err clustered by campus		✓					
Quadratic $f(age_{it} \times X_i)$			✓				
Omitted $f(age_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	135.9 (103.8)	135.9 (155.5)	139.8 (103.7)	152.5 (103.7)	142.9 (97.54)	101.7 (103.5)	151.1 (115.1)
TCAT diploma	1041.2*** (62.77)	1041.2*** (144.9)	1060.5*** (62.99)	1090.2*** (63.03)	675.0*** (59.53)	1107.9*** (61.92)	1085.4*** (66.59)
TCAT certificate \times ind mobility	459.2*** (128.0)	459.2*** (163.3)	455.8*** (127.8)	458.8*** (127.9)	216.3* (122.0)	459.5*** (128.4)	447.8*** (143.9)
TCAT diploma \times ind mobility	192.7** (75.36)	192.7** (78.98)	183.6** (75.56)	192.3** (75.70)	12.73 (72.14)	181.5** (75.63)	138.1* (80.48)
2 nd TCAT certificate							71.96 (488.1)
2 nd TCAT certif \times ind mobility							-1022.5 (700.5)
N_{it} (student-quarters)	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,088,893
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522	28,939
Adjusted R^2	0.704	0.704	0.704	0.704	0.868	0.703	0.697

NOTES: The dependent variable in each column is quarterly inflation-adjusted earnings, with zero assumed for missing earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 1 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 8 and also in Column 1 of Table 4 of the main text. Except for Columns 2 and 9, robust standard errors clustered at the student level are in parentheses below each coefficient. Column 3-7 and 10-14 specifications modify controls as indicated.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A6. Other specifications of Equations 2 and 3 - $\ln(\text{earnings})$ returns to TCAT certificates and diplomas

Equation 2 specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline	✓						
St. err clustered by campus		✓					
Quadratic $f(\text{age}_{it} \times X_i)$			✓				
Omitted $f(\text{age}_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	0.0117 (0.0165)	0.0117 (0.0290)	0.00590 (0.0165)	0.00440 (0.0165)	0.0187 (0.0177)	-0.00245 (0.0164)	0.0153 (0.0165)
TCAT diploma	0.173*** (0.0105)	0.173*** (0.0260)	0.166*** (0.0105)	0.169*** (0.0105)	0.120*** (0.0113)	0.173*** (0.0103)	0.173** (0.0105)
2 nd TCAT certificate							-0.123* (0.0680)
N_{it} (student-quarters)	1,110,763	1,110,763	1,110,763	1,110,763	1,110,763	1,110,763	1,110,763
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.594	0.594	0.593	0.593	0.994	0.593	0.594
Equation 3 specification	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Baseline	✓						
St. err clustered by campus		✓					
Quadratic $f(\text{age}_{it} \times X_i)$			✓				
Omitted $f(\text{age}_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	-0.0379 (0.0240)	-0.0379 (0.0363)	-0.0426* (0.0240)	-0.0407* (0.0239)	-0.0121 (0.0256)	-0.0524** (0.0239)	-0.0412* (0.0247)
TCAT diploma	0.142*** (0.0155)	0.142*** (0.0291)	0.138*** (0.0155)	0.145*** (0.0155)	0.0925*** (0.0161)	0.146*** (0.0152)	0.145*** (0.0160)
TCAT certificate \times ind mobility	0.105*** (0.0324)	0.105** (0.0387)	0.104*** (0.0325)	0.105*** (0.0324)	0.0635* (0.0348)	0.102*** (0.0325)	0.0946*** (0.0339)
TCAT diploma \times ind mobility	0.0640*** (0.0202)	0.0640*** (0.0136)	0.0613*** (0.0202)	0.0630*** (0.0203)	0.0482** (0.0215)	0.0549*** (0.0202)	0.0530** (0.0210)
2 nd TCAT certificate							0.0394 (0.107)
2 nd TCAT certificate \times ind mobility							-0.278* (0.159)
N_{it} (student-quarters)	970,555	970,555	970,555	970,555	970,555	970,555	897,021
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522	28,939
Adjusted R^2	0.573	0.573	0.573	0.573	0.994	0.572	0.565

NOTES: The dependent variable in each column is the natural log of non-missing quarterly inflation-adjusted earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 2 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 8 and also in Column 2 of Table 4 of the main text. Except for Columns 2 and 9, robust standard errors clustered at the student level are in parentheses below each coefficient. Column 3-7 and 10-14 specifications modify controls as indicated.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A7. Other specifications of Equations 2 and 3 - employment returns to TCAT certificates and diplomas

Equation 2 specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline	✓						
St. err clustered by campus		✓					
Quadratic $f(age_{it} \times X_i)$			✓				
Omitted $f(age_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	0.0547*** (0.00680)	0.0547*** (0.00930)	0.0565*** (0.00680)	0.0580*** (0.00681)	0.0492*** (0.00695)	0.0532*** (0.00679)	0.0559*** (0.00683)
TCAT diploma	0.113*** (0.00434)	0.113*** (0.0143)	0.116*** (0.00434)	0.119*** (0.00433)	0.0824*** (0.00433)	0.119*** (0.00426)	0.113*** (0.00434)
2 nd TCAT certificate							-0.0454 (0.0281)
N_{it} (student-quarters)	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.430	0.430	0.430	0.430	0.880	0.429	0.430
Equation 3 specification	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Baseline	✓						
St. err clustered by campus		✓					
Quadratic $f(age_{it} \times X_i)$			✓				
Omitted $f(age_{it} \times X_i)$				✓			
Quadratic individual time trends					✓		
1/k displacement control						✓	
2 nd certificate control							✓
TCAT certificate	0.0319*** (0.0107)	0.0319** (0.0127)	0.0333*** (0.0107)	0.0337*** (0.0107)	0.0383*** (0.0110)	0.0379*** (0.0107)	0.0338*** (0.0111)
TCAT diploma	0.0644*** (0.00731)	0.0644*** (0.0145)	0.0676*** (0.00730)	0.0687*** (0.00730)	0.0495*** (0.00717)	0.0805*** (0.00725)	0.0727*** (0.00753)
TCAT certificate \times ind mobility	0.0716*** (0.0141)	0.0716*** (0.0203)	0.0714*** (0.0141)	0.0716*** (0.0141)	0.0427*** (0.0145)	0.0717*** (0.0141)	0.0630*** (0.0148)
TCAT diploma \times ind mobility	0.0923*** (0.00904)	0.0923*** (0.0103)	0.0916*** (0.00903)	0.0926*** (0.00904)	0.0543*** (0.00904)	0.0913*** (0.00907)	0.0802*** (0.00937)
2 nd TCAT certificate							0.00428 (0.0445)
2 nd TCAT certificate \times ind mobility							-0.0286 (0.0647)
N_{it} (student-quarters)	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,088,893
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522	28,939
Adjusted R^2	0.355	0.355	0.355	0.355	0.881	0.354	0.328

NOTES: The dependent variable in each column is the binary existence of non-zero earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 3 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 8 and also in Column 3 of Table 4 of the main text. Except for Columns 2 and 9, robust standard errors clustered at the student level are in parentheses below each coefficient. Column 3-7 and 10-14 specifications modify controls as indicated.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A8. Assessing the importance of controls in Equations 2 and 3 - earnings returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics×f(age)			✓	✓	✓	✓
Enrollment proximity indicators				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	-195.4*** (55.71)	231.9*** (59.05)	222.7*** (58.97)	291.5*** (59.23)	242.6*** (59.25)	50.36 (47.57)
TCAT diploma	696.7*** (38.05)	1345.8*** (35.68)	1303.4*** (35.43)	1034.3*** (36.88)	964.3*** (36.97)	630.3*** (29.73)
N_{it} (student-quarters)	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.621	0.715	0.715	0.720	0.720	0.774
Equation 3	(7)	(8)	(9)	(10)	(11)	(12)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics×f(age)			✓	✓	✓	✓
Enrollment proximity indicators,				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	93.87 (91.96)	101.0 (104.4)	93.01 (104.7)	135.9 (103.8)	80.68 (103.7)	-39.29 (87.43)
TCAT diploma	1284.5*** (60.55)	1445.0*** (62.74)	1400.3*** (62.55)	1041.2*** (62.77)	969.2*** (62.99)	693.3*** (50.56)
TCTA certificate × ind mobility	29.79 (113.8)	462.4*** (130.5)	464.6*** (128.0)	459.2*** (128.2)	459.2*** (130.7)	247.6** (105.3)
TCAT diploma × ind mobility	-515.6*** (73.50)	159.8** (77.16)	160.7** (76.93)	192.7** (75.36)	177.0** (75.68)	48.90 (60.36)
N_{it} (student-quarters)	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522
Adjusted R^2	0.609	0.698	0.699	0.704	0.705	0.762

NOTES: The dependent variable in each column is quarterly inflation-adjusted earnings, with zero assumed for missing earnings. Baseline Equation 2 results are found in Column 4 of this table as well as Column 1 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 10 and also in Column 1 of Table 4 of the main text. Columns 1 and 7 specifications of Equations 2 and 3 control for the listed attainment measures and student fixed effects. Moving left to right, Columns 2-6 and 8-12 add successively more controls, with preferred specifications reported in Columns 4 and 10. Columns 5-6 and 11-12 add controls for Pell grant eligibility and industry fixed effects, factors that may be determined in part by TCAT attendance. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A9. Assessing the importance of controls in Equations 2 and 3 - $\ln(\text{earnings})$ returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics \times f(age)			✓	✓	✓	✓
Enrollment proximity indicators				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	0.0273** (0.0124)	-0.0181 (0.0165)	-0.0128 (0.0165)	0.0117 (0.0165)	0.00853 (0.0165)	0.000754 (0.0157)
TCAT diploma	0.188*** (0.00831)	0.207*** (0.0103)	0.210*** (0.0103)	0.173*** (0.0105)	0.169*** (0.0107)	0.166*** (0.0101)
N_{it} (student-quarters)	1,110,763	1,110,763	1,110,763	1,110,763	1,110,763	1,110,763
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.501	0.588	0.589	0.594	0.594	0.609
Equation 3	(7)	(8)	(9)	(10)	(11)	(12)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics \times f(age)			✓	✓	✓	✓
Enrollment proximity indicators,				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	0.0114 (0.0174)	-0.0694*** (0.0242)	-0.0657*** (0.0242)	-0.0379 (0.0240)	-0.0425* (0.0240)	-0.0409* (0.0231)
TCAT diploma	0.222*** (0.0121)	0.192*** (0.0154)	0.192*** (0.0153)	0.142*** (0.0155)	0.140*** (0.0156)	0.140*** (0.0150)
TCAT certificate \times ind mobility	0.0479** (0.0241)	0.101*** (0.0330)	0.102*** (0.0330)	0.105*** (0.0324)	0.105*** (0.0325)	0.0899*** (0.0310)
TCAT diploma \times ind mobility	-0.0332** (0.0157)	0.0384* (0.0206)	0.0389* (0.0205)	0.0640*** (0.0202)	0.0599*** (0.0203)	0.0572*** (0.0195)
N_{it} (student-quarters)	970,555	970,555	970,555	970,555	970,555	970,555
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522
Adjusted R^2	0.477	0.567	0.567	0.573	0.574	0.590

NOTES: The dependent variable in each column is the natural log of non-missing quarterly inflation-adjusted earnings. Baseline Equation 2 results are found in Column 4 of this table as well as Column 2 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 10 and also in Column 2 of Table 4 of the main text. Columns 1 and 7 specifications of Equations 2 and 3 control for the listed attainment measures and student fixed effects. Moving left to right, Columns 2-6 and 8-12 add successively more controls, with preferred specifications reported in Columns 4 and 10. Columns 5-6 and 11-12 add controls for Pell grant eligibility and industry fixed effects, factors that may be determined in part by TCAT attendance. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A10. Assessing the importance of controls in Equations 2 and 3 - employment returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics×f(age)			✓	✓	✓	✓
Enrollment proximity indicators				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	-0.0269*** (0.00523)	0.0472*** (0.00685)	0.0453*** (0.00684)	0.0547*** (0.00680)	0.0520*** (0.00681)	0.00574* (0.00312)
TCAT diploma	0.0524*** (0.00339)	0.145*** (0.00430)	0.139*** (0.00430)	0.113*** (0.00434)	0.109*** (0.00439)	0.0236*** (0.00199)
N_{it} (student-quarters)	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619	1,447,619
N_i (students)	39,877	39,877	39,877	39,877	39,877	39,877
Adjusted R^2	0.312	0.422	0.423	0.430	0.431	0.812
Equation 3	(7)	(8)	(9)	(10)	(11)	(12)
Student fixed effects	✓	✓	✓	✓	✓	✓
Student time trends		✓	✓	✓	✓	✓
Demographics×f(age)			✓	✓	✓	✓
Enrollment proximity indicators,				✓	✓	✓
Pell grant controls					✓	✓
Industry fixed effects						✓
TCAT certificate	0.000896 (0.00771)	0.0349*** (0.0108)	0.0336*** (0.0108)	0.0319*** (0.0107)	0.0278*** (0.0107)	-0.00347 (0.00535)
TCAT diploma	0.0736*** (0.00485)	0.113*** (0.00730)	0.108*** (0.00733)	0.0644*** (0.00731)	0.0595*** (0.00733)	0.00496 (0.00331)
TCAT certificate × ind mobility	0.0176* (0.00974)	0.0721*** (0.0143)	0.0721*** (0.0143)	0.0716*** (0.0141)	0.0715*** (0.0141)	0.0265*** (0.00687)
TCAT diploma × ind mobility	-0.00187 (0.00587)	0.0892*** (0.00915)	0.0891*** (0.00918)	0.0923*** (0.00904)	0.0908*** (0.00904)	0.0339*** (0.00418)
N_{it} (student-quarters)	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031	1,220,031
N_i (students)	33,522	33,522	33,522	33,522	33,522	33,522
Adjusted R^2	0.252	0.345	0.346	0.355	0.356	0.782

NOTES: The dependent variable in each column is the binary existence of non-zero earnings. Baseline Equation 2 results are found in Column 4 of this table as well as Column 3 of Table 2 in the main text. Baseline interactive Equation 3 results are here in Column 10 and also in Column 3 of Table 4 of the main text. Columns 1 and 7 specifications of Equations 2 and 3 control for the listed attainment measures and student fixed effects. Moving left to right, Columns 2-6 and 8-12 add successively more controls, with preferred specifications reported in Columns 4 and 10. Columns 5-6 and 11-12 add controls for Pell grant eligibility and industry fixed effects, factors that may be determined in part by TCAT attendance. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A11. Subsample analyses of Equations 2 and 3 - earnings returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	291.5*** (59.23)	279.4*** (71.02)	315.2*** (92.96)	340.8*** (71.47)	103.4 (97.80)	249.3*** (65.39)	339.8*** (100.7)	160.9** (67.38)
TCAT diploma	1034.3*** (36.88)	1112.1*** (41.04)	847.2*** (66.07)	1155.7*** (41.49)	503.6*** (79.44)	958.9*** (43.67)	1006.3*** (58.67)	713.1*** (37.92)
N_{it} (student-quarters)	1,447,619	743,997	703,622	1,177,074	270,545	619,130	737,548	673,157
N_i (students)	39,877	20,386	19,491	32,434	7,443	18,041	19,299	18,646
Adjusted R^2	0.720	0.700	0.711	0.721	0.677	0.643	0.685	0.616
Equation 3	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	135.9 (103.8)	8.650 (122.9)	275.4* (165.6)	213.5* (129.3)	-135.4 (154.4)	-32.02 (100.7)	306.1 (186.3)	-7.890 (124.3)
TCAT diploma	1041.2*** (62.77)	1062.8*** (68.86)	932.0*** (116.5)	1188.3*** (70.03)	469.6*** (139.0)	827.9*** (74.48)	1164.3*** (100.6)	706.3*** (65.61)
TCAT certificate \times ind mobility	459.2*** (128.0)	501.3*** (154.2)	397.4** (202.6)	472.5*** (156.9)	415.3** (205.1)	531.0*** (126.5)	366.4 (231.6)	374.9** (151.6)
TCAT diploma \times ind mobility	192.7** (75.36)	167.5** (84.37)	200.4 (140.0)	161.7* (83.28)	206.6 (174.5)	335.4*** (89.80)	67.65 (121.2)	130.0* (77.73)
N_{it} (student-quarters)	1,220,031	647,034	572,997	982,831	237,200	549,478	636,129	577,539
N_i (students)	33,522	17,688	15,834	27,004	6,518	16,015	16,604	16,008
Adjusted R^2	0.704	0.676	0.699	0.706	0.673	0.634	0.686	0.603

NOTES: The dependent variable in each column is quarterly inflation-adjusted earnings, with zero assumed for missing earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 1 of Table 2. Baseline interactive Equation 3 results are here in Column 8 and also in Column 1 of Table 3. Columns 2-7 and 9-14 restrict the main analytical sample as indicated. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A12. Subsample analyses of Equations 2 and 3 - $\ln(\text{earnings})$ returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	0.0117 (0.0165)	0.00975 (0.0251)	0.0192 (0.0216)	0.0187 (0.0190)	-0.00759 (0.0331)	0.0757*** (0.0224)	-0.0338 (0.0243)	0.0231 (0.0219)
TCAT diploma	(0.0105)	(0.0145)	(0.0152)	(0.0117)	(0.0240)	(0.0147)	(0.0154)	(0.0129)
N_{it} (student-quarters)	1,110,763	561,744	549,019	914,593	196,170	449,623	576,794	484,882
N_i (students)	39,877	20,386	19,491	32,434	7,443	18,041	19,299	18,646
Adjusted R^2	0.594	0.544	0.614	0.603	0.529	0.498	0.578	0.495
Equation 3	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	-0.0379 (0.0240)	-0.0734* (0.0376)	0.00199 (0.0300)	-0.0342 (0.0272)	-0.0531 (0.0501)	-0.0241 (0.0347)	-0.0390 (0.0322)	-0.0322 (0.0327)
TCAT diploma	0.142*** (0.0155)	0.196*** (0.0214)	0.0443** (0.0216)	0.169*** (0.0172)	0.0441 (0.0347)	0.163*** (0.0221)	0.108*** (0.0214)	0.120*** (0.0181)
TCAT certificate \times ind mobility	0.105*** (0.0324)	0.139*** (0.0496)	0.0675 (0.0421)	0.119*** (0.0375)	0.0655 (0.0645)	0.160*** (0.0449)	0.0328 (0.0465)	0.0889** (0.0425)
TCAT diploma \times ind mobility	0.0640*** (0.0202)	0.0713*** (0.0272)	0.0540* (0.0291)	0.0616*** (0.0225)	0.0502 (0.0457)	0.120*** (0.0279)	0.00911 (0.0290)	0.0671*** (0.0218)
N_{it} (student-quarters)	970,555	505,773	464,782	789,052	181,503	415,073	524,308	437,579
N_i (students)	33,522	17,688	15,834	27,004	6,518	16,015	16,604	16,008
Adjusted R^2	0.573	0.523	0.596	0.581	0.523	0.491	0.569	0.486

NOTES: The dependent variable in each column is the log of quarterly inflation-adjusted earnings, restricted to quarters with non-zero, non-missing earnings. Baseline Equation 2 results are found in Column 1 of this table as well as Column 2 of Table 2. Baseline interactive Equation 3 results are here in Column 8 and also in Column 2 of Table 3. Columns 2-7 and 9-14 restrict the main analytical sample as indicated. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

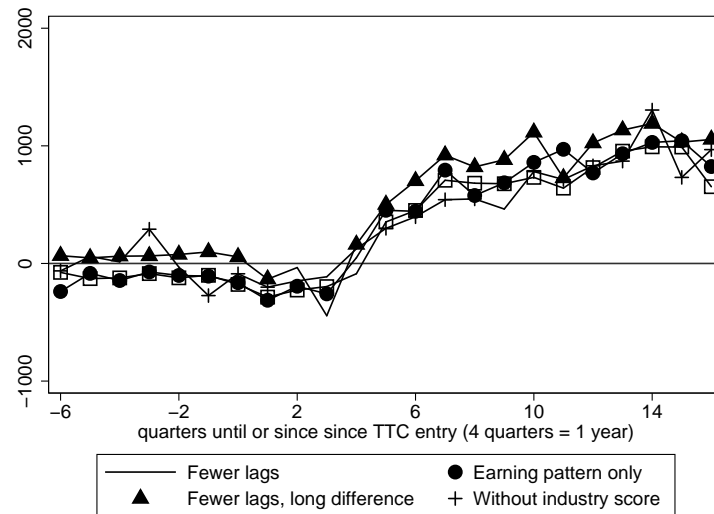
Table A13. Subsample analyses of Equations 2 and 3 - employment returns to TCAT certificates and diplomas

Equation 2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	0.0547*** (0.00680)	0.0706*** (0.0101)	0.0416*** (0.00917)	0.0626*** (0.00796)	0.0246* (0.0130)	0.0364*** (0.00913)	0.0710*** (0.0102)	0.0476*** (0.00841)
TCAT diploma	0.113*** (0.00434)	0.106*** (0.00570)	0.114*** (0.00675)	0.128*** (0.00483)	0.0472*** (0.00978)	0.0892*** (0.00606)	0.125*** (0.00624)	0.0876*** (0.00490)
N_{it} (student-quarters)	1,447,619	743,997	703,622	1,177,074	270,545	619,130	737,548	673,157
N_i (students)	39,877	20,386	19,491	32,434	7,443	18,041	19,299	18,646
Adjusted R^2	0.430	0.411	0.455	0.434	0.411	0.376	0.472	0.398
Equation 3	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
Baseline sample	✓							
Women		✓						
Men			✓					
White				✓				
Non-White					✓			
Under age 36						✓		
Age 36 and up							✓	
With FAFSA								✓
TCAT certificate	0.0319*** (0.0107)	0.0365** (0.0163)	0.0286** (0.0139)	0.0379*** (0.0126)	0.00777 (0.0202)	-0.00444 (0.0143)	0.0679*** (0.0158)	0.0285** (0.0140)
TCAT diploma	0.0644*** (0.00731)	0.0345*** (0.00959)	0.100*** (0.0113)	0.0800*** (0.00823)	0.00383 (0.0156)	0.0326*** (0.00995)	0.0886*** (0.0107)	0.0310*** (0.00810)
TCAT certificate \times ind mobility	0.0716*** (0.0141)	0.0783*** (0.0209)	0.0643*** (0.0189)	0.0761*** (0.0166)	0.0577** (0.0263)	0.0814*** (0.0185)	0.0622*** (0.0214)	0.0615*** (0.0177)
TCAT diploma \times ind mobility	0.0923*** (0.00904)	0.111*** (0.0116)	0.0621*** (0.0144)	0.0910*** (0.0101)	0.0826*** (0.0200)	0.0887*** (0.0123)	0.0982*** (0.0132)	0.0911*** (0.00960)
N_{it} (student-quarters)	1,220,031	647,034	572,997	982,831	237,200	549,478	636,129	577,539
N_i (students)	33,522	17,688	15,834	27,004	6,518	16,015	16,604	16,008
Adjusted R^2	0.355	0.346	0.369	0.356	0.350	0.325	0.380	0.334

NOTES: The dependent variable in each column is the binary incidence of having any earnings in a given quarter. Baseline Equation 2 results are found in Column 1 of this table as well as Column 3 of Table 2. Baseline interactive Equation 3 results are here in Column 8 and also in Column 3 of Table 3. Columns 2-7 and 9-14 restrict the main analytical sample as indicated. Robust standard errors clustered at the student level are in parentheses below each coefficient.

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure A3. Matching results: Average earnings returns to enrollment under alternative specifications



NOTES: The figure plots Mahalanobis matching results for three alternative matching vectors. See Section 5.2 and Figure 4 in the main text for baseline results.