Employment Outcomes for Graduates of Washington State's Applied Baccalaureate Degree Programs

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ABSTRACT

As of 2017, 24 states allow community colleges to confer bachelor's degrees, mostly in applied and technical fields. There are several reasons for allowing community colleges to confer bachelor's degrees; to improve access to baccalaureate education for students for whom a public four-year institution is geographically inaccessible, students who face challenges transferring credits to a four-year institution with an applied associate's degree, and those for whom the desired program is not offered by a public four-year institution. Community college bachelor's degrees also provide a more affordable option for obtaining a bachelor's degree. Critics contend that a bachelor's degree conferred by a community college will be of lesser quality than one conferred by a four-year institution, placing graduates at a disadvantage when they seek employment or graduate education. To date, no study has compared employment outcomes of students who graduated with a bachelor's degree from a community college with those who graduated from a four-year institution. Using longitudinal administrative data from Washington State, this study is the first to estimate the causal effect of earning a community college bachelor's degree in nursing or business administration with instrumental variables and fixed effects regressions. Results provide no evidence that community college bachelor's degree graduates suffer a penalty in short-term employment outcomes (employment status and median hourly wages) measured in the year after degree completion. Implications for research and policy are discussed.

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1. Introduction

In response to the demand for increased baccalaureate attainment, some states have adopted policies that allow community colleges to confer bachelor's degrees (CCB degrees) in certain high demand applied and technical fields. CCB degrees are applied baccalaureate degrees offered in fields such as nursing and allied health, business administration, education, and security ("Applied Baccalaureate Degrees," 2017; Floyd & Walker, 2009; Ruud & Bragg, 2013). CCB degree programs have been developed to meet the needs of students by providing affordable access to baccalaureate education, particularly for working adults and those who cannot move to attend college (Floyd & Walker, 2009; Fulton, 2015; Poliono & Goldstein, 2015). The CCB is also intended to meet the needs of the local community by providing the baccalaureate-level programming to fill local workforce needs (England-Siegerdt & Andreas, 2012; Floyd, 2005; Phelan, 2016). As of 2015, 23 states had adopted policies that authorize community colleges to confer bachelor's degrees (Fulton, 2015). Bringing the count to 24 in 2017, Ohio became the most recent state to allow bachelor's degrees to be conferred by community colleges with proposals to offer bachelor's degrees in manufacturing technology management and land surveying (Morris, 2017).

Though the trend of allowing community colleges to confer bachelor's degrees is growing, some critics have expressed concerns, particularly about academic quality. If CCB degrees are actually of lesser quality or are perceived to be of lesser quality, then graduates may be negatively impacted when they enter the labor market.

Several arguments suggest reasons to suspect that a bachelor's degree conferred by a community college could not match the quality of a degree conferred by a four-year college (Eaton, 2005; Russell, 2013; Wattenbarger, 2000). Community colleges have not been designed

to offer baccalaureate-level programming and have been offering baccalaureate-level programming for a relatively short time. West Virginia was the first state to allow a CCB in 1989 (Fulton, 2015), but Florida was the first to really implement the CCB in earnest beginning in 2001 (Floyd, Garcia Falconetti, & Felsher, 2012). Townsend (2005) suggested that CCB degrees would not provide a comparable level of rigor compared to a bachelor's degree from a 4-year institution. It has also been suggested that community colleges wishing to offer bachelor's degrees would have difficulty recruiting and retaining qualified faculty (Daugherty, Goldman, Butterfield, & Miller, 2014; Levin, 2004; McKinney, Scicchitano, & Johns, 2013). The time and resources required to obtain and maintain accreditation could pose significant challenges to community colleges (Russell, 2013). Upgrading facilities, especially libraries, could prove difficult (Fulton, 2015; Russell, 2013). Despite the arguments against CCB degrees, there has been no empirical comparison of CCB graduates with those who graduated from a traditional 4-year baccalaureate granting (TBA) institution.

Though the aforementioned concerns are largely speculative, a large body of evidence suggests that institution type and quality are important to understand employment outcomes. Several studies of post-college employment outcomes have found that certain characteristics of institutions, including those that reflect student abilities, institutional resources, and instructional quality, are related to subsequent economic outcomes (Black & Smith, 2006; Dale & Krueger, 2002; Mayhew et al., 2016; Zhang, 2009). New research has extended the inquiry of institution type and employment outcomes to compare for-profit institutions with other institution types and has found differential outcomes by sector (Darolia, Koedel, Martorell, Wilson, & Perez-Arce, 2015; Deming, Yuchtman, Abulafi, Goldin, & Katz, 2016).

The purpose of this study was to measure and compare employment outcomes within one year after graduation between students who earned a bachelor's degree from a community college and those who graduated from a traditional 4-year baccalaureate granting institution, controlling for major. The idea is that employment rates and wages serve as a proxy for the value that the credential holds in the labor market; employers will be more likely to hire and offer higher wages to individuals whom they believe to have higher ability, skill, and productivity. It is possible that a degree awarded by a community college and one awarded by a public 4-year institution signal different levels of ability, skill, and potential productivity to potential employers.

Such a comparison is relatively straightforward. The methodological challenge lies in designing the research study in a way that minimizes selection bias, which arises as individuals make decisions about where to enroll in college and what to study and then where to work. If unobservable factors drive the aforementioned decisions and are associated with employment outcomes, then the estimates of the effect of the institution type will be biased. This study uses an instrumental variables approach that exploits exogenous variation in proximity to public colleges that offer bachelor's degrees in fields that are available at both institution types to identify a valid comparison group.

Research Questions

The questions addressed by this study are:

1. Are employment rates one year after graduation comparable for CCB and TBA graduates?
2. Are earnings one year after graduation comparable for CCB and TBA graduates?

There are three possible outcome scenarios:

1. CCB critics contend that a bachelor's degree conferred by a community college will be of inferior quality to one conferred by a TBA. In this scenario, postbaccalaureate employment rates and wages would be lower for CCB graduates than for TBA graduates.
2. CCB supporters maintain that the CCB degree meets specific local workforce needs. Because employers often have established relationships with the community colleges, it is likely that they will view CCB degrees as having comparable value as TBA degrees. In this scenario, postbaccalaureate employment rates and wages will be comparable for graduates of the two institution types.
3. Another possible outcome scenario is that, for the reasons stated in (2) above, degrees will be perceived *more* positively than TBA degrees. If this is the case, then it is possible that graduates will exhibit higher postbaccalaureate employment rates and wages.

To date, there has been no rigorous comparison of employment outcomes between CCB and TBA graduates. This study draws upon existing literature regarding the relationship between institution quality and employment outcomes and applies a quasi-experimental method to the question of the effects of earning a bachelor's degree from a community college. This study uses geographic variation as instrumental variables to identify the effect of CCB receipt on employment outcomes. The findings from this study will provide much-needed data for higher education policy makers as they decide whether to adopt and/or expand CCB policies to address unmet educational needs.

2. Literature Review

The CCB degree is a bachelor's degree that is conferred solely by a community college (Floyd, 2005; Floyd & Walker, 2009; Townsend, 2005). The CCB degree is often referred to as a workforce or applied bachelor's degree because it is "designed in response to local, statewide,

and national workforce needs and demands" (Floyd, 2012, p. 1) and is "…externally stimulated, guided, and evaluated…" (Walker & Floyd, 2005, p. 98). These degrees are generally offered in applied fields such as business, education, and nursing (Floyd et al., 2012). Community colleges are not conferring bachelor's degrees in liberal arts, nor are they intended to be a "substitute for what might be called a traditional college experience" (Hagan, 2015, p. 3).

Figure 1 displays a map of the states in which community colleges have been authorized to confer bachelor's degrees and indicates the years in which the policy was adopted. There is wide variation in the number of institutions and programs in the states in which it is available. For example, Florida began offering CCB degrees in 2001 and currently has 175 bachelor's degree programs in 24 colleges (Poliono & Goldstein, 2015). Alternatively, in 2003, Texas began offering 7 degree programs through 4 institutions. California has the largest community college system in the country with 112 colleges serving 2.1 million students and passed legislation to allow a CCB in 2014 ("California Community College Chancellor's Office," 2014). Most states though have CCB programs in fewer than five institutions (Fulton, 2015), and Idaho has allowed CCB degrees since 1995 but has yet to implement one.

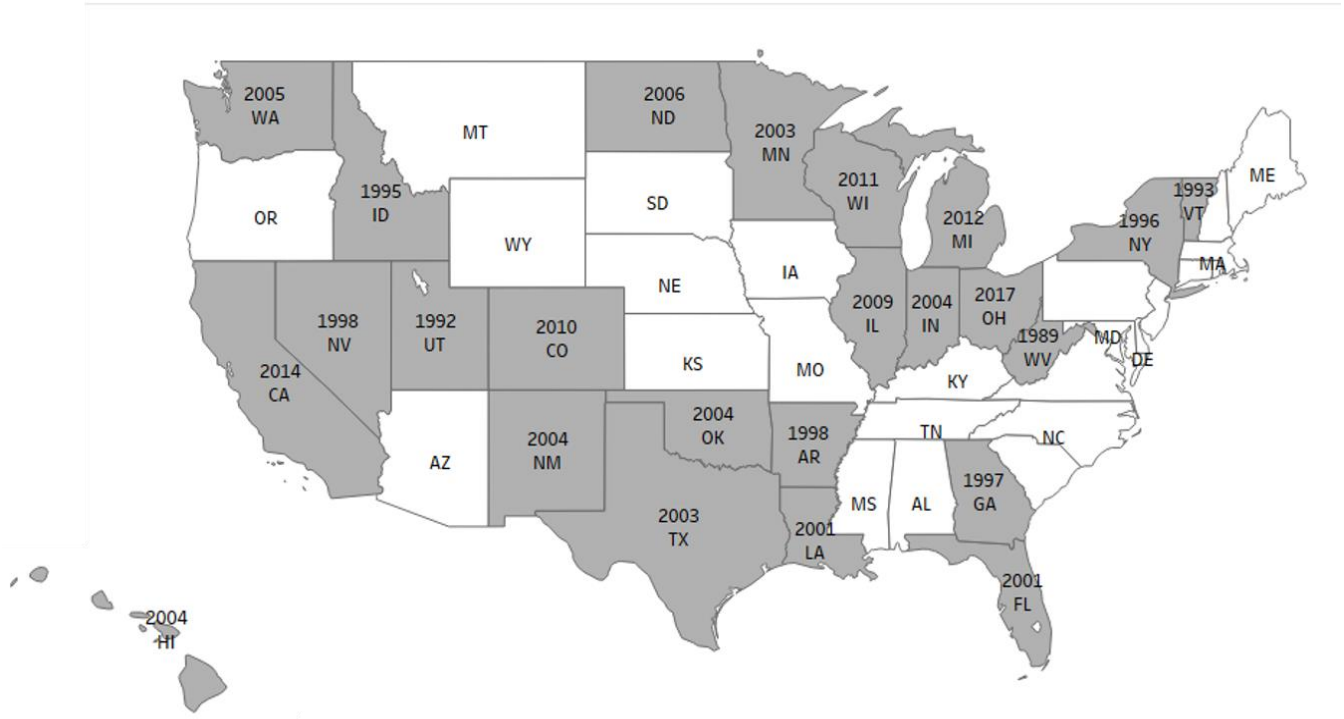

Figure 1. States in which community colleges are authorized to confer bachelor's degrees. Adapted from (Fulton, 2015; Morris, 2017).

Generally, the CCB degree has been developed as a response to the needs of communities and students. The CCB addresses needs of the community by increasing the level of baccalaureate attainment to more adequately meet local workforce demand. Specifically, it is intended to improve access to baccalaureate education in applied fields, particularly for place-bound, nontraditional students (Daugherty et al., 2014; Fulton, 2015; Walker, 2001). The CCB also provides a more affordable option due to lower enrollment costs and savings from not paying for on-campus housing (Floyd & Walker, 2009; Nicastro, 2014; Walker, 2001). Community colleges also provide a different learning environment that is often smaller and less intimidating than a four-year college (Nicastro, 2014; O'Connell, 2014; Walker, 2001). Another benefit of the CCB is that it enables seamless transfer for students who have an applied associate's degree (Daugherty et al., 2014; Floyd & Walker, 2009; Ruud & Bragg, 2013).

However, the impetus for implementing the CCB is largely dependent on state context. In many cases, the challenge is geography; the public four-year college is not close enough to attend for individuals who are place-bound because they are employed or have a family. Another challenge is capacity; the public four-year college cannot serve the number of potential students or generate enough graduates to meet local workforce demands. Unmet employer demand for fields of study not offered by public four-year colleges and universities is an additional factor cited in the need for the CCB (England-Siegerdt & Andreas, 2012; Floyd & Walker, 2009; O'Connell, 2014).

Some argue that the CCB is unnecessary given existing alternatives, including articulation models, university extension models, and university center models (Floyd et al., 2012; Ruud & Bragg, 2013). Opponents contend that the CCB poses a threat to the traditional mission of community colleges and detracts from the core community college functions such as open access education, awarding associate's degrees for workforce training and academic transfer, remedial and developmental education, and workforce preparation (Eaton, 2005; Farnsworth, 2006; Levin, 2004). Thus, there is concern that the CCB may divert resources away from community college students who do not intend to earn a bachelor's degree (Farnsworth, 2006; Levin, 2004; Wagoner & Ayon, 2012).

One of the primary concerns about the CCB, however, relates to quality—the rigor of the program, the quality of the faculty, and the quality of the students. Critics allege that graduates of CCB programs will have earned an inferior degree (Russell, 2013; Wattenbarger, 2000), that CCB programs will be less rigorous than baccalaureate programs at 4-year institutions (Russell, 2013), and that CCB programs will have difficulty recruiting and retaining qualified faculty (Wattenbarger, 2000).

Postbaccalaureate Employment Outcomes

It is well established that the amount of schooling and level of attainment are important determinants of employment outcomes (Baum, Kurose, & Ma, 2013; Card, 1993; Card, 2001; Carnevale & Rose, 2011). Another key determinant of employment outcomes is field of study (Abel, Deitz, & Su, 2014; Carnevale, Cheah, & Hanson, 2015; Gelblum, 2014). Institution characteristics also help explain variation in employment outcomes (Baum et al., 2013; Black & Smith, 2006; Eide, Hilmer, & Showalter, 2016; Kalleberg & Dunn, 2014; Scott-Clayton, 2016; Zhang, 2009).

One possible explanation for the mechanism behind the relationship between institution characteristics and employment outcomes is that "better" institutions provide a better-quality education, thereby increasing human capital, so that the graduate is more productive (Baum et al., 2013; Bills, 2003; Zhang, 2009). Another possible explanation is that the quality of an institution is a proxy for the ability of the individual—where higher ability students are admitted to higher quality schools (Baum et al., 2013; Doyle & Skinner, 2016; Zhang, 2009). It is also possible that the underlying mechanism reflects a combination of the human capital and signaling effects.

Many studies have used institution selectivity as a single proxy for institution quality (see Black & Smith, 2006, for a review). Other studies have examined average test scores and tuition to capture additional components of institutional quality (Dale & Krueger, 2002). Still other studies of institution effects employ multiple measures of college quality. Black and Smith (2006) include the faculty-student ratio, the rejection rate among those who applied for admission, the freshman retention rate, the mean SAT score of the entering class, and mean faculty salaries (Black & Smith, 2006). A review of studies that estimated causal effects of

postsecondary education on employment and earnings (Mayhew et al., 2016) found that college quality consistently had positive effects on earnings when multiple quality measures were used.

The measures mentioned above largely reflect indicators for four-year institutions and may not be applicable to CCB programs. Because community colleges provide open access programming, the four-year selectivity metrics are generally not required by community colleges for admission and are not appropriate for comparison between the institution types. However, research on community college graduates has identified characteristics of public two-year colleges that are associated with employment outcomes. For instance, in their study of North Carolina community college students, Kalleberg and Dunn (2014) found that earnings were higher among students who attended community colleges with larger enrollments, which may reflect availability of greater resources. Earnings were negatively associated with transfer rates, possibly signaling an effect of resource allocation that focuses more heavily on the transfer function and less on workforce-specific programming. Students who attended a community college with a relatively high ratio of applied courses compared to academic courses earned more. Lower earnings were found among students who attended community colleges with relatively high proportions of non-high school completers, indicating possible peer effects (Kalleberg & Dunn, 2014).

Also important were characteristics of the college's service area and the local labor market in which the community college is located. Students who attended a community college that served just one county earned more than students who attended a community college that served more than one county, perhaps indicating that single-county service schools are able to tailor their curricular offerings more specifically to local workforce demands. Earnings were higher in areas with lower unemployment, suggesting that employment opportunities may be

higher in areas with lower unemployment. Population density was also examined and was negatively correlated with earnings, though the effect was not statistically significant. The authors speculate that more densely populated areas have more employment opportunities but may also have greater competition for those opportunities (Kalleberg & Dunn, 2014). Considering the evidence regarding institution effects, this research area should be extended to examine the effects of earning a CCB on employment outcomes.

Comparisons between for-profit and public institutions may be the most analogous to an examination of CCB and TBA outcomes. Compared to traditional two- and four-year colleges, both for-profit and CCB institutions are relatively new to the higher education landscape, and both provide an unconventional alternative path to an existing credential through a different institution type. A recent experimental study analyzed the impact of institution sector and selectivity on employer callback rates for interviews, holding individual characteristics constant and varying only the institution type. This study compared results for business and health majors across 1) for-profit and public institutions, 2) for-profit online programs with for-profit colleges with a local brick-and-mortar presence, and 3) more selective public colleges with public less selective colleges (Deming et al., 2016). They found that, compared to public college graduates, callback rates were lower for graduates of for-profit institutions by about 22% among business majors and about 57% lower among health majors. However, there was no difference in callback rates for health majors by sector in cases when an external credential such as an occupational license was required. The authors surmise that "employers view for-profit postsecondary credentials as a negative signal of applicant quality, particularly when objective measures of quality such as a licensing exam are unavailable" (Deming et al., 2016, p. 780). Further, the observed differences in callback rates were correlated with measures of school

quality, such as completion rates and institution expenditures, suggesting that these quality measures drive the observed differences more than the institution type itself. Whether employers were reacting to the perceived quality of the institution per-se or to the characteristics of students that often attend for-profit institutions is unclear. It has been shown that students who attended for-profit colleges are more disadvantaged than students at public colleges on characteristics that could also be correlated with productivity (Deming, Goldin, & Katz, 2013).

Critics have argued that the CCB will be inferior to a bachelor's degree conferred by a four-year college or university, but this has yet to be tested empirically. However, in both two- and four-year colleges, characteristics related to the amount and allocation of resources, curricular functions and priorities, and the makeup of the student body are shown to relate to employment outcomes even after controlling for selection bias. Experimental studies of institution type comparing for-profit and public institutions have found evidence that institution type sends a differential signal of quality such that an applicant with a for-profit credential is less attractive to prospective employers than an identical applicant with a credential from a public institution. Based on findings from analyses of institution quality effects in other postsecondary contexts, it is not unreasonable to question whether CCB programs differ from TBA programs in ways that could negatively impact employment outcomes.

3. Data

The Washington State Education Research and Data Center maintains a state longitudinal data system that follows students from preschool through secondary and postsecondary education and into the workforce. These longitudinal data combine information on public high school completions from the Office of Superintendent of Public Instruction, postsecondary enrollment, completions data from the State Board for Community and Technical Colleges, the

Public Centralized Higher Education Enrollment System, and quarterly wages from the state's unemployment insurance database.

Analysis Sample. From the postsecondary data system, the Washington State Education Research and Data Center created a student-level file containing data on college enrollment and completions for approximately 165,000 students who earned a bachelor's degree from Washington State public 2- and 4-year institutions between 2007 and 2015. The Washington State Education Research and Data Center then matched the college enrollment and completions data file with the other data sources to obtain available information for each baccalaureate recipient on high school completion and employment data.

The first Washington CCB degrees were awarded in 2009. The most recent wage data available were through 2015, so individuals who graduated after 2014 are excluded to allow for observation of outcomes one year after degree completion. Among the analysis sample, about 280 TBA graduates (just under 5%) and fewer than ten CCB graduates (less than 2%) earned more than one bachelor's degree between 2009 and 2014. In such instances, I retained the first completion for analysis purposes. The final analysis sample includes graduates in Business Administration and Nursing from institutions that offered face-to-face programming[2] at both community colleges and minimally or moderately selective[3] public four-year colleges during the study period.

Table 1 presents the community colleges in Washington that were authorized to confer CCB during the study period (2009−2014), the year in which they began offering CCB degrees,

[2] Programs that were delivered exclusively online were excluded. The Business Administration programs through Washington State University were only available through online programming and served students in all WSU branch campuses.

[3] To maximize comparability across institution types, graduates from the most selective public institution (University of Washington – Seattle Campus) were excluded.

and the majors in which the CCB degrees were available. To be included in the analysis sample, the majors offered at a CCB institution must have had one or more comparison TBA institutions that were minimally or moderately selective, did not offer the program solely online, and had enough graduates to support statistical multivariate analysis.

Table 1

Washington Applied Baccalaureate Degree Programs, CCB Institution, and Year of First Graduating Cohort (2009–2014)

Bachelor's Degree Program	CCB Institution	First Graduating Cohort
Business Administration	Peninsula College	2009
	Columbia Basin College	2011
Nursing	Olympic College	2009

The sample was further restricted to exclude out-of-state students and students who attended private institutions. One of the primary aims of the CCB degree is to make baccalaureate education more accessible to students who need convenience and affordability, especially nontraditional students and those who are place bound. Students who attend out-of-state institutions and students who enroll in private institutions are generally less constrained by affordability and location when deciding where to attend college. About 490 cases were excluded because there was no available data regarding their pre-college location. The final analysis sample includes 6,610 students who earned a bachelor's degree in business administration or nursing from a public two- or four-year institution between 2009 and 2014.

Descriptive statistics for the analysis sample are presented in Table 2. Results are shown overall and for TBA and CCB graduates. Relative to TBA graduates, CCB graduates are older with average age at time of bachelor's degree completion of 36 compared to 28 for TBA graduates. CCB graduates have approximately one more year of employment prior to enrolling, averaging about 33 quarters compared to TBA graduates who have about 28 pre-enrollment

quarters of employment. Graduates from the two institution types also differ in terms of reported race and ethnicity. Examining the pre-college county locations shows that CCB graduates tend to be from counties with lower median household income, more poverty, more unemployment, and that are less densely populated.

Table 2

Descriptive Statistics for Analysis Sample, by Treatment Status

	Mean			*t*-test	
	Full sample	TBA	CCB		
Student Characteristics					
Age at bachelor's degree completion	28.6	28.2	36.0	-15.7	***
Number of quarters employed before enrolling	28.4	28.2	33.1	-8.0	***
High School GPA	3.4	3.4	3.2	2.7	***
Percent Female	62.0	62.0	66.0	-1.4	
Percent American Indian	3.0	3.0	3.0	0.1	
Percent Asian	14.0	15.0	6.0	3.9	***
Percent Black	4.0	4.0	3.0	1.5	
Percent White	68.0	68.0	72.0	-1.4	
Percent Hispanic	6.0	6.0	11.0	-3.5	***
Characteristics of pre-college county					
2014 Median household income	$ 57,760	$ 57,930	$ 54,050	10.0	***
2014 Population Density	299.3	303.5	207.4	1.4	
2014 Percent in poverty, all ages	12.4	12.4	12.1	-4.6	***
Unemployment averaged over 2009-2015	7.7	7.6	8.1	5.6	***
N	6,610	6,330	280		

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

Outcome variables. Postbaccalaureate employment outcome measures (employment status and wages) were obtained from Washington unemployment insurance data, which are reported by employers to the state each quarter.

Employment status. Employment status was measured in the four quarters after graduation. Employment status was set to equal 1 if wages were reported in any of quarters 1-4. While the presence of unemployment insurance data indicates employment, lack of

unemployment insurance data does not indicate unemployment. The resulting value is not a true employment rate but rather a measure of employment in covered occupations. To allow for estimation of participation in covered occupations, employment status was assigned one of two values: "Employed by a covered employer" and "Not employed by a covered employer" since there is no way to determine the status for this group. According to the above definition, I calculated that about 88% of the 6,610 individuals in the analysis cohort matched with the Washington unemployment insurance data, indicating that they were employed (by a Washington employer in covered employment) at some time in the first year after degree completion.

Wages. Wages were measured in the four quarters after graduation. The Washington unemployment insurance data include both total wages earned and total hours worked per quarter from which the hourly wage rate can be derived (Education Research and Data Center, 2012). Employers report actual hours worked each quarter, rounded to the next whole number. Employers are instructed to report 40 hours per week for full-time salaried and commissioned employees whose hours are not tracked (Washington State Employment Security Department, n.d.).

Prior to calculating the hourly wage rate, I adjusted quarterly wages to account for regional variation in economic conditions and the cost of living. Following the conceptual approach used by Taylor and Fowler (2006), I developed an index that is based on data specific to counties in Washington and that correspond to the years of interest in my study. Using county-level measures of per capita income (U.S. Department of Commerce, Bureau of Economic Analysis, 2009-2015), I calculated the inverse ratio of per capita income for each county relative to the average per capita income for the state for years 2009–2015. For

example, in 2015, the ratio for King County, one of the state's wealthiest counties and the one that includes Seattle, was 0.72. Therefore, wages paid by an employer in King County in 2015 were decreased by 28% to account for the fact that wages are higher relative to the state average. Conversely, the ratio for Pend Oreille County, located in the far northeast corner of the state, was 1.48, so wages paid to graduates employed in Pend Oreille in 2015 were increased by 48% for comparison purposes. This adjustment was made for each quarter of postbaccalaureate employment. Figure 2 presents the 2014 per capita income by county to illustrate the regional variation.

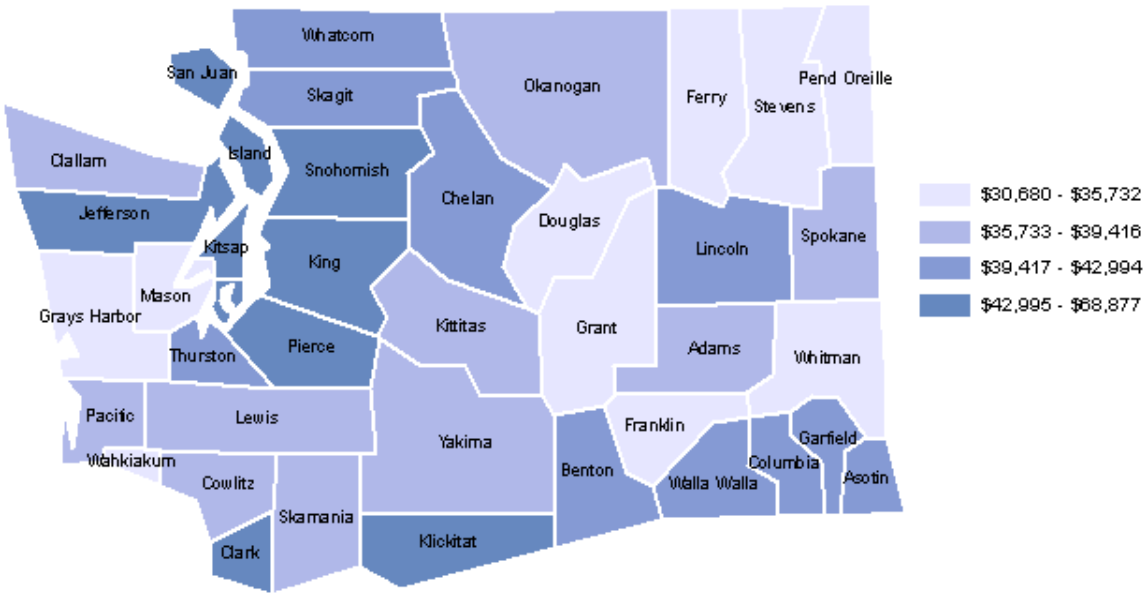

Figure 2. Per capita income by county, 2014 (Office of Financial Management, 2014)

To calculate an hourly wage rate, the regionally-adjusted wages were added across all employment reported for each quarter and then divided by the total number of hours worked in that quarter (wages were not calculated unless both wages and hours were reported; otherwise they were set to missing). Next, I calculated the hourly rate as the median of the

hourly rates across the four post-graduation quarters. Wages were then adjusted for inflation to 2015 values using the Consumer Price Index using the "West Urban region" rate (http://www.bls.gov/cpi/).

Treatment variable. In this study, the treatment is the type of institution that confers the bachelor's degree - a TBA or a CCB institution. There are two main components of institutions that can vary across CCB and TBA institutions, and these differences could be related to graduates' employment outcomes. First, the student populations served by community colleges and public four-year institutions differ on several dimensions including demographic characteristics, academic preparation and achievement, noncognitive factors such as motivation that can influence a student's level of success in education, and even possibly educational goals (e.g. TBA students may be interested in the "college experience" in addition to earning the degree, while CCB students may prioritize earning the credential for career purposes as quickly and efficiently as possible).

Second, differences in characteristics of the institutions themselves are important to consider. TBA institutions generally have larger enrollments and larger tuitions. This can be an advantage for TBA institutions because there is more revenue to dedicate to instructional expenditures and academic services for students. However, the smaller enrollments probably translate to smaller class sizes, which could, in turn, provide more individualized attention for CCB students. Faculty qualifications may affect the quality of instruction across the institution types such that it is more rigorous at a TBA institution, but it is more likely that a student will receive instruction from a graduate assistant rather than a faculty member at a TBA institution.

This set of characteristics across students and institutions constitutes the "treatment" and provides the educational experiences that lead to earning a bachelor's degree. Therefore, the treatment is "bundled" because there are many elements that can be relevant in driving outcomes. So, though outcomes are compared by institution type, it is not within the scope of this study to clearly ascertain how, where, or why the treatment achieves the observed effect.

Table 3 presents institution characteristics for the TBA and CCB[4] institutions in the analysis sample with a focus on the student body and institution resources that have been shown as related to employment outcomes. At first glance, there are some striking differences. Students who attended CCB institutions tend to be more nontraditional than the TBA student population. For example, there is a higher percentage of first-generation students among the group that attends CCB institutions. The percentages of students aged 25 and above and those who are financially independent are much greater for CCB than for TBA institutions. There are more Pell Grant recipients among students who attended TBA institutions, likely because of the lower tuition and fees at CCB institutions.

Students who attended TBA institutions have some advantages over those who attended CCB students. For instance, TBA institution students have higher average family incomes than do the students who enroll in CCB institutions. Metrics related to institution characteristics show that the average enrollment size for TBA institutions is more than twice that of the CCB institutions. Tuition and fees and instructional expenditures are higher at TBA institutions. Faculty are paid more and are much more likely to be full-time at TBA

[4] The results for CCBA institutions are based on the entire institution and do not necessarily accurately reflect the subset of CCBA students, however, the data needed to subset to CCBA students for these institution characteristics are not available.

institutions. Selectivity metrics are not reported for CCB institutions because they are generally open admission. However, we can see that the four-year institutions in the comparison sample are not very selective, with an average admission rate of 80%.

Table 3

Characteristics of Analysis Sample Institutions, by Institution Type

Variable label	TBA Institutions	CCB Institutions
Student characteristics (Percentage of undergraduate degree-seeking students)		
Female	54.2	55.7
Aged 25 and above	25.1	55.8
First-generation students	32.2	49.1
White	53.2	62.6
Black	3.4	5.4
Hispanic	6.1	10.7
Asian	8.8	7.3
American Indian/Alaska Native	0.9	1.6
Native Hawaiian/Pacific Islander	0.4	0.2
Two Or More Races	1.5	2.4
Non-Resident Aliens	1.7	2.9
Race is unknown	8.2	6.9
Pell Grant recipients	23.7	13.5
Financially independent	28.9	68.1
Financially independent, family income between $0-30,000	23.1	77.8
Average family income of dependent students in real 2015 dollars	$82,120	$36,035
Average family income of independent students in real 2015 dollars	$26,340	$21,738
Institution characteristics		
Number of undergraduate certificate/degree-seeking students enrolled in fall	9,940	2,670
In-state tuition and fees	$7,030	$3,055
Instructional expenditures per full-time equivalent student	$7,920	$5,090
Average monthly faculty salary	$7,620	$5,850
Percentage of faculty that is full-time	69.4	30.4
Admission rate	79.8	
Midpoint of the ACT cumulative score	22.0	
Average SAT equivalent score of students admitted	1029.0	

Note: TBA institutions include Central Washington University, Eastern Washington University, University of Washington-Bothell Campus, University of Washington-Tacoma Campus, Washington State University, and Western Washington University. CCB institutions include Columbia Basin College, Olympic College, and Peninsula College.

Source: College Scorecard Data (U.S. Department of Education, 2017).

Field of Study. The six-digit NCES Classification of Instructional Programs (CIP) code identified the field of study associated with the bachelor's degree (National Center for Education Statistics, 2010).

Covariates. Individual-level characteristics were obtained from the Washington Education Data Resource Center. Because the data were compiled from different administrative systems (the State Board for Community and Technical Colleges, the Public Centralized Higher Education Enrollment System, and the Office of Superintendent of Public Instruction), a limited set of variables was available for both CCB and TBA graduates. These included age, sex, race and ethnicity, high school grade point average, and prior employment information. The individual-level data were supplemented with county-level data including population density, median household income, percent of residents in poverty, and the average rate of unemployment.

4. Empirical Strategy

Estimation with Instrumental Variables

The primary question of this study is whether CCB and TBA graduates experience similar postbaccalaureate employment outcomes. The relationship between institution type and postbaccalaureate employment outcomes can be expressed as shown in equation 1:

$$Employment\_outcome_i = \beta_0 + \beta_1 CCBA_i + \beta_2 X_i + \mu_i \quad (1)$$

where *Employment_outcome* represents the dependent variable of interest (employment status or wages one year after graduation) for individual *i*. *CCB* is the treatment status indicator for individual *i,* and *X* captures observable individual characteristics that are related to the treatment and employment outcomes (e.g. field of study).

Ideally, to answer this question, individuals seeking a bachelor's degree would be randomly assigned to attend either a CCB or TBA, and then employment outcomes would be compared after degree completion. Random assignment would allow for estimation of the

causal effect of institution type on postbaccalaureate outcomes since, due to the randomization, the two groups would have an equal chance of selection into the treatment group and would be equivalent except for the treatment assignment. In this study, however, individuals have not been randomly assigned to institution types. The treatment variable, institution type (CCB or TBA), is endogenous because individuals make decisions about where to attend college, and it is likely that there are factors that affect the choice of college that are also related to employment outcomes. For instance, it could be that the types of students who choose to attend a CCB institution are more similar to the community college student population than to the four-year bachelor's degree-seeking population. This difference could be associated with other attributes such as background characteristics (e.g. SES) or academic characteristics (e.g. ability) that could also be responsible for differential employment outcomes.

The instrumental variables chosen to predict treatment (institution type) include measures of proximity to the nearest CCB and TBA institutions. Equations 2 and 3 illustrate how the instrumental variables approach works by estimating a two-stage least squares (2SLS) model. In the first stage, I predict the endogenous treatment variable with the distance instruments using the general equation:

$$CCB_i = Z_i\alpha_1 + X_i\ \alpha_2 + \upsilon_i \qquad (2)$$

where CCB_i is treatment status indicator for individual *i* and the Z_i includes the distance to the nearest CCB and TBA institutions from individual *i*'s pre-college location, X_i represents individual-level covariates (such as age, race/ethnicity, sex, employment experience), and υ_i captures unmeasured factors for individual *i*.

In the second stage, the predicted value for the treatment status (institution type) estimated in the first stage (Equation 2) is used in place of the actual institution type as shown in equation (3):

$$Employment\_outcome_i = \beta_1 \widehat{CCB_i} + \beta_2 X_i + \varepsilon_i \quad (3)$$

where $\widehat{\text{CCB}_\text{i}}$ is the predicted treatment status from the first stage, and ε_i captures unmeasured factors for individual *i*.

Distance measures as instruments for college choice. The endogenous treatment variable is instrumented by measures related to the proximity of the nearest public two- and four-year institutions that award a bachelor's degree in a major that is available in both public two- and four-year institutions. Up to three pre-college locations were available for the analysis sample: the high school attended, the county of employment, and the county of residence at the time of the college application. I calculated the distance from each available pre-college location to all public two- and four-year institutions that awarded bachelor's degrees in at least one of the majors available at both public two- and four-year institutions. Geographic coordinates for high schools were obtained from the Common Core of Data files (National Center for Education Statistics, 2003/04 - 2009/10). Geographic coordinates for each college were obtained from the Integrated Postsecondary Education Data System files (U.S. Department of Education, National Center for Education Statistics, 2009). For the pre-college county of employment and pre-college residence, I used coordinates that reflect the population center.

Most sample cases had more than one pre-college location measure available. If the measure for the high school attended was available, then it was selected as the primary pre-college location since it is arguably the least endogenous to college choice. Families do

make decisions about where to live based on the quality of nearby K-12 schools, but it is unlikely that those decisions are also influenced by the proximity of public colleges. If the high school attended was unavailable, then the pre-college employment location was used as the best pre-college location when it was available. The pre-college employment location is defined as the county of employment one or more years prior to the college enrollment start date as reported on the unemployment insurance data file. Absent high school and pre-college employment locations, the county of residence at the time of college application was used for the primary distance measure.

Using the Stata *osrmtime* command (Huber & Rust, 2016), I calculated travel distance in miles from the pre-college location to the nearest baccalaureate-granting institution by sector: CCB, non-selective public four-year, private not-for-profit, and private for-profit institutions. The travel distance generated by *osrmtime* uses the public road network and, therefore, captures a more precise measure of how far apart two points are than straight-line distance measures and how long it takes to travel between them. Figure 3 shows the predicted probability of graduating from a CCB institution by the distance from the pre-college location to the nearest CCB, non-selective public four-year, private not-for-profit, and private for-profit institutions. This figure shows that, as distance to the nearest CCB institution increases, the predicted probability of earning a bachelor's degree from a CCB institution decreases. Conversely, as the distance to the nearest non-selective public four-year institution increases, the predicted probability of earning a bachelor's degree from a CCB increases. A similar but weaker relationship is observed for distance to the nearest private not-for-profit institution. Distance to the nearest private for-profit institution does not appear to have much effect on the predicted probability of being a CCB graduate. Though

the choice set for an individual includes institutions from all sectors, the two strongest predictors of treatment status, distance to the nearest CCB and the nearest TBA institutions, are used in the final IV regression models.

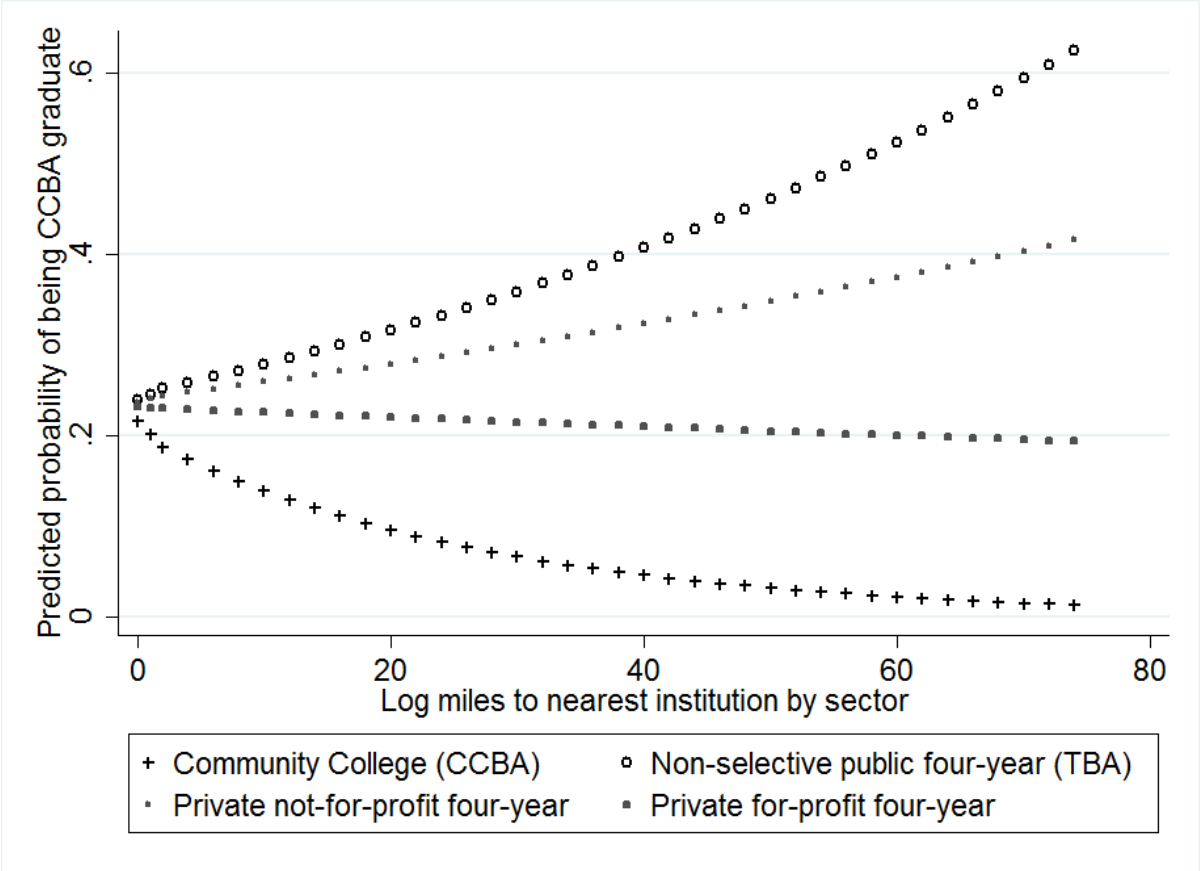

Figure 3. Predicted probability of graduating from a CCB institution, by distance to nearest institution

Distance to the nearest college[5] is a good candidate to serve as an instrument for college choice because it is an important determinant of whether and where an individual enrolls in college (Card, 1993; Card, 2001; Dee, 2004; Doyle & Skinner, 2016; Jepsen & Montgomery, 2009; Kane & Rouse, 1993; Long & Kurlaender, 2009). Institutions that are

[5] There are many variations on distance instruments, including number of nearby institutions, the distance to certain types of institutions, interactions with distance and institutional characteristics such as tuition and enrollment size.

nearby can be more affordable in terms of living expenses and travel costs, less time getting to and from school, and closeness to family, thereby influencing the treatment decision. In their discussion of "education deserts," Sponsler and Hillman (2016) emphasize the importance of geography in the college access conversation, noting that 79% of community college students and 53% of public four-year students attend a college that is within 20 miles of their home, and that location can be particularly important for students who are also juggling work and family (Sponsler & Hillman, 2016).

The strength of an instrument can be assessed by reviewing the magnitude of the correlation between the instrument and the treatment and by the *F*-statistic testing that the instrument coefficient in the first stage equation is equal to zero (Dunning, 2012; Murray, 2006; Stock & Yogo, 2005). Correlations between the treatment and the distance measures (available upon request) show that being in the treatment condition is negatively correlated with distance to the nearest CCB and is positively correlated with distance to the nearest TBA.

Table 4 presents results from the first stage equations for both outcome measures - employment status and wages the year after graduating. First stage results are presented for two specifications: a) estimating the effect of the treatment on the outcome and b) estimating the effect of the treatment on the outcome with covariate controls. As a rule, the *F*-statistic from the first-stage equation should be statistically significant but should also be greater than the critical value of the highest acceptable error level for the 2SLS Size of nominal 5% Wald test (Stock & Yogo, 2005). The *F*-statistics from the first stage equations satisfy the recommended threshold, even when covariate controls are included. The *F*-statistic is 20 or above for both majors.

Table 4

2SLS First Stage Statistics for Year One Employment Outcomes, By Field of Study

	Employment Status			Wages		
	N	*F*-statistic	Partial *R*-square	*N*	*F*-statistic	Partial *R*-square
Model without covariates						
Business Administration	3,960	**490.13**	0.20	3,410	**423.70**	0.20
Nursing	2,640	**98.79**	0.07	2,410	**87.37**	0.07
Model with covariates						
Business Administration	3,650	**182.71**	0.44	2,130	**101.40**	0.49
Nursing	2,430	**45.02**	0.23	1,540	**29.86**	0.28

Note. Counts have been rounded to the nearest ten. *F*-statistics > 19.93 are in boldface.

For these distance instruments to be considered random (or "as good as random, conditional on covariates,") then there should be no differences between the types of people who live near CCB institutions and those who live farther away. An empirical way to examine whether the instrument serves to randomize the sample to CCB or TBA institutions is to review the regressions between the instrumental variables and pre-treatment covariates (Dunning, 2012). If the distance instruments are as good as random, then they should be unrelated to the covariates, indicating that the covariates do not vary as the distance measures change. The regression coefficients between the distance instruments and demographic characteristics, shown in Table 5, are significant but small with the exception of high school GPA and percent Asian.

The regression coefficients for the distance instruments and county-level measures are sizeable, however. These results indicate that there are regional differences between areas close to and areas far from CCBs. The average rate of unemployment in the pre-college county is moderately and positively related to the distance to the nearest CCB

institution, indicating that unemployment is higher in counties that are farther away from CCB institutions. The 2010 pre-college county median household income and poverty rates are strongly correlated with distance and show that the counties closer to CCB institutions are much better off economically. Population density is moderately and negatively related to distance to the nearest CCB institution. These results indicate that the distance measures selected as instrumental variables are not ignorably random. Therefore, covariates are included in the 2SLS model to control for regional variation that could be related to employment outcomes.

An additional requirement is that a valid instrument must be related to treatment assignment, but there must be only one path between instrument and outcome, and it must pass through the treatment (Angrist & Pischke, 2009; Dunning, 2012). It is possible that public K-12 schools in the Puget Sound counties (where the CCB institutions are concentrated) are better resourced than schools in outlying areas, possibly equipping nearby residents with better quality education so they are more academically prepared, which could in turn lead to better employment outcomes. To the extent that there are county-level differences in terms of population and economic characteristics that could affect employment outcomes, then the exclusion restriction is violated. To address this, county-level covariates are included to minimize the threat of confounding.

Table 5

Regression Results Predicting Distance Instruments by Covariates

Instrument	Covariate	*n*	*B*	*SE*	*β*	*p*	
Log miles to nearest CCB institution							
	Age at bachelor's degree completion	6,610	-0.01	0.00	-0.04	0.00	***
	Number of quarters employed before enrolling	6,370	0.00	0.00	-0.02	0.17	
	High School GPA	2,410	0.68	0.05	0.24	0.00	***
	Percent female	6,610	0.16	0.03	0.06	0.00	***
	Percent American Indian	6,610	-0.19	0.09	-0.03	0.04	*
	Percent Asian	6,610	-0.49	0.04	-0.14	0.00	***
	Percent Black	6,610	-0.46	0.08	-0.07	0.00	***
	Percent White	6,610	0.32	0.03	0.12	0.00	***
	Percent Hispanic	6,610	0.08	0.06	0.02	0.21	
	Median household income of county	6,610	0.00	0.00	-0.76	0.00	***
	Percent in poverty, all ages	6,610	0.21	0.00	0.65	0.00	***
	Unemployment averaged over 2009--2015	6,610	0.47	0.01	0.67	0.00	***
	Population Density 2014	6,340	0.00	0.00	-0.71	0.00	***
Log miles to nearest non-selective public four-year institution							
	Age at bachelor's degree completion	6,610	0.01	0.00	0.09	0.00	***
	Number of quarters employed before enrolling	6,370	0.00	0.00	0.04	0.00	***
	High School GPA	2,410	0.16	0.04	0.07	0.00	***
	Percent female	6,610	0.17	0.02	0.09	0.00	***
	Percent American Indian	6,610	0.10	0.07	0.02	0.12	
	Percent Asian	6,610	-0.30	0.03	-0.12	0.00	***
	Percent Black	6,610	-0.23	0.06	-0.05	0.00	***
	Percent White	6,610	0.13	0.02	0.07	0.00	***
	Percent Hispanic	6,610	0.27	0.05	0.07	0.00	***

Table 14 Continued

Median household income of county	6,610	0.00	0.00	-0.18	0.00	***
Percent in poverty, all ages	6,610	0.01	0.00	0.06	0.00	***
Unemployment averaged over 2009--2015	6,610	0.18	0.01	0.36	0.00	***
Population Density 2014	6,340	0.00	0.00	-0.13	0.00	***

Note. Counts have been rounded to the nearest ten. * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Estimation with fixed effects regression

While the IV method improves upon OLS regression by minimizing selection bias in the treatment variable, it is effective in doing so only to the extent that the instrumental variables meet the required assumptions. The review of the relationship between proximity to the nearest CCB and TBA institutions and the likelihood of being a CCB graduate mentioned above indicates that there may be some lingering endogeneity. I have argued that the distance instruments are ignorably random, conditional on the inclusion of covariates; however, confidence in results from IV estimation is strongest when covariates are not required to meet the ignorably random assumption. As a robustness check, I also estimated the effect of earning a CCB on wages using fixed effects (FE) regression, which has advantages over OLS and IV regression because it controls for all time-stable characteristics (both observable and unobservable), making it an attractive option when there is concern about omitted variable bias. Similar results from the fixed effects model will strengthen confidence that the IV results are unbiased.

I used fixed effects to estimate the effect of graduating from a CCB on wages in the year after graduation and ran models separately by major. I limited the sample to the subset of cases with at least 4 quarters of employment prior to enrollment and observed wages through the fourth quarter following graduation. The data includes wages present in the unemployment insurance data files back to 2002 for a maximum of 48 quarters of pre-completion employment. I estimated the fixed effects model using the Stata *xtreg* command with the following equation (4):

$$PostBA\ wage_{it} = \beta_0 + \beta_1(Completion)_{it} + \beta_2(Completion_{it} * CCB_{it}) + \beta_3(Enrolled)_{it} + \beta_4(Enrolled_{it} * CCB_{it}) + \beta_5(AshDip2/3/4)_{it} + \beta_{6-8}(AshDip2/3/4_{it} * CCB_{it}) + \rho_{i+}\eta_t + \varepsilon_{it} \quad (4)$$

where $PostBA\ wage_{it}$ is the median hourly wage measured for each individual in each quarter. $Completion$ is an indicator of bachelor's degree completion status; it is coded 0 in all quarters until degree completion and is then coded as a 1 in all subsequent observations. Because all cases in my sample earned a bachelor's degree, I interacted completion status with treatment status. $Completion_{it} * CCB_{it}$ is an interaction term that allows the effect of degree completion on wages to vary by treatment status. This is the key coefficient of interest and indicates whether there is a differential effect of degree completion on wages between CCB and TBA graduates. $Enrolled_{it}$ is a dummy variable that is set to 1 for all quarters in which an individual was enrolled in college to control for any change in earnings due to enrollment. This is also interacted with treatment status as indicated by $Enrolled_{it} * CCB_{it}$. To account for the phenomenon in which wages tend to decrease prior to enrolling in college (often referred to "Ashenfelter's Dip", (Ashenfelter, 1978)) and following the model set by Dadgar and Trimble (2015), I include dummy variables in $AshDip2/3/4$ to indicate the 2, 3, and 4 quarters just prior to beginning enrollment. These indicators are interacted with treatment status as indicated by $AshDip2/3/4_{it} * CCB_{it}$. ρ_i is a dummy variable that captures the individual fixed effect which controls for all time-stable characteristics of that individual. η_t is a dummy variable that captures quarter fixed effects to account for variation in economic conditions over time that would affect all cases. The error term is represented by ε_{it}.

5. Results

Employed Within One Year of Graduation

OLS and IV estimates of employment status within the year after graduation are presented in Table 5. Results of the OLS models show that, among graduates who majored in nursing, there was no statistical difference in the likelihood of employment in the year after graduation. Among business majors, the OLS estimate was significant and positive. CCB graduates who majored in business were about 8 percentage points more likely to be employed than TBA business majors.

IV estimates of the effect of earning a CCB on post-graduation employment status are also shown in Table 5. IV estimates the local area treatment effect, or the effect of the treatment on the set of cases whose institution choice is predicted by its proximity. In the first stage, treatment status was predicted with two instruments: the distance in miles to the nearest CCB institution and distance to the nearest non-selective public four-year institution. The second stage results, presented below, estimate employment status based on the predicted value of treatment status from the first stage. The IV estimate of the CCB effect on employment status is similar to the OLS estimate in that it is significant and positive, though the effect is slightly larger at just above 8 percentage points. Though the OLS model did not detect a difference between CCB and TBA nursing majors, the IV model estimates that CCB nursing graduates are about 33 percentage points more likely to be employed than TBA nursing graduates.

Table 5
Employed Within One Year of Graduation, OLS and IV Regression Results

	OLS		IV	
Variable	Nursing	Business	Nursing	Business
CCB Graduate	0.034	0.075***	0.327***	0.083*
	(0.032)	(0.027)	(0.093)	(0.050)
Age at graduation	0.003	-0.014**	0.000	-0.014**
	(0.005)	(0.006)	(0.005)	(0.006)
Age at graduation, squared	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Number of quarters employed before graduation	0.002**	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.028*	0.043***	0.025	0.043***
	(0.016)	(0.010)	(0.016)	(0.010)
Black	0.039	-0.039	0.036	-0.039
	(0.027)	(0.032)	(0.027)	(0.032)
Asian	0.007	-0.042**	0.000	-0.042**
	(0.023)	(0.018)	(0.023)	(0.018)
American Indian	0.012	-0.005	0.020	-0.005
	(0.038)	(0.030)	(0.038)	(0.030)
White	0.024	0.013	0.023	0.013
	(0.017)	(0.016)	(0.018)	(0.016)
Hispanic	-0.049*	0.024	-0.052**	0.023
	(0.026)	(0.024)	(0.026)	(0.024)
Median household income of county, logged	-0.045	0.106	0.058	0.111
	(0.101)	(0.103)	(0.107)	(0.106)
Percent in poverty, all ages	0.002	0.004	0.010*	0.004
	(0.004)	(0.004)	(0.005)	(0.004)
County unemployment rate, 2009	-0.012***	0.004	-0.005	0.004
	(0.004)	(0.006)	(0.005)	(0.006)
County population density, 2010	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
High School GPA				
Constant	1.325	-0.159	0.082	-0.214
	(1.155)	(1.190)	(1.229)	(1.227)
Observations	2,440	3,670	2,440	3,670
First Stage F-statistic			162.3	781.0
Partial *R*-squared			0.12	0.30

Note. Counts have been rounded to the nearest ten. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Median Hourly Wages Within One Year of Graduation

Here, I included wages in various quarters prior to degree completion in addition to the covariates used in the models of employment status to control for wages associated with employment before or during enrollment that could be related to post-graduation wages. I tested 3 models with different time controls (2, 4, and 6 years before degree completion) because of the variation in age at degree completion and amount of prior work experience among the analysis sample. The estimate of the CCB effect on wages was similar across the different prior-wage control specifications, so results are shown with controls for the 2 years before degree completion. Table 6 presents results of OLS regression models estimating median hourly wages for CCB and TBA graduates, by field of study, and indicate that post-graduation wages are not statistically different for nursing or business majors.

Table 7 provides IV estimates of the effects on median hourly wages one year after degree completion for nursing and business majors, respectively. The 2SLS size of nominal 5% Wald test is 19.9, and both specifications exceed this threshold. Among the set of cases whose decision to attend a CCB is influenced by distance (e.g. compliers), CCB nursing graduates earned significantly higher wages by about $7 per hour than TBA nursing graduates in the year after graduation when controlling for wages earned in the 2 years before completion. Post-graduation wages for CCB and TBA business majors were statistically equivalent.

Table 6
Wages Within One Year of Graduation, OLS Regression Results

Variable	Nursing	Business
CCB Graduate	1.709	0.734
	(1.512)	(0.835)
Age at graduation	0.125	0.283
	(0.255)	(0.221)
Age at graduation, squared	-0.001	-0.003
	(0.003)	(0.003)
Number of quarters employed before graduation	-0.076*	-0.035
	(0.043)	(0.032)
Female	0.223	-0.362
	(0.800)	(0.357)
Black	-1.009	-1.195
	(1.201)	(1.176)
Asian	-0.213	-0.263
	(1.201)	(0.632)
American Indian	0.617	-0.905
	(1.951)	(1.109)
White	-0.073	1.061**
	(0.875)	(0.515)
Hispanic	0.085	0.699
	(1.324)	(0.776)
Median household income of county, logged	8.218	0.582
	(5.770)	(3.542)
Percent in poverty, all ages	0.246	0.008
	(0.234)	(0.146)
County unemployment rate, 2009	0.545**	-0.226
	(0.255)	(0.276)
County population density, 2010	-0.005**	-0.002
	(0.002)	(0.001)
Quarterly wage - pre-completion Q9	0.072***	0.168***
	(0.027)	(0.027)
Quarterly wage - pre-completion Q10	0.149***	0.0515*
	(0.034)	(0.027)
Quarterly wage - pre-completion Q11	0.139***	0.274***
	(0.031)	(0.034)
Quarterly wage - pre-completion Q12	0.161***	0.293***
	(0.035)	(0.041)
Constant	-74.040	-1.577
	(65.920)	(41.310)
Observations	1,120	1,300

Note. Counts have been rounded to the nearest ten. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 7
Wages Within One Year of Graduation, IV Regression Results

Variable	Nursing	Business
CCB Graduate	6.895**	0.799
	(-3.320)	(1.215)
Age at graduation	-0.147	0.268
	(-0.202)	(0.177)
Age at graduation, squared	0.002	-0.002
	(-0.003)	(0.003)
Number of quarters employed before graduation	-0.056*	-0.035*
	(-0.029)	(0.021)
Female	0.061	-0.596**
	(-0.655)	(0.276)
Black	-0.956	-0.449
	(-1.048)	(0.942)
Asian	-0.227	-0.554
	(-0.976)	(0.487)
American Indian	0.905	-0.627
	(-1.563)	(0.819)
White	-0.264	0.905**
	(-0.739)	(0.412)
Hispanic	-1.081	1.027*
	(-1.110)	(0.624)
Median household income of county, logged	9.319**	3.410
	(-4.618)	(2.799)
Percent in poverty, all ages	0.453**	0.069
	(-0.207)	(0.118)
County unemployment rate, 2009	0.455**	-0.024
	(-0.216)	(0.190)
County population density, 2010	-0.004**	-0.002***
	(-0.002)	(0.001)
Quarterly wage - pre-completion Q9	0.0915***	0.161***
	(-0.023)	(0.021)
Quarterly wage - pre-completion Q10	0.102***	0.0598***
	(-0.027)	(0.020)
Quarterly wage - pre-completion Q11	0.128***	0.270***
	(-0.026)	(0.024)
Quarterly wage - pre-completion Q12	0.192***	0.172***
	(-0.029)	(0.025)
Constant	-83.970	-32.790
	(-53.060)	(32.440)
N	1,500	2,150
First Stage F-statistic	137.2	524.2
Partial *R*-squared	0.15	0.33

Note. Counts have been rounded to the nearest ten. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

As a sensitivity check, I ran an individual fixed effects model to compare CCB and TBA post-graduation wages. The OLS models relied on observable control variables to estimate the relationship between institution type and post-graduation wages. The IV models relied on measures of proximity to the nearest CCB and TBA institutions to isolate the effect of the CCB on wages. With fixed effects regression, each individual serves as their own control because the outcome is measured over time and compared before and after the treatment occurs. Therefore, the fixed effects model controls for all individual-level attributes that are constant over time. Table 8 provides results of the fixed effects estimation. Both nursing and business majors experience a significant and positive effect on wages after graduation. The coefficient of interest for this study, however, is the interaction of bachelor's degree completion and treatment status which represents the effect of degree completion for CCB graduates. The fixed effects regression results show that there are no significant differences between CCB and TBA graduates in hourly wages measured in the year after graduation for both nursing and business majors.

Table 8
Wages Within One Year of Graduation, Fixed Effects Regression Results

Variable	Nursing	Business
Bachelor's degree completion indicator	6.584***	7.418***
	(0.628)	(0.387)
Bachelor's degree completion indicator * treatment status	-1.091	-1.498
	(1.509)	(0.960)
Enrollment status indicator	3.529***	6.227***
	(0.411)	(0.282)
Enrollment status indicator * treatment status	0.512	-0.807
	(0.913)	(0.700)
Two quarters before enrollment	1.123**	1.368***
	(0.446)	(0.356)
Three quarters before enrollment	0.671*	1.468***
	(0.379)	(0.342)
Four quarters before enrollment	0.645*	1.319***
	(0.359)	(0.335)
Two quarters before enrollment * treatment status	-0.191	1.276
	(1.408)	(0.955)
Three quarters before enrollment * treatment status	0.753	2.585
	(1.955)	(1.615)
Four quarters before enrollment * treatment status	1.224	1.615
	(1.527)	(1.025)
Constant	18.45***	11.49***
	(0.560)	(0.732)
N (observations)	51,100	57,030
R-squared	0.16	0.08
N (graduates)	1,300	1,590
Quarter Fixed Effects	Yes	Yes

Note. Counts have been rounded to the nearest ten. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

6. Discussion and Conclusion

The purpose of this inquiry was to assess whether a bachelor's degree conferred by a community college holds the same value in the labor market as a bachelor's degree in the same field awarded by a 4-year college or university as measured by employment status and median hourly wages in the first year following degree completion. Critics of the CCB contend that a bachelor's degree conferred by a community college will be of lesser quality and will put graduates at a disadvantage in the labor market. Yet, to date, there has been no empirical

comparison of employment outcomes between CCB and TBA graduates. The results of this study provide credible evidence that the short-term employment outcomes for graduates of CCB and TBA institutions who majored in nursing and business administration are comparable, which refutes the unsubstantiated concerns of CCB critics.

Employment status. The effects of earning a CCB on employment status were somewhat sensitive to estimation method. It is likely that the OLS estimates are biased due to selection into institution type, so the estimates produced by the IV models are the more credible findings when comparing these two approaches. Among business administration majors, the CCB effect on employment status was positive based on the OLS model in the full sample specification, but not significant in the IV model. This suggests that, to the extent that the distance instruments used in the IV model simulated random assignment, the OLS estimate is biased upwards. The positive effect observed in the OLS model of the full sample became non-significant in the high school and prior employment subgroups.

For nursing majors, the opposite was true: OLS showed no difference in employment status, but the IV model estimated a very large positive effect indicating that nursing CCB graduates were about 33% more likely to be employed than their TBA counterparts. It is possible that this large effect is related to the location of the CCB institution that awarded nursing degrees. For instance, the demand for BSN nurses could be higher in the service area of the degree-awarding institution than in other areas. There could also be a higher concentration of residents who are elderly or very young, both being populations that require more intensive health care than residents.

In summary, none of the specifications showed a negative effect of earning a CCB degree. Assuming that the IV estimates are more credible than those from the OLS models, then

CCB graduates were as likely or more likely than TBA graduates to be employed in the year after graduation. Thus, there is no evidence to support the hypothesis that potential employers view the CCB as a signal that the degree is of lower quality than a TBA degree in the same major.

Analyses of the effects of education on employment outcomes have often been examined through the lens of signaling effects where the credential is believed to reflect the underlying ability of an individual more so than the knowledge and skills obtained through education (Baum et al., 2013; Bills, 2003; Deming et al., 2013). In the current study, a negative effect on employment status for the treatment group could suggest that the CCB sends a negative signal of applicant quality to prospective employers. Employers may assume that the TBA would provide a more rigorous program of study, but it could be simply because community colleges are generally open admission. It may be not widely known that CCB programs are not open admission and have admission requirements that are comparable to non-selective TBA institutions.

The lack of a negative CCB effect on employment may seem somewhat surprising considering the negative signaling effects found in experimental studies of resumes to examine the impacts of graduating from a for-profit institution (Darolia et al., 2015; Deming et al., 2016). Darolia et al., (2015) found no difference in interview request rates between applicants with a for-profit college when compared to a community college, but they also found no difference in rates between applicants who had earned a for-profit credential and applicants with no college at all. On the other hand, Deming et. al. (2016) found a clear negative effect on interview callback rates among for-profit graduates relative to those from a non-selective public institution. Among business majors in Deming's study, relative to graduates of a non-selective public institution,

for-profit business majors were 22 percent less likely to receive a call for an interview request. However, they note a qualification to this finding: "…applicants with BAs from smaller brick-and-mortar for-profit colleges with a local presence are not significantly less likely to receive a callback than applicants with BAs from public institutions" (Deming et al., 2016, p. 779).

This allows us to draw a parallel to the CCB analysis. Community colleges are, by definition, physically present in the community, and have historically maintained close relationships with the local employment community. Daugherty et al. (2014) noted that, because of their close relationships with employers, community colleges were better able to develop programs specifically tailored to meet the workforce needs of the local service area and have generally prioritized local employment needs to a greater degree than regional universities. Often, community colleges and stakeholders from local businesses worked together early in the planning stages to develop programs with the specific knowledge and skills required for the specific occupations of the local business representatives. These features of CCB programs could partially explain why a negative effect was not observed in the current study.

Another interesting finding from Deming et al., (2016) was that the negative effect of attending a for-profit institution disappeared when there was additional information available. For instance, among those in health fields, a similar negative effect was observed except when there was another piece of information available to indicate applicant quality, such as an occupational license. It is quite likely that a similar mechanism is present in the case of the nursing graduates. The BSN degree, whether conferred by a CCB or a TBA, is held to the same accreditation standards, and nurses are required to pass the same licensing exam, so it makes sense that the specific institution that conferred the degree would hold less relevance when it is not the only indicator of application skill and ability. In the case of business majors, however,

there is a broader range of flexibility in curriculum, and there is no comparable licensure requirement as that required for nurses.

Wages. There is currently very little existing information about the post-graduation wages of CCB graduates and how they compare to TBA graduates with which to set the context to understand the findings of this study. Schneider (2014a) reported that earnings of CCB graduates in Florida one year after graduation were higher than those of TBA graduates in nursing, business, and education, however this comparison does not control for bias due to selection into institution type. The results of this study showed that the CCB effect on wages varied by major.

As a robustness check, wages were also estimated with FE regression. Assuming that there are no unmeasurable confounders that vary over time and individuals, the FE method produces an unbiased estimate of the effect of graduating from a CCB on wages. When individual-level and quarter fixed effects were included, there was no significant effect of institution type on post-graduation wages.

To summarize the findings of the CCB effect on wages, the IV estimates provide evidence to suggest a positive effect on wages among nursing majors. However, this result was not supported by the FE analysis. When the assumptions of IV analysis are met, all unobservable factors (both time-stable and time-varying) are controlled. When FE assumptions are met, all unobservable time-stable characteristics are controlled. In the context of this study, it is probable that the IV estimates are somewhat confounded by regional characteristics that are not controlled for with the covariates available for this analysis. Therefore, the FE results provide a more conservative estimate of the CCB effect, suggesting that post-graduation wages are not significantly different for CCB and TBA graduates.

We might expect to find differences in post-graduation wages if TBA and CCB institutions equip their students with different levels of skills and knowledge (Baum et al., 2013; Bills, 2003; Card, 2001). There may be real variations in quality between CCB and TBA institutions that could lead to different levels of productivity in the labor market. While there is wide variation in how institution quality has been operationalized, certain characteristics were shown to be important in understanding the relationship between the quality of education and employment outcomes, especially characteristics related to the student body (Black & Smith, 2006; Eide et al., 2016), the availability and allocation of institutional resources (Black & Smith, 2006; Dale & Krueger, 2002; Kalleberg & Dunn, 2014; Zhang, 2009), and the attributes of the service area in which the institution is located (Kalleberg & Dunn, 2014).

TBA and CCB institutions vary quite a bit on many of the relevant characteristics known to impact employment outcomes, so it stands to reason that these differences might translate to varied levels of instructional quality that could lead to different outcomes. For instance, the student populations are different, with students at TBA institutions being younger, less financially independent, and from wealthier backgrounds. With larger enrollments and higher tuitions, TBA institutions have greater financial resources to devote to instructional spending, including faculty salaries and academic services. On the other hand, CCB institutions are known for their focus on teaching (as opposed to research), and smaller class sizes may enable more individualized instruction. CCB institutions are also renowned for their technical expertise in applied fields, those in which CCB degrees are offered.

Another feature of community colleges is that, apart from programming dedicated to preparing students for university transfer, their terminal applied associate's degrees are generally occupationally specific. Other work has demonstrated a positive effect on earnings among

majors that have "…the most functional direct linkage to jobs or occupational sectors (e.g. computer science, social work, nursing, and accounting)" (Mayhew et al., 2016, p. 449). It could be that, because CCB degrees are offered in majors that are generally tightly linked to occupations, the positive effect due to the congruence between major and occupation counteracts any potential negative signal of quality.

The key message from the results of these analyses is that there is no evidence of a penalty in employment status or median hourly wages in the first year after degree completion for CCB graduates who majored in business administration or nursing. When an effect was detected, it was positive, indicating that CCB graduates fared *better* than their TBA counterparts. Despite differences in the student characteristics and institutional resources of CCB and TBA institutions, employment outcomes for CCB and TBA graduates are comparable.

The CCB has been growing steadily and looks like it will continue. It still accounts for a relatively small portion of students, but to be good stewards of the precious resources available to be spent on higher education, it is important to investigate CCB outcomes to assess whether it is helping to achieve the goals for which it was developed, and also to ensure that the students who invest in CCB degrees are experience the benefits of earning a bachelor's degree. Therefore, states and institutions that have implemented CCB programs should work with their state data systems to link education and employment records to enable analysis of outcomes. In particular, states should partner with other states to develop regional data sharing agreements to minimize the issues of unemployment insurance data coverage limitations. Institutions should also pursue opportunities to conduct follow-up surveys of former students (including non-completers) to collect data on migration and employment patterns in the short-term and longer-term outcomes at the institution level.

The results of the analyses presented here should be interpreted with caution. Students who attend a community college to earn a bachelor's degree differ in many important ways from students who attend 4-year colleges and universities. In fact, this is one of the primary reasons that CCB programming has been justified−CCB programs are designed to improve access to baccalaureate education for students who have been historically underserved by TBA institutions. I took steps to control for these pre-existing differences in the analysis before comparing outcomes. Using measures of distance as instruments to predict CCB status improved upon the OLS estimation by purging the endogeneity due to the correlation between unmeasured factors that are related to outcomes and the error term, thereby minimizing bias in the resulting estimates. To meet the assumption that the instruments are ignorably random conditional on covariates, I included a set of controls to address the remaining variation, especially with regards to characteristics of the pre-college county. However, it is possible that there is some residual bias in the IV estimates. Thus, as an additional check, I estimated FE regression models of wages and found that the positive CCB effects among nursing disappeared.

While additional study of CCB effects is required to determine whether the results observed here can be replicated, the results of this study provide valuable insight into the employment outcomes experienced by CCB nursing and business administration graduates in Washington, and how they compare to TBA graduates in the same field of study.

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