

Evaluating the Hourly Wage Return of Community Colleges

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Abstract: This study examines the effect of 2-year college credits, postsecondary certificates and Associate Degrees on hourly wages for high school graduates with no 4-year college experience using restricted-use National Educational Longitudinal Study 1988 (NELS: 1988). The analysis does not find a statistically significant increase in hourly wages associated with 2-year college credits, post-secondary certificates, or Associate Degrees.

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I. Introduction

Community colleges play a significant role in postsecondary education in the United States. According to the American Association of Community Colleges¹, in 2012, 45% of U.S. undergraduate students were enrolled in community colleges. Community colleges are particularly important for Hispanics, Native Americans and African-Americans; 56% of Hispanic undergraduate students, 59% of Native American undergraduate students, and 48% of African-American undergraduate students are enrolled in community colleges.

Associate Degrees and Postsecondary certificates issued by community colleges have increased significantly among minorities and females in recent years. According to data from the Institute of Education Science (IES) IPEDS data center², the total number of Associate Degrees issued to females annually increased by 50.2% from 2000 to 2010. The proportion of total Associate Degrees issued to minority females increased from 26.3% during 1999 to 2000 to 33.7% during 2009 to 2010, and annually total Associate Degrees issued increased by 89.1% for African-American females and 117.6% for Hispanic females during the same period.

Two major reasons that a large proportion of socioeconomically disadvantaged students go to community colleges is: first, they are educationally disadvantaged and not prepared to attend a 4-year postsecondary education; second, community colleges typically have lower tuition and fees compared to 4-year colleges. According to The College Board the average annual total for tuition and fees for public community colleges is \$3,260 during 2013 to 2014, while the average annual tuition and fees was \$8,890 for 4-year public colleges³. Since people enrolled in community colleges are likely to be socioeconomically disadvantaged already, it is crucial to understand whether the community colleges can help them in the labor markets or not. This paper will evaluate how much benefit people receive from taking courses in 2-year colleges, and whether postsecondary certificates or Associate Degrees provide advantages relative to high school graduation without postsecondary certificates or Associate Degrees.

¹ Data available at http://www.aacc.nche.edu/AboutCC/Documents/Facts14_Data_R3.pdf.

² Data available on: <http://nces.ed.gov/ipeds/datacenter/>.

³ Data available at <https://trends.collegeboard.org/college-pricing>.

II. Literature Review

The effect of education on earnings is well studied. Studies across different countries show that average wages are higher for more educated workers (Psacharopoulos, 1985). In addition, studies using institutional aspects of the education system as instrumental variables and studies of the earnings and schooling of twins indicate there is a positive causal effect of education on earnings (Card, 1994).

Kane and Rouse (1995) found positive returns of 2-year and 4-year college credits on hourly wages and annual earnings. In addition, the marginal effect of 2-year college credits actually exceeded the marginal effect of 4-year college credits for males, and 2-year colleges generated positive wage differences even for people who did not acquire an Associate Degree. This paper will conduct a set of related analysis. However, the sample will be restricted to respondents who graduated from high school but never received any 4-year post-secondary credit. Thus, the result of this paper is only relevant for people who would like to invest in 2-year college education and not use 2-year colleges as transitions into 4-year colleges.

Marcotte et al. (2005) concluded similarly as Kane and Rouse (1995); they found positive effects of community college education on hourly wages and annual earnings for young workers, no matter whether an Associated Degree was acquired or not. However, Grubb (1993) found that individuals who enrolled in postsecondary education but failed to receive credentials had no higher earnings than high school graduates.

Leigh and Gill's (1997) study on adults returning to school also concluded that community colleges have positive and significant returns on hourly wages and annual earnings. Jacobson et al.'s (2005) study on displaced workers also suggested that community college increase the long-term earnings of both males and females. Furthermore, additional years of technically oriented vocational training and academic math and science courses lead to much more sizable earnings than other training and courses at community colleges.

In addition, studies have focused on the returns to postsecondary degrees and certificates, the credentialing effect or "sheepskin effect," which is the return in addition to the total return of

postsecondary credits. Hungerford and Solon (1987) tested the sheepskin effect by comparing the return of one additional year of education on wages at 8th grade, 12th grade, and 4th year of college education and found that 8th and 12th grade and 4th year college education have a higher wage returns compared to one additional year of education.

Jaeger and Page (1996) matched Current Population Survey data in 1991 and 1992 to obtain information regarding whether diplomas were received or not to estimate the effect of the diploma on wages; they compared their finding with the result without diploma information. Their study suggested that omitting diploma status biases the estimation of the sheepskin effect. They found that the sheepskin effect is significant for white men, minorities and women. They also found that the return to high school diplomas is lower for minorities compared to whites, while the return to college education is higher for minorities. This conclusion was consistent with Belman and Heywood (1991).

Grubb (1993) found a significant effect of a B.A. degree and an insignificant effect of Associate Degrees and certificates. Kane and Rouse (1995) discovered a significantly positive return to B.A. completion for males and Associate Degree completion for females, even though the effects on hourly wages and annual earnings of degree completion were small.

Belman and Heywood (1997) and Hebermalz (2006) further examined how returns to degrees and certificates change over time and found a diminishing return with increasing time spent on the job. In addition, Bitzan (2009) examined the impact of the sheepskin effects on white-black earning differences and found a significant difference between white men and black men: white men received higher rewards for degrees of a college education or less, while black men received higher rewards for graduate degrees.

The conventional view is that education adds to an individual's productivity and therefore increases the market value of his or her labor. However, employers are not aware of the productivity of an individual at the time of hiring. In addition, employees are unlikely to demonstrate their productivity immediately after they are hired. This creates a market with imperfect information which makes hiring a process of purchasing lottery tickets because similar to the uncertain payoff (Spence, 1972). What applicants signal matters in labor markets.

Arrow (1973) made a similar argument: that given imperfect information, employers make decisions based on the information they can obtain at a low-cost, such as whether an individual has a college diploma. More specifically, Arrow made an assumption that employers have at least some experience or information regarding the expected productivity of individuals with certain types of background. However, employers cannot distinguish between people with similar backgrounds, because they lack specific information regarding within-group difference. Arrow expected that higher education affects employers' decisions at two levels. First, whether individuals are admitted by a college may indicate personal ability; second, whether people successfully graduate from college or receive a college diploma may also correlate with productivity. Thus, instead of contributing to higher economic performance, "higher education serves as a screening device, in that it sorts out individuals of differing ability, thereby conveying information to the purchasers of labor" (Arrow, 1973). Employers are using information such as college diplomas to filter out the individuals with higher expected productivity without observing the true productivity.

III. Model and Methodology

In order to evaluate the hourly wages return of two-year college education, this paper considers students benefit from: first, accumulating human capital through taking courses; and second, the signaling effect of certificates and degrees for students who received post-secondary certificates and Associate Degrees. Thus, the returns of two-year college education include credit effect and sheepskin effect.

This paper will measure students' human capital accumulation in two-year colleges using credits from post-secondary transcripts, which should be a more reliable and direct measurement than self-reported years of education. Also, another advantage of this paper is that it will control for students' academic performance while in high school and in two-year colleges. Students' academic performance, measured by grade point average or GPA, may approximate students' "ability" that is potentially associated with their labor market performance later to some extent.

This paper will construct a variable that approximates people's working experience. This potential experience variable is defined as years since last being a student. This paper will also control for respondents' base year English proficiency and respondents' base year school characteristics. School characteristics are measured by percentage of race/ethnicity minority teachers, and percentage of teachers with graduate degrees.

Key demographic indicators, such as race/ethnicity, gender, and base year family socioeconomic status, are also controlled in the regression models. Empirical evidence has shown that race/ethnicity minorities are disadvantaged in labor markets relative to whites, females are disadvantaged relative to males, and people with low socioeconomic status are disadvantaged relative to people with higher socioeconomic status.

The analysis will be restricted to respondents who graduated from high school, defined as receiving a high school diploma, GED certificate, or other proof of high school graduation, and who received no 4-year college credit. With such a selected sample, the paper tries to answer a relatively situational question that how much a high school graduate will benefit from two-year college education, if he or she does not use two-year colleges as transitions into four year colleges. Two set of models will be applied to the entire restricted sample, to a male subgroup and female subgroup. Each set of models will include a pooled model and a state fixed effect model.

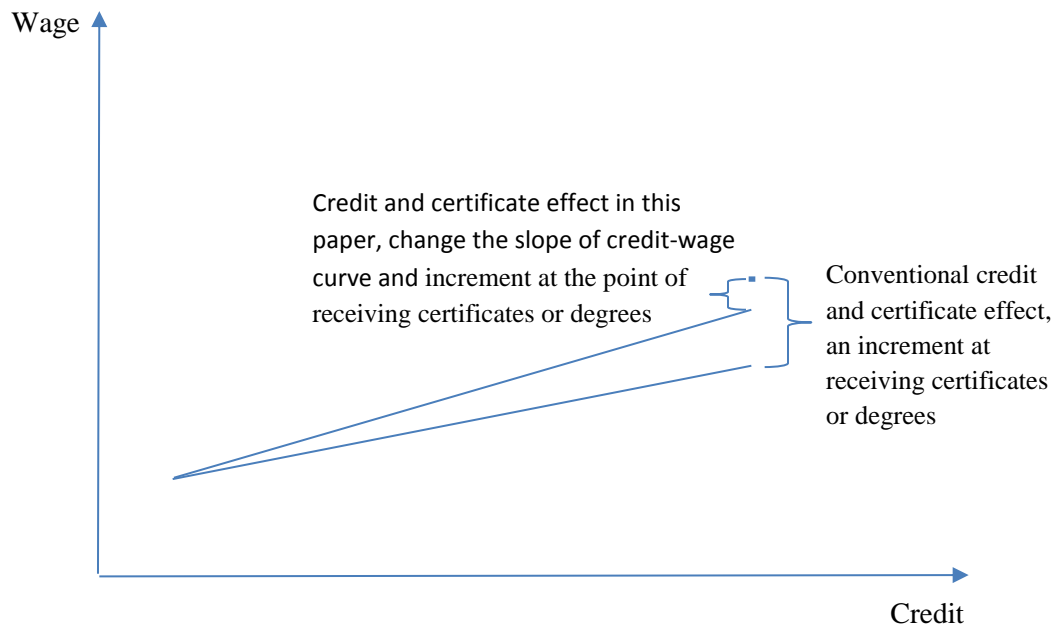
Since people with certificate or Associate Degree may receive different return on one additional credit, the certificates and Associate Degrees are interacted with credits are added into the model. The OLS regression model is specified as following:

$$\text{Ln(wage)}_{ij} = \beta_0 + \beta_1 C_{ij} + \beta_2 D_{ij} + \beta_3 C_{ij} * D_{ij} + \beta_4 X_{ij} + \gamma_j + \varepsilon_{ij}$$

The dependent variable is logged hourly wages at the respondents' current or most recent job. C stands for the effect of post-secondary credits. D is the "sheepskin effect", a vector includes acquiring associated degrees or postsecondary certificates. X is a vector of personal characteristics and other control variables. γ_j is the state fixed effect. This paper will evaluate the credit effect for people who graduated from high school and received no certificate or degree, who received Associate Degree, who received post-secondary certificate and who received both

post-secondary certificate and Associate Degree. Also, this paper will evaluate the sheepskin effect at mean credit.

The model settings of this paper use interactive terms between credit effect and sheepskin effect, which is different from the conventional settings. The conventional settings see the sheepskin effect as the bonus in addition to the benefit of receiving credits. This paper, however, sees the effect of degree or certificate as making post-secondary credits more valuable, which means in addition to give the credit-wage curve an increment at the point of receiving certificates or degrees, certificates or degrees will also increase the slope of credit-wage curve. In other words, if employers value the post-secondary education of degree seeking students more than non-degree seeking students, the alternative setting used in this paper may fit the labor markets better.



IV. Data

This study uses a restricted version of the National Educational Longitudinal Study 1988 (NELS: 1988) as data source. NELS: 1988 provides information on labor market outcomes, key demographic indicators, socioeconomic status, and information on school characteristics. In

addition, the restricted data provides students' postsecondary education transcripts and residential census data.

NELS: 1988 conducted its first survey in 1988 then revisited the same group of students in 1990, 1992, 1994, and 2000. The base year (8th grade) survey was completed in the spring of the 1987 to 1988 school year, when respondents were in 8th grade. The first follow-up was in the spring term of the 1989 to 1990 school year, when most respondents were sophomores in high school. The second follow-up was taken in the spring term of the 1991 to 1992 school year. When the second follow-up was taken, most of the respondents were in the second term of their senior year in high school. The third follow-up was conducted in 1994 between February and June, when most of the respondents were two years out of high school. The last follow-up took place in 2000 between January and August, when most of the respondents were 26 years old and typically 8 years from high school graduation. In addition to students, their parents, teachers, and school principals were surveyed to gather information on school policies, family involvement, teacher practices, and educational environments.

Each wave of follow-ups had a different focus. The base year of NELS: 88 focused on the "educational processes and outcomes pertaining to student learning, predictors of dropping out, and school effects on students' access to programs and equal opportunity to learn." The first wave aims at capturing the early dropouts between 8th grade and 10th grade in high school, and monitoring the transition from high school to post-secondary education. The second follow-up resurveyed students who dropped out in 1990 and those who left school after the first follow-up. The third follow-up collected information on "education histories, work experience histories, work-related training, family formation, income, opinion, and other experiences." The fourth follow-up focused on "the educational and labor market processes and transitions experienced by young adults." Interview topics covered experiences with "postsecondary education, labor market participation, job-related training, community integration, and marriage and family formation." The study also collected students' transcript data from the postsecondary institutions for respondents reported enrolling colleges⁴.

⁴ Information on NELS: 1988 above was gathered from Postsecondary Education Transcript study (PETS: 2000) data file user's manual. Information is also available at: Source: <http://nces.ed.gov/surveys/nels88/design.asp>.

This analysis will be restricted to respondents who graduated from high school—meaning received a high school diploma or a GED certificate—and did not acquire any 4-year college credits. Thus, the targeted population should not have Bachelors’ degree or higher, nor should they have received any postsecondary credit from 4-year colleges.

Labor market outcomes are measured by respondents’ hourly wages in their current or most recent job. These hourly wages are likely to be a better choice than income in 1999 for the following three reasons. First, the wage variable has many fewer missing values—there are 19.83% missing in income in 1999 and 6.46% missing in wages of current or most recent job. Second, in 1999, most of the respondents were aged 25 to 26, and thus if a woman was out of the labor force due to maternal leave for part of 1999, her income would be greatly understated. Also, the standard deviation of hourly income in 1999 is 7.54 times that of the mean hourly income, while the standard deviation of current or most recent job is 72.21% of the mean hourly wages, and thus raises the concern on the data quality of income in 1999, because all respondents are in their earlier career and their wages should not diverge so significantly.

Respondents were asked “for your current/ most recent job, about how much do/did you earn before taxes and other deductions?”⁵ and whether the income is hourly, weekly, monthly or annually was recorded separately⁶.⁷ The information was gathered in the fourth wave in 2000. Hourly wages were calculated with information on how many hours per week do respondents work⁸, earn before taxes and earning period. More specifically, one month is an equivalent of 4.3181 weeks and one year is an equivalent of 52.1775 weeks.

Completed amounts of postsecondary education are captured by credits received in 2-year colleges and 4-year colleges. The mean number of credits received was 16.54 and 62.15 for 2-year and 4-year colleges respectively. Academic performance is captured by undergraduate grade average point arrange or GPA and high school GPA with a maximum of 4.0. The mean

⁵ Variable named F4BRATE

⁶ whether the income is hourly, weekly, monthly or annually was recorded as variable named F4BRATP.

⁷ A detailed questionnaire of the 4th wave at:
https://nces.ed.gov/surveys/nels88/pdf/16_F4_Student_Dropout_CATI_CAPI_Fac.pdf.

⁸ Variable named F4BJHPW.

undergraduate GPA was 2.64 and the mean high school GPA was 2.70. Both information on credits and GPA were gathered from the restricted-use transcript study in the fourth wave.

Information on postsecondary degrees and certificates recorded the degrees and certificates respondents received between 1994 (when most of the respondents graduated from high school for two years) and 1999 (the year before the 4th follow up).

Individual skill is measured by English Proficiency in 8th grade and potential experience in 1999. English Proficiency is a dummy variable where 1 stands for limited English proficient in 1988. I also constructed a variable to approximate individuals' potential experience by calculating the time (years) since last being a student. More specifically, for people who completed high school but received no postsecondary education, their last year as a student is the year they completed high school; while for people who received postsecondary education, information on last postsecondary enrollment is given by the dataset. Years since last being a student is calculated as 1999 minus the year of last enrollment.

Characteristics of schools are also used as control variables. The proportion of students with free lunch is calculated by dividing the numbers of students receiving free lunch by the total number of enrolled students. The proportion of minority students by race/ethnicity in 8th grade, Percentage of student with limited English proficiency is given by a series of variables in the dataset. I also calculated the percentage of minority teachers by race/ethnicity using number of minority teachers by race/ethnicity and total full time regular teachers. In addition, respondents' base year socioeconomic status is controlled using the Socioeconomic Composite, an index that measures parents' education and income level.

For the entire sample, 87.39% of the respondents received high school diplomas, and 6.94% received GED certificates. Both high school diploma holders and GED certificate holders will be considered as high school graduates, which in total accounts for 94.33% of all the respondents.

As shown in Table 1, 9.82% and 9.62% of the entire sample received at least one postsecondary certificate and one Associate Degree respectively. A total of 33.61% of the entire sample received B.A. degrees or higher.

For entire sample, 86.21% were working for pay in 1999, and 59.62% of people who received postsecondary credits were working for pay in 1999. Also, 51.38% of respondents who received credit from 2-year colleges were working for pay when the 4th following up was conducted.

The sample is restricted to high school graduates with no 4 year college experience. There are 3,920 (78.43%) observations with neither postsecondary certificate nor Associate Degrees, 554 (11.08%) certificate holders, and 524 (10.48%) degree holders as presented in Table 2. Table 3 presents the cross tabulation of frequencies of respondents with no certificate and no degree, with only certificates, with only Associate Degrees, and with both certificates and degrees.

Table 4 summaries the key demographic information of the restricted sample in 2000. The sample consists of 66.22% White, 10.82% African-American, 17.11% Hispanic, 4.20% Asian and 1.65% American Indian; 47.95% are male and 52.05% are female. It is well established that there is a statistically significant gap in wage across race/ethnicity and gender groups, and thus race/ethnicity and gender will be controlled. In 2000, most of the respondents were ages 26 to 28 and typically in their 8th year from high school graduation.

Table 5 presents the frequency distribution by employment status for the restricted sample. For the restricted sample, 85.59% of respondents worked for pay in 2000. As presented in Table 6, the mean potential working experience is 6.78 years; mean hourly wages of current or most recent job is \$12.19, and mean hourly income of 1999 is \$14.76. As briefly mentioned before, Table 6 indicates that hourly income in 1999 has an abnormally high standard deviation, which raises the concern about data quality of the variable for income in 1999, since respondents are in similar age and their early carrier. Their wage level should not diverge significantly.

School characteristics will also be controlled, and Table 7 presents the summary statistics for base year (8th grade) school characteristics of the restricted sample. Ritter and Taylor (2011) proposed an explanation for the unemployment gap between African-Americans and Whites arguing that sociolinguistic miscommunication makes managers, who are usually middle or upper middle class whites, fail to assess minority workers precisely, and this disadvantages minority workers in the labor market. Controlling for characteristics of schools will take into

account the cultural environment that students experienced; which may have an impact on forming students' socio-linguistic expression and thus have influence on labor market performance later.

V. Wage return of 2-Year College Credits, Post-Secondary Certificate and Associate Degrees.

Columns 1 and 2 of Table 8 present the effect of 2-year college credits on hourly wages, and Columns 3 and 4 of Table 8 present the effect of post-secondary certificates, Associate Degrees and 2-year college credits. The regression models control for race/ethnicity, gender, potential experience, family socioeconomic status, students' academic performance in both high school and colleges, and high school characteristics.

The effect of one additional 2-year college credits appears significant in the pooled model (column 1 of Table 8)—it increases wages by 0.08%. But in the state fixed effect model, which is more preferable than pooled as it controls for unobservable heterogeneities of states (column 2 of Table 8), one additional two-year college credit is not associated with wage increases. Columns 3 and 4 of Table 8 present the models with information on whether people received a certificate or an Associate Degree. Since people with certificate or Associate Degree may receive different return on one additional credit, the certificates and Associate Degrees are interacted with credits are added into the model. Table 11, columns 1 and 2, present the marginal effect credits. The marginal effects of credits are evaluated for people with no degree or certificate, certificate holders, degree holders, and for those with both degree and certificate. The marginal effect calculations take into account both the credit effect and credit effect that is embedded in the interactive terms. None of the marginal effects were significant. Tables 9 and 10 present the effect of credits on wages for male and female subgroups. Columns 1 and 2 of Table 9 and 10 indicate that credit effect is not significant for both males and females with state fixed effect. Table 11, columns 3 and 4 and 5 and 6, also indicate that the marginal effect of 2-year credit on wages is insignificant for no degree or certificate holders, certificate holders, degree holders and

people with both Degree and Certificates. Also, since the coefficient and standard error are fairly small, the true return of postsecondary credits is unlikely to be large.

Table 11 also presents the marginal effect of post-secondary certificates and Associate Degrees. Certificate and Associate Degree effects are evaluated at the mean number of credits. Table 11 indicates that certificate and Associated Degrees do not have significant effect on wages, overall and for both male and female subgroups.

Surprisingly, higher academic performance in two year colleges seems to be associated with lower wages overall. One additional point increase in two year college GPA decreases wage by approximate 3% in both pooled model and fix effect model as indicated in Table 8, columns 1 to 4. After breaking down to male and female subgroups, although the coefficients of postsecondary credits are negative, they are insignificant for males and significant for females.

Table 8 also suggests that females are disadvantaged in the labor market relative to males. Females receive more than 20% lower wages than males. African Americans are also disadvantaged relative to whites. African Americans receive approximately 14% to 17% lower wage than whites overall. The finding of lower wages for African American is consistent for both males and females. Finally, respondents with limited English proficiency in base year also receive overall statistically significantly lower wages than people who are proficient in English. But after breaking down to male and female subgroups, the findings are slightly different. For males, base year English language proficiency matters, while for females the effect of limited English proficiency is insignificant, instead, base year socioeconomic status is positively associated with wages.

VI. Importance of Post-Secondary Certificate Information

Most of the widely used data sources, such as Current Population Survey and American Community Survey, do not provide information on post-secondary certificates. Thus, certificate holders without Associate or higher degrees will be counted as high school graduates. Omitting certificate information may underestimate the return of 4-year college degrees, if post-secondary

certificates have non-negative effect on wage, because the gap between 4-year college students and high school graduates with post-secondary certificate but without Associate or higher degrees is in fact narrower than what we can observe from CPS or ACS data.

This hypothesis is confirmed by Table 12 columns 1 and 2. Table 12 column 1 indicates that whether respondents received post-secondary certificate or not, while Table 12 column 2 does not use information on post-secondary certificates, so certificates holders with no Associate or higher degrees are counted as high school graduates. The marginal effects of Associate Degree, B.A. Degree, Master's Degree and Ph.D. Degrees with certificate information are slightly higher than estimations without certificate information, which suggest omitting certificate information underestimates the return of 4-year college degrees.

VII. Limitations

This paper cannot control for the heterogeneity of certificates and diplomas very well. For instance, some certificates are required for certain types of occupations, while not for others. Thus, not all certificates have an equal return on the labor market. Also, 2-year college students received various types of training, and it is also very likely that not all training receives the same level of wage return. However, this heterogeneity is also not controlled for in the analysis. Moreover, the occupations were not controlled for because the number of observation is not sufficient for estimation of gender, certificate status or degree status specified subgroups. Also, with only one period of labor market returns, I cannot control for time-invariant unobservable heterogeneities by using fixed effect estimations.

By restricting the sample to high school graduates with no 4-year college education, the analysis of this paper is based on a sample that was selected in a particular way. Compared to people with education levels lower than high school graduates, people in the sample are less likely to benefit from 2-year college education; however, compared to people who had a 4-year college education, people in the sample are more likely to benefit from 2-year college education. In addition, if personal characteristics are correlated with education, analysis based on restricted samples cannot be generalized to the entire population. Thus, this paper aims at answering one

relatively situational question: what is the hourly wage return to 2-year college education for someone who graduated from high school but does not plan to enroll in any 4-year college?

In addition, this paper does not take into account the heterogeneity of high school graduates and GED holders. As Heckman argued, high school graduates and GED holders are two very heterogeneous groups of people. Also, the analysis does not apply weight, which will bias the estimation if students of a given subgroup were over sampled.

VIII. Discussion and Conclusion

This paper does not find a significant positive effect of 2-year college credits, post-secondary certificates, or associate degrees for both males and females compared to high school graduates. It is surprising to find that academic performance in 2-year colleges is negatively associated with hourly wage. Females and African Americans have lower wage than males and whites respectively is consistent with established empirical evidence. But base year family socioeconomic status and English proficiency has different effects on males and females. Family socioeconomic status is positively associated with hourly wages for females but not males, while limited English proficiency is negatively associated with wages for males but not females.

Table 1. Summary Statistics, Frequency of Certificate and Associate Degree Holders, All respondents

	Freq.	Percent
Certificate	1,192	9.82
Associate degree	1,168	9.62
Bachelor degree or higher	4,082	33.61

Note: Summary statistics for all respondents in the sample.

Table 2. Summary Statistics, Frequency of Certificate and Associate Degree Holders, Restricted Sample

	Freq.	Percent
No-Certificate; No Associate Degree	3,920	78.43
Certificate Holders	554	11.08
Associate Degree Holders	524	10.48

Note: Summary statistics for respondents who graduated from high school and received no 4-year college education.

Table 3. Summary Statistics, Cross-tabulation Certificate and Associate Degree Holders

Certificate Holders	Associate Degree Holders		Total
	No	Yes	
No	3,920	478	4,398
Yes	554	46	600
Total	4,474	524	4,998

Note: Summary statistics for respondents who graduated from high school and received no 4-year college education.

Table 4. Summary Statistics, Key Demographic Indicators, Restricted Sample

	Freq.	Percent
Race/Ethnicity		
White	3,011	66.22
Black	492	10.82
Hispanic	778	17.11
Asian	191	4.20
American Indian	75	1.65
Gender		
Male	2,199	47.95
Female	2,387	52.05
Age		
21	4	0.09
22	1	0.02
25	13	0.29
26	2,746	60.71
27	1,496	33.08
28	244	5.39
29	19	0.42

Note: Summary statistics for respondents who graduated from high school and received no 4-year college education.

Table 5. Summary Statistics, Employment Status, Restricted Sample

	Freq.	Percent
Not Employed for Pay	720	14.41
Employed for Pay	4,277	85.59

Note: Summary statistics for respondents who graduated from high school and received no 4-year college education.

Table 6. Summary Statistics, Potential Experience and Hourly Wages, Restricted Sample

	Mean	SD
Potential Experience in 1999	6.777	0.6383
Wage--Current/Most Recent Job	12.188	8.8011
Hourly Income in 1999	14.762	111.3776

Note: Summary statistics for respondents graduated from high school and received no 4-year college education.

Table 7. Summary Statistics, Base Year School Characteristics, Restricted Sample

	Mean	SD
% of Students Have Free Lunch	27%	0.2330
% of Students in Limited English Proficiency	1%	0.8878
% of American Indian Teachers	0%	0.0280
% of Asian Teachers	1%	0.0579
% of Hispanic Teachers	4%	0.1187
% of African American Teachers	8%	0.1570
% of White Teachers	87%	0.2066
% of Teachers with Graduate Degrees	45%	0.2432

Note: Summary statistics for respondents graduated from high school and received no 4-year college education.

Table 8. Credit Effects and Degree or Certificate Effect

	1	2	3	4
Certificate			-0.0333 [0.036]	-0.0145 [0.030]
Associate Degree			0.0403 [0.055]	0.0514 [0.053]
2-year college credit	0.0008** [0.000]	0.0009 [0.001]	-0.0006 [0.001]	-0.0002 [0.001]
Certificate * 2-year college credit			0.0003 [0.001]	0.0000 [0.001]
Associate Degree * 2-year college credit			0.0014 [0.001]	0.0011 [0.001]
PSE GPA	-0.0304** [0.012]	-0.0327*** [0.011]	-0.0284** [0.013]	-0.0327*** [0.011]
HS GPA	0.0265 [0.020]	0.0255 [0.023]	0.0230 [0.020]	0.0217 [0.023]
African Americans	-0.1639*** [0.042]	-0.1412*** [0.034]	-0.1719*** [0.042]	-0.1478*** [0.033]
Hispanics	0.0596 [0.039]	0.0205 [0.035]	0.0507 [0.040]	0.0143 [0.036]
Asians	0.0350 [0.051]	-0.0171 [0.041]	0.0376 [0.050]	-0.0121 [0.042]
American Indians	-0.1366 [0.119]	-0.1117 [0.156]	-0.1419 [0.120]	-0.1178 [0.157]
Female	-0.2094*** [0.022]	-0.2072*** [0.031]	-0.2116*** [0.022]	-0.2090*** [0.032]
Potential Experience	0.0703 [0.171]	0.0746 [0.146]	0.0736 [0.173]	0.0807 [0.147]
Potential Experience^2	-0.0056 [0.013]	-0.0059 [0.011]	-0.0058 [0.013]	-0.0064 [0.011]
Base Year Family SES	0.0463*** [0.018]	0.0315 [0.020]	0.0442** [0.018]	0.0298 [0.020]
Base Year Limited English proficiency	-0.1939** [0.081]	-0.1981*** [0.054]	-0.1974** [0.083]	-0.1997*** [0.055]
% of African American Teachers	0.0775 [0.084]	0.1112 [0.089]	0.0773 [0.085]	0.1106 [0.087]
% of Hispanic Teachers	-0.2889** [0.122]	-0.1922 [0.168]	-0.3132*** [0.121]	-0.2168 [0.167]
% of Asian Teachers	-0.1184 [0.171]	-0.2550 [0.181]	-0.1336 [0.159]	-0.2995* [0.178]
% of American Indian Teachers	-3.3982* [1.994]	-3.5470*** [1.228]	-3.3687* [1.983]	-3.5211*** [1.212]
% of Teachers with Graduate Degrees	0.0464 [0.046]	0.0425 [0.055]	0.0473 [0.046]	0.0450 [0.053]
Observations	1,643	1,643	1,643	1,643
R-squared	0.115	0.112	0.123	0.120
State Fixed Effect	No	Yes	No	Yes

Robust standard errors in brackets. Standard errors corrected for heteroskedasticity for pooled models. Standard errors for state fixed effect corrected for heteroskedasticity and clustered at state-level. *** p<0.01, ** p<0.05, * p<0.1. Sample includes only high school graduates with no 4-year college credits. The estimations did not apply weights.

Table 9. Credit Effects and Degree or Certificate Effect for male

	1	2	3	4
	Male	Male FE	Male	Male FE
Certificate			-0.0101 [0.062]	0.0127 [0.074]
Associate Degree			0.0203 [0.084]	0.0192 [0.095]
2-year college credit	0.0001 [0.001]	0.0004 [0.001]	-0.0017* [0.001]	-0.0013 [0.001]
Certificate * 2-year college credit			0.0004 [0.001]	0.0004 [0.001]
Associate Degree * 2-year college credit			0.0025* [0.001]	0.0023 [0.001]
PSE GPA	-0.0179 [0.018]	-0.0225 [0.016]	-0.0161 [0.018]	-0.0219 [0.016]
HS GPA	0.0083 [0.030]	-0.0024 [0.035]	0.0016 [0.030]	-0.0090 [0.035]
African Americans	-0.1822*** [0.056]	-0.1665*** [0.055]	-0.1957*** [0.058]	-0.1764*** [0.056]
Hispanics	0.0300 [0.071]	-0.0020 [0.054]	0.0140 [0.073]	-0.0090 [0.054]
Asians	-0.0328 [0.073]	-0.0468 [0.068]	-0.0299 [0.072]	-0.0396 [0.069]
American Indians	-0.0969 [0.259]	-0.0741 [0.371]	-0.1117 [0.258]	-0.0814 [0.374]
Potential Experience	0.1467 [0.255]	0.0081 [0.208]	0.1527 [0.261]	0.0272 [0.215]
Potential Experience^2	-0.0110 [0.020]	0.0002 [0.017]	-0.0112 [0.020]	-0.0011 [0.018]
Base Year Family SES	0.0152 [0.029]	-0.0053 [0.029]	0.0163 [0.029]	-0.0028 [0.029]
Base Year Limited English proficiency	-0.3718*** [0.118]	-0.3647*** [0.121]	-0.3889*** [0.118]	-0.3796*** [0.125]
% of African American Teachers	-0.0363 [0.118]	-0.0999 [0.160]	-0.0355 [0.120]	-0.1044 [0.155]
% of Hispanic Teachers	-0.5638** [0.262]	-0.5800* [0.341]	-0.5751** [0.262]	-0.5833* [0.343]
% of Asian Teachers	-0.1926 [0.268]	-0.3577 [0.247]	-0.2061 [0.238]	-0.4420** [0.217]
% of American Indian Teachers	-4.7598** [1.928]	-4.9878*** [1.036]	-4.6213** [1.937]	-4.8770*** [1.051]
% of Teachers with Graduate Degrees	0.1219* [0.072]	0.0333 [0.062]	0.1233* [0.072]	0.0436 [0.063]
Observations	769	769	769	769
R-squared	0.125	0.113	0.138	0.124
State Fixed Effect	No	Yes	No	No

Robust standard errors in brackets. Standard errors corrected for heteroskedasticity for pooled models. Standard errors for state fixed effect corrected for heteroskedasticity and clustered at state-level. *** p<0.01, ** p<0.05, * p<0.1. Sample includes only high school graduates with no 4-year college credits. The estimations did not apply weights.

Table 10. Credit Effects and Degree or Certificate Effect for female

	1	2	3	4
	Female	Female FE	Female	Female FE
Certificate			-0.0403 [0.046]	-0.0121 [0.038]
Associate Degree			0.0686 [0.065]	0.0791 [0.051]
2-year college credit	0.0016*** [0.001]	0.0013* [0.001]	0.0006 [0.001]	0.0006 [0.001]
Certificate * 2-year college credit			0.0003 [0.001]	0.0000 [0.001]
Associate Degree * 2-year college credit			0.0004 [0.001]	0.0003 [0.001]
PSE GPA	-0.0419*** [0.016]	-0.0447*** [0.013]	-0.0400** [0.017]	-0.0463*** [0.014]
HS GPA	0.0330 [0.026]	0.0413* [0.023]	0.0308 [0.026]	0.0388* [0.023]
African Americans	-0.1530** [0.060]	-0.1127*** [0.041]	-0.1560*** [0.060]	-0.1168*** [0.042]
Hispanics	0.0907** [0.044]	0.0585 [0.043]	0.0883** [0.044]	0.0549 [0.045]
Asians	0.1249* [0.067]	0.0508 [0.043]	0.1284* [0.067]	0.0549 [0.046]
American Indians	-0.1932** [0.087]	-0.1523** [0.074]	-0.1892** [0.087]	-0.1557** [0.073]
Potential Experience	0.0828 [0.245]	0.1353 [0.202]	0.0943 [0.249]	0.1414 [0.205]
Potential Experience^2	-0.0075 [0.019]	-0.0110 [0.016]	-0.0084 [0.019]	-0.0115 [0.017]
Base Year Family SES	0.0791*** [0.023]	0.0682*** [0.024]	0.0758*** [0.023]	0.0653*** [0.024]
Base Year English proficiency	-0.0159 [0.091]	-0.0429 [0.068]	-0.0111 [0.093]	-0.0371 [0.070]
% of African American Teachers	0.1878 [0.116]	0.2500** [0.101]	0.1863 [0.117]	0.2509** [0.102]
% of Hispanic Teachers	-0.1304 [0.106]	0.0591 [0.121]	-0.1595 [0.104]	0.0235 [0.114]
% of Asian Teachers	-0.0343 [0.254]	-0.2753 [0.265]	-0.0584 [0.245]	-0.3039 [0.268]
% of American Indian Teachers	-0.0628 [1.008]	0.0837 [1.345]	-0.1687 [1.019]	0.0375 [1.335]
% of Teachers with Graduate Degrees	0.0090 [0.058]	0.0384 [0.078]	0.0130 [0.058]	0.0413 [0.078]
Observations	874	874	874	874
R-squared	0.057	0.048	0.063	0.078
State Fixed Effect	No	Yes	No	No

Robust standard errors in brackets. Standard errors corrected for heteroskedasticity for pooled models. Standard errors for state fixed effect corrected for heteroskedasticity and clustered at state-level. *** p<0.01, ** p<0.05, * p<0.1. Sample includes only high school graduates with no 4-year college credits. The estimations did not apply weights.

Table 11. Marginal Credit Effects and Degree or Certificate Effect

		1	2	3	4	5	6
		Pooled	FE	Male	Male FE	Female	Female FE
Certificate		-0.0290 [0.032]	-0.0140 [0.027]	-0.0044 [0.053]	0.0181 [0.062]	-0.0359 [0.042]	-0.0120 [0.037]
Associate Degree		0.0609 [0.045]	0.0671 [0.047]	0.0557 [0.069]	0.0529 [0.078]	0.0744 [0.053]	0.0830 [0.046]
2-year college credit							
	No Degree or Certificate	-0.0005 [0.001]	-0.0001 [0.001]	-0.0017 [0.001]	-0.0013 [0.001]	0.0006 [0.001]	0.0006 [0.001]
	Certificate holders	-0.0003 [0.001]	-0.0002 [0.0009]	-0.0013 [0.0012]	-0.0010 [0.0013]	0.0009 [0.001]	0.0006 [0.001]
	Degree holders	0.0009 [0.001]	0.0009 [0.001]	0.0007 [0.001]	0.0010 [0.001]	0.0010 [0.001]	0.0008 [0.001]
	With both Degree and Certificate	0.0010 [0.001]	0.0009 [0.001]	0.0011 [0.002]	0.0014 [0.002]	0.0013 [0.001]	0.0008 [0.001]

Coefficients and standard errors are calculated as linear combinations of corresponding regression estimators. *** p<0.01, ** p<0.05, * p<0.1. Sample includes only high school graduates with no 4-year college credits. Certificate and Associate Degree effects evaluated at mean credit.

Table 12. Credit Effects and Degree or Certificate Effect

	1	2
Post-Secondary Certificate	0.0151 [0.024]	
Associate Degree	0.0616** [0.028]	0.0599** [0.027]
B.A. Degree	0.1871*** [0.026]	0.1859*** [0.026]
Master's Degree	0.1649*** [0.025]	0.1644*** [0.025]
Ph.D. Degree	0.3914*** [0.079]	0.3912*** [0.079]
4-Year College Credits	0.0001 [0.000]	0.0001 [0.000]
2-Year College Credits	-0.0005 [0.000]	-0.0004 [0.000]
PSE GPA	-0.0278*** [0.009]	-0.0268*** [0.009]
HS GPA	0.0307 [0.019]	0.0303 [0.019]
Female	-0.1545*** [0.013]	-0.1542*** [0.013]
African Americans	-0.0387 [0.025]	-0.0390 [0.025]
Hispanics	-0.0005 [0.028]	-0.0005 [0.028]
Asians	-0.0129 [0.032]	-0.0129 [0.032]
American Indians	-0.2929** [0.123]	-0.2930** [0.123]
Potential Experience	-0.0884 [0.146]	-0.0896 [0.147]
Potential Experience^2	0.0076 [0.011]	0.0076 [0.011]
Base Year Family SES	0.0298*** [0.010]	0.0295*** [0.010]
Base Year English proficiency	-0.0706 [0.044]	-0.0708 [0.044]
% of African American Teachers	0.0430 [0.075]	0.0437 [0.074]
% of Hispanic Teachers	-0.1901* [0.112]	-0.1903* [0.112]
% of Asian Teachers	-0.2538** [0.117]	-0.2526** [0.116]
% of American Indian Teachers	-1.8900** [0.749]	-1.8927** [0.749]
% of Teachers with Graduate Degrees	0.0014 [0.031]	0.0016 [0.030]
Observations	5,175	5,175
R-squared	0.097	0.097
State Fixed Effect	No	Yes

Robust standard errors adjust for 51 state clusters in brackets. Standard errors for state fixed effect corrected for heteroskedasticity and clustered at state-level. *** p<0.01, ** p<0.05, * p<0.1. Sample includes the entire sample with no restriction. The reference category for certificate and degree effect is respondents who does not acquired any post-secondary certificate or degree. The estimations did not apply weights.

References

- Acemoglu, D., and Pischke, A. (1999). Beyond Becker: Training in imperfect labour markets. *The Economic Journal*, 109(453), 112-142.
- Acemoglu, D., and Pischke, J. R. (2000). Training and labor market: Incentives and outcomes certification of training and training outcomes. *European Economic Review*, 44(2000), 917-927.
- Angrist, J. D., and KRUEGER, A. B. (1999). Empirical strategies in labor economics. *Handbook of Labor Economics*, 3, 1278-1357.
- Arkes, J. (1999). What do educational credentials signal and why do employers value credentials? *Economics of Education Review*, 18(1999), 133–141.
- Arrow, K. J. (1973). Higher education as a filter. *Journal of Public Economics*, 1973(2), 193-216.
- Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5), 9-49.
- Bedard, K. (2001). Human capital versus signaling models: University access and high school dropouts. *Journal of Political Economy*, 109(4), 749-775.
- Belfield, C. R., and Bailey, T. (2011). The benefits of attending community college: A review of the evidence. *Community College Review*, 39(I), 46– 68.
- Belman, D., and Heywood, J. S. (1991). Sheepskin effects in the returns to education: An examination of women and minorities. *The Review of Economics and Statistics*, 73(4), 720-724.
- Belman, D., and Heywood, J. S. (1997). Sheepskin effects by cohort: Implications of job matching in a signaling model. *Oxford Economic Papers*, 49(1997), 623-637.
- Bitzan, J. D. (2009). Do sheepskin effects help explain racial earnings differences? *Economics of Education Reviews of Education Review*, 28(2009), 759–766.
- Cameron, S. V., and Heckman, J. J. (1993). The nonequivalence of high school equivalents. *Journal of Labor Economics*, 11(1), 1-47.
- Card, D. (1994). Earnings, schooling, and ability revisited. National Bureau of Economic Research.

- Card, D. (2001). Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica*, 69(5), 1127-1160.
- David Card, The Causal Effect of Education on Earnings, *Handbook of Labor Economics*, Volume 3, chapter 30, sections 1-3.1
- Card, D., and Krueger, A. (1990). Does school quality matter? Returns to education and the characteristics of public schools in the United States. *NBER WORKING PAPER SERIES*, (3353)
- Card, D., and Krueger, A. (1996). Labor market effects of school quality: Theory and evidence. *NBER WORKING PAPER SERIES*, (5450)
- Carneiro, P., Heckman, J. J., and Vytalil, E. J. (2010). Estimating marginal returns to education. *NBER WORKING PAPER SERIES*, (16474),
- Golbe, Devra L. Imperfect signaling, affirmative action, and black-white wage differentials. *Southern Economic Journal* (1985): 842-848.
- Grubb, W. N. (1993). The varied economic returns to postsecondary education: New evidence from the class of 1972. *The Journal of Human Resources*, 28(2), 365-382.
- Grubb, W. N. (1995). Postsecondary education and the sub- baccalaureate labor market: Corrections and extensions. *Economics of Education Review*, 14(3), 285-299.
- Habermalz, Steffen. More detail on the pattern of returns to educational signals. *Southern Economic Journal* (2006): 125-135.
- Heckman, J., Layne-Farrar, A., and Todd, P. (1996). Human capital pricing equations with an application to estimating the effect of schooling quality on earnings. *The Review of Economics and Statistics*, 78(4), 562-610.
- Heckman, J. J., and Rubinstein, Y. (2001). The importance of noncognitive skills: Lessons from the ged testing program. *The American Economic Review*, 91(2), 145-149.
- Jaeger, D. A., and Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The Review of Economics and Statistics*, 78(4), 733-740.

- Kane, T. J., and Rouse, C. E. (1995). Labor-market returns to two- and four-year college. *The American Economic Review*, 85(3), 600-614.
- Kane, T. J., and Rouse, C. E. (1999). The community college: Educating students at the margin between college and work. *The Journal of Economic Perspectives*, 13(1), 63-84.
- Lam, D., and Schoeni, R. F. (1993). Effects of family background on earnings and returns to schooling: Evidence from Brazil. *Journal of Political Economy*, 101(4), 710-740.
- Leigh, D. E., and Gill, A. M. (1997). Labor market returns to community colleges: Evidence for returning adults. *Journal of Human Resources*, 334-353.
- Marcotte, D. E., Bailey, T., Borkoski, C., and Kienzl, G. S. (2005). The returns of a community college education: Evidence from the National Education Longitudinal Survey. *Educational Evaluation and Policy Analysis*, 27(2), 157-175.
- Habermalz, S. (2006). More detail on the pattern of returns to educational signals. *Southern Economic Journal*, 7(1), 125-135.
- Hungerford, T., and Solon, G. (1987). Sheepskin effects in the returns to education. *The Review of Economics and Statistics*, 69(1), 175-177.
- Jacobson, L., LaLonde, R., and G Sullivan, D. (2005). Estimating the returns to community college schooling for displaced workers. *Journal of Econometrics*, 125(1), 271-304.
- Jepsen, C., Troske, K., and Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics*, 32(1), 95-121.
- Kane, T. J., and Rouse, C. E. (1995). Labor-market returns to two-and four-year college. *American Economic Review*, 85(3), 600-614.
- Kane, T. J., and Rouse, C. E. (1999). The community college: Educating students at the margin between college and work. *The Journal of Economic Perspectives*, 63-84.
- Ritter, J. A., and Taylor, L. J. (2011). Racial disparity in unemployment. *The Review of Economics and Statistics*, 93(1), 30-42.
- Spence, M. (1972). Job market signaling. *The Quarterly Journal of Economics*, 8(3), 355-374.

Tyler, J., Murnane, R., and Willett, J. (2000). Estimating the labor market signaling value of the GED. *The Quarterly Journal of Economics*, 115(2), 431-468.

Weiss, A. (1995). Human capital vs. signaling explanations of wages. *The Journal of Economic Perspectives*, 133-154.