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What About Certificates? Evidence on the Labor Market Returns to Non-Degree Community College Awards in Two States

A CAPSEE Working Paper

Di Xu

Madeline Joy Trimble

Community College Research Center
Teachers College, Columbia University

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Abstract

The annual number of certificates (non-degree awards that typically require less time to complete than degrees) awarded by community colleges has increased dramatically since 2000, but relatively little research has been conducted on the economic benefits of certificates in the labor market. Based on detailed student-level information from matched college transcript and employment data in two states, this paper estimates the relationship between earning a certificate and student earnings and employment status after exiting college. While prior research in this area has explored how returns to certificates vary across broad fields of study, there may still exist substantial variation across programs within broad fields of study. Our paper extends prior research by examining the returns to specific programs that are most popular in each state. Our results indicate that certificates have positive impacts on earnings in both states overall, and in cases where there is no impact on earnings, certificates may nonetheless lead to increased probability of employment. In addition, we find substantial variation in the returns across fields of study and, more importantly, across specific programs within a particular field. These results suggest that important evidence is lost when information about the benefits of certificate programs are simply averaged together.

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1. Introduction

Certificates are something of a well-kept secret in higher education. Until recent years, there had been relatively little discussion of certificates either in the academic literature or in education news outlets. Yet, in the face of increasing national pressure from the "completion agenda" in postsecondary education (McPhail, 2011; National Governors Association, 2010), state policymakers have increasingly linked funding priorities to college graduation rates. And in response to excess demand for community college education, some states even provide registration priorities to students who intend to pursue a credential (Bahr, Gross, Slay, & Christensen, 2013).

Concomitant with the growing emphasis on credential attainment is the increasing nationwide support for certificates—non-degree awards of different lengths but typically requiring less time to complete compared to degree programs[1]—even though there has been relatively little evidence on their likely impacts. According to data from the Integrated Postsecondary Education System (IPEDS), the number of certificates awarded by community colleges has increased steadily over the past decade. In 2010, 41 percent of credentials awarded by community colleges in the United States were non-degree certificates.[2]

Current attempts to increase the national visibility and availability of certificates assume that certificates from these programs have potential value in the labor market and are worthy of students' time and efforts to obtain. In this paper, we explore the economic returns to certificates overall, and we also differentiate among certificates awarded by various programs. In doing so, we shed light on not only the labor market value of certificates but also on the complexities involved in interpreting the economic returns to these non-degree credentials.

The Important Role of Certificates

Certificates have assumed an increasingly important role in the postsecondary landscape, and the rapid growth and heightened support for certificate programs is related both to the particular emphasis that certificates have given to vocational training and to their higher completion rates relative to associate degree programs (Bailey & Belfield, 2013; Berkner & Choy, 2008; Kane & Rouse, 1999; Kasper, 2003). Indeed, while non-degree credentials vary in length of study—some require less than a year of full-time study to complete while others require one to two years of full-time study (Bosworth, 2010)—they are almost all shorter than

[1] The Integrated Postsecondary Educational Data System (IPEDS) differentiates non-degree awards that take less than one year of full-time study, awards that take at least one year but fewer than two years of full-time study, and awards that take at least two but fewer than four years of full-time study. Since this last category is uncommon, the present study groups all non-degree awards into two categories: short-term certificates and long-term certificates. We define a short-term certificate as any non-degree credential officially awarded by colleges to students that takes less than one year of full-time study, and a long-term certificate to be such a credential that takes one year or more of full-time study. The long-term certificate is also sometimes referred to as a *diploma* in some states.

[2] Authors' calculations using IPEDS data.

associate degree programs. Probably as a consequence, the completion rates of certificate programs are generally higher than those of associate degree programs (e.g., Berkner & Choy, 2008).

Moreover, although certificate programs also offer academically inclined courses, most certificate programs have a clear vocational orientation (Bosworth, 2010). This particular emphasis, together with the open-door admission policies and flexible course schedules typical in community colleges, has enabled certificates to act as a primary mechanism by which adult learners access postsecondary education, increase job marketability, and upgrade their working skills to adapt to the changing business landscape (Carnevale, Rose, & Hanson, 2012; Jacobson & Mokher, 2009).

In addition, due to open-door admissions, flexibility, and low cost at community colleges, certificate programs at these institutions have disproportionately enrolled many of the lowest performing students and low-income adults (Carnevale et al., 2012; Marcotte, Bailey, Borkoski, & Kienzl, 2005), potentially providing a pathway to economic opportunity for these populations who have been under-represented in higher education and are most at risk of being left behind by ongoing changes in the labor market (Lumina Foundation, 2013). It is worth noting that a report from Complete College America, a research and advocacy organization focused on increasing college completion, has championed certificates as a strategy for increasing college completion and workforce success (Bosworth, 2010). Even President Obama argued for the primacy of community college vocational education during his 2012 re-election campaign: "I want everybody to get a great education. … I also want to make sure that community colleges are offering slots for workers to get retrained for the jobs that are out there right now and the jobs of the future" (ABC News, 2012).

Existing Studies on Certificates

Despite the rapid increase in the popularity of certificates and their increasingly important role in the postsecondary landscape, relatively little research has been conducted to explore the economic benefits of certificates in the labor market. Most empirical research about the impact of postsecondary education on earnings has centered on the bachelor's degree, and even those studies that have examined sub-baccalaureate credentials have often focused on associate degrees. Only a handful of studies have included certificates in analyses using national datasets (e.g., Bailey, Kienzl, & Marcotte, 2004; Carnevale et al., 2012; Grubb, 1995; Hollenbeck, 1993; Kerckhoff & Bell, 1998; Marcotte et al., 2005; Rivera-Batiz, 1998), and taken together, these have failed to find a consistent effect of certificates on earnings in general.

Furthermore, one limitation of the national survey datasets is that they are cross-sectional and include limited controls for ability bias. Since students enrolled in certificate programs are disproportionately low-income and low-performing students (Carnevale et al., 2012), absence of key individual characteristics may bias the estimates downward. In addition, due to lack of detailed information on the length and field of study, various types of certificates are often

combined into a single category, masking important differences among certificate programs. Studies based on national survey data are also subject to problems such as short follow-up periods after degree completion, possible measurement errors in self-reported earnings, and low response rates, which can substantially influence the accuracy of an estimate. Finally, even if these studies had provided a consistent estimate on the average returns to certificates nationwide, such national results may not be particularly useful for state policymakers who need evidence about returns to programs in their local labor markets.

With the increasing availability of college administrative data matched with local employment records, several researchers have used these merged datasets on the population of community college students in a single state to estimate the economic returns to certificates (e.g., Bahr, 2014; Belfield, Liu, & Trimble, 2014; Dadgar & Trimble, 2014; Jacobson & Mokher, 2009; Jepsen, Troske, & Coomes, 2014). Compared with national survey data, administrative data tend to include detailed information about certificates, such as length, field of study, and even the specific programs in which students have enrolled, thus enabling researchers to differentiate among types of certificates. In addition, administrative datasets often track students for several years, with earning records before, during, and after college enrollment. Such a panel data structure allows for the adoption of an individual fixed effects model that has been commonly used in the job-training literature (e.g., Dyke, Mueser, Troske, & Jeon, 2006; Jacobson, LaLonde, & Sullivan, 2005). The major advantage of the individual fixed effects model over traditional Mincerian models[3] in estimating returns to certificates lies in its ability to control for any unobserved individual characteristics that are constant over time.

Belfield et al. (2013) used both a traditional Mincerian model and an individual fixed effects model to estimate the economic returns to sub-baccalaureate awards in North Carolina. While the Mincerian approach yielded evidence of negative returns for both short-term and long-term certificates for males and negative returns to short-term certificates for females, the authors found positive returns to both long-term and short-term certificates using the individual fixed effects model. In another study using a large administrative dataset in Kentucky, Jepsen et al. (2014) also identified significant positive returns to both long-term and short-term certificates. Specifically, Jepsen and his colleagues found that long-term certificates had quarterly returns of around $1,300 for men and $1,900 for women, while short-term certificates had returns of around $300 per quarter for men and women. In terms of employment, long-term certificates led to a higher likelihood of employment, while this positive influence from short-term certificates existed only for women.

In addition to the average effects, Jepsen et al. (2014) also found substantial variations in the labor market returns to certificates across fields of study, where the highest returns for long-term certificates were in health-related fields, and the highest returns for short-term certificates

[3] Mincerian models estimate earnings at a given time as a function of prior education, prior work experience, and other individual characteristics (Mincer, 1974).

were in vocational fields for men and health fields for women. Such heterogeneity of returns to certificates by field of study was also found in both Bahr (2014) and Dadgar and Trimble (2014) based on data from California and Washington respectively. Using a more detailed field categorization, both of these studies found that the highest returns to long-term certificates were in nursing. Bahr also identified substantial variation in returns to short-term certificates across fields of study, where short-term certificates yielded positive returns in approximately half of the fields but null to negative returns in the others. Similarly, while Dadgar and Trimble concluded that there was no evidence of substantial benefits to short-term certificates in Washington overall, there were some exceptions, notably in protective services.

Why is Program-level Information Particularly Important to Stakeholders?

All the by-field analyses mentioned above are quite important in establishing initial estimates of the returns to a certificate by major concentration and in highlighting the importance of taking into account heterogeneity in returns to certificates. Yet, the broad categorization of fields of study may still mask important differences by programs within a field of study. For example, Jepsen et al. (2014) divided all of California's programs into only five broad categories, in which "vocational certificates" included a wide range of programs including mechanics, construction, cosmetics, and so on, each of which could lead to substantially different pathways to economic opportunity.

Indeed, using data obtained from interviews and program websites at Washington community and technical colleges, Van Noy, Weiss, Jenkins, Barnett, and Wachen (2012) found that the structural features of college programs, such as program alignment and labor market alignment, varies substantially across programs within a particular field of study; these structural features can have strong impacts on students' labor market outcomes because they influence both the curriculum that students are exposed to and the approaches that programs use to help students transition into the labor market. As a result, average effects based on broad field categorizations may not be particularly useful for some purposes. For students making their program choice, especially for adult learners who want to increase their chances of landing a job, program-specific information is much more valuable than general information about a broad category. Administrators deciding whether to expand, eliminate, or reform specific programs also need evidence about programs themselves, not average effects across an entire field. These potential interests from various parties highlight the importance of understanding whether and how returns to certificates vary across programs within a particular field.

The Current Study

In this research study, we use administrative data from two state community college systems to estimate the returns to short-term and long-term certificates in different fields as well as in different programs within a field. Similar to Jepsen et al. (2014) and Dadgar and Trimble (2014), we use an individual fixed effects model, where we compare a student's post-college

earnings with his or her pre-college earnings, and then compare the size of this change between those students who received a certificate and those who left college without earning any credential. In addition to the overall impacts of certificates on earnings, we also separately examine the impacts on probability of employment and on earnings conditional on employment. Doing so allows us to understand the extent to which the economic returns can be attributed to an increase in employability or in human capital reflected by higher earnings conditional on employment.

Overall, we find considerable between-state variation in both programs offered and in the economic returns to certificates, which highlights the importance of conducting locally based analysis. Despite such differences, however, we identify several consistent patterns of results across both states. First, overall, we find a positive impact of attaining either a short-term or long-term certificate on an individual's probability of employment and earnings conditional on employment. In addition, consistent with previous work, we find a large degree of variation across fields of study, where the largest positive returns are to nursing for long-term certificates in both states. Yet, within particular fields of study, we also find sharp disparities across programs, where programs with tight labor market alignment and clear indicators of the career trajectory of program graduates seem to lead to better economic opportunities than programs that have only a general approach to the labor force. Additionally, certificates in some fields that do not increase students' earnings appear to confer other benefits to graduates, such as gaining entry into a desired industry and increasing the probability of employment.

The current study therefore contributes to the existing literature on returns to education in several important ways. First, based on administrative data from two states, this study adds to the very limited evidence on the labor market value of certificates in two particular state contexts. The positive evidence of the value of certificates provides timely support to current national efforts to increase the visibility and accessibility of certificate programs. Second, by providing the first rigorous estimates of labor market returns to specific certificate programs, the current study reveals substantial variations in returns by program within fields, highlighting the importance of providing detailed program-level information to students and administrators. In addition, the positive evidence for programs with clear indicators of job skills provides support for building stronger labor market linkages in certificate programs. Third, this study shows that there are sharp between-state variations in the economic returns of certificate programs, providing additional support to the existing argument that evidence based on national data or data from other states need to be re-interpreted to reflect the different labor market and education conditions across states. Finally, the finding that earning a certificate may bring about other benefits such as increased probability of employment without necessarily boosting individual earnings draws attention to the importance of including multiple measures in evaluating the benefits of certificate programs in community colleges.

The paper includes five sections. In Section 2, we describe the administrative data we use, discuss national trends in certificate awards, and summarize information about our student sample and certificates earned in these two states. Section 3 provides information about the

method used to answer our research questions. We present results in Section 4. Finally, in Section 5, we conclude and offer implications for policymakers and for future research.

2. Data and Descriptive Statistics

Data

In order to examine the economic returns to short-term and long-term certificates, we use administrative datasets from two state community college systems: the Virginia Community College System (VCCS) and the North Carolina Community College System (NCCCS). NCCCS has 58 community colleges, making it the third largest community college system in the United States. These colleges collectively enrolled approximately 210,000 fall-term students during the time period examined in this paper. VCCS has 23 community colleges and enrolled approximately 170,000 students. Both systems comprise a mix of large and small schools, as well as institutions located in rural, suburban, and urban settings.

Administrative data from the two states include information on student demographics, institutions attended, transcript data on courses taken and grades received, and information on credentials received. These records are also matched with enrollment and graduation data from the National Student Clearinghouse (NSC)[4], which provided us with information about college enrollment and credentials awarded outside of the state community college system. These student unit-record data are further matched with Unemployment Insurance (UI) records, where all earnings records used are adjusted to 2010 dollars to account for inflation.[5]

Our primary analysis focuses on the 2006–2007 and 2007–2008 first-time student cohorts with earnings data from the first quarter of 2005 through the first quarter of 2012 in North Carolina, and the 2006–2007, 2007–2008, and 2008–2009 first-time student cohorts with earnings data from the first quarter of 2005 through the first quarter of 2013 for Virginia.[6] As a result, in each state, we have both at least one year of prior earnings and at least four years of follow-up earnings data for all cohorts.

[4] According to the National Student Clearinghouse's website, the colleges and universities covered by the Clearinghouse enroll over 96 percent of all students in public and private U.S. institutions. From http://www.studentclearinghouse.org/about/clearinghouse_facts.php

[5] The NCCCS dataset includes wage record data only in the state of North Carolina, while the VCCS dataset includes wage record data from five states (Virginia, Maryland, New Jersey, Ohio, Pennsylvania, and West Virginia) and the District of Columbia (DC).

[6] We include the additional cohort for Virginia because the most recent cohort has much more comprehensive data on field of study for short-term certificates. In a separate robustness check not reported below, we dropped the 2008-2009 cohort from Virginia and the pattern of results remains the same.

Trends in Certificates in the Two States and Nationally

In order to put certificates in the two states into context in terms of the national picture and to shed light on the extent to which the results in the current analysis can be generalizable nationally, we use publicly available data from the Integrated Postsecondary Education Data System (IPEDS) to present the changes in the proportion of various types of credentials awarded by community colleges in the two states as well as nationwide over the past fifteen years.

Each state tends to use its own terminology when referring to credentials of different lengths. In this study, we define a short-term certificate as any non-degree credential officially awarded by colleges to students that takes less than one year of full-time study to complete; we define a long-term certificate as such a credential that takes one year or more of full-time study to complete. Long-term certificates are usually called "diplomas" in NCCCS, and they are called both "certificates" and "diplomas" in VCCS; short-term certificates are typically called "certificates" in NCCCS and "career studies certificates" in VCCS.

Figures 1 and 2 show the trends in the proportion of short-term and long-term certificates awarded among sub-baccalaureate credentials at community colleges in recent years.[7] Nationally, while the number of short-term certificates awarded by community colleges grew from 0.11 million to approximately 0.28 million,[8] this trend has been largely masked by the simultaneous increase in associate degrees. Nevertheless, the share of short-term certificates increased somewhat over this time period from 18 percent in 1997 to 24 percent in 2013, with a particularly rapid growth in the early 2000s. In contrast, the increase in short-term certificates in the states examined in this paper has been even more modest, from 14 percent to 18 percent in Virginia and with no overall rise in North Carolina, generally fluctuating within a narrow band over this time period. North Carolina has consistently awarded a greater proportion of short-term certificates than the national average; Virginia has tended to award a smaller proportion of short-term certificates in general.

Similarly, there is considerable variation between states in the proportion of long-term certificates awarded, though the variation over time is comparatively less dramatic: the proportion of long-term certificates awarded nationally decreased slightly from 19 percent in 1997 to 16 percent in 2013. While both states awarded a lower share of long-term certificates compared to the national average generally (roughly 14 percent in North Carolina and 13 percent in Virginia), Virginia has seen a notable spike in long-term certificates awarded in just the last few years of data, reaching 24 percent in 2013.

[7] These estimations are based on credentials awarded by United States community colleges, which we define as all public, primarily postsecondary, Title IV-eligible institutions in the 50 U.S. states or the District of Columbia from which at least 90 percent of credentials awarded in 2011 were at the sub-baccalaureate level.

[8] Information based on the data from Integrated Postsecondary Education Data Systems.

Figure 1: Trends in Short-Term Certificates, 1997–2013

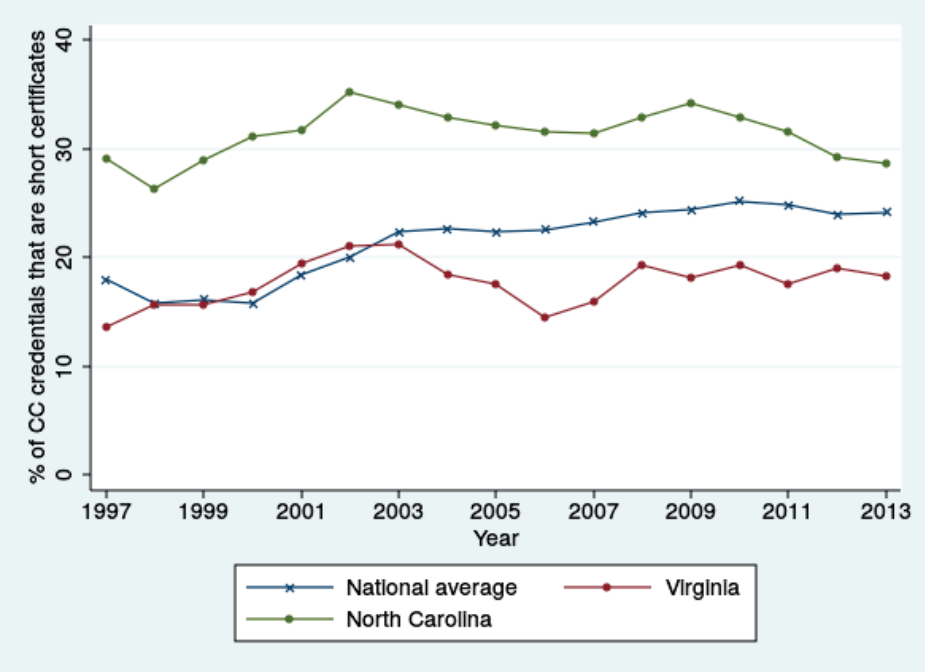
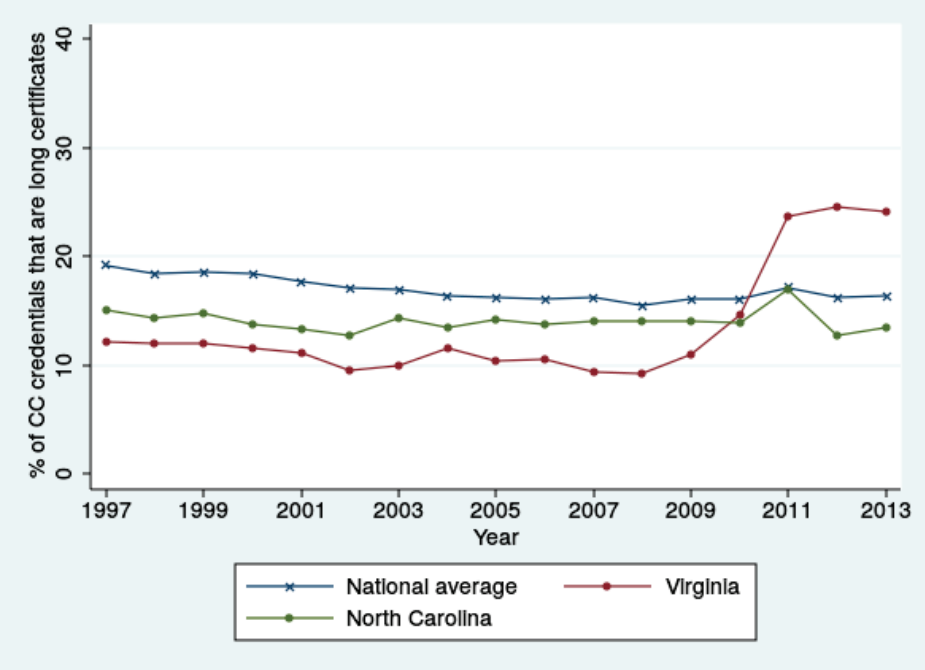


Figure 2: Trends in Long-Term Certificates, 1997–2013



Note. The national data is calculated from the Integrated Postsecondary Data System (IPEDS) using credentials awarded by community colleges, which we define as all public, primarily postsecondary, Title IV-eligible institutions in the 50 U.S. states or the District of Columbia from which at least 90 percent of credentials awarded in 2011 were at the sub-baccalaureate level.

Overall, the differences between the two states and between each state and the national averages suggest that different states may have substantially different approaches in community college program offerings and awards. These variations, together with distinct local labor market conditions, may lead to substantial differences in the economic returns to certificates. As a result, results from the current study need to be interpreted with caution by policymakers in other states.

Sample Description

To explore the economic returns to certificates, we exclude from the sample quarters where individuals earned more than $100,000 since these are outliers representing less than 1 percent of the sample in both states. Some individuals may fail to be successfully matched with the UI database and therefore may have zero earnings across all quarters; this group represents a relatively small proportion of the total sample (about 9 percent of the sample in North Carolina and 16 percent in Virginia) and has been excluded from the analytical sample. Finally, given that most individuals are not active in the labor market below age 18 or above age 65, we impose age restrictions and drop quarters in which an individual was younger than 18 or older than 65 years. The final sample includes 3,868,703 earnings records for 165,884 individuals in North Carolina and 1,839,893 earnings records for 67,735 individuals in Virginia.

To explore whether there are substantial differences in the type of student who earns a certificate between the two states, Table 1 presents key demographic characteristics on students who ever obtained a long-term certificate (LC) and students who ever obtained a short-term certificate (SC). For the purpose of comparison, we also present the corresponding characteristics of students who ever obtained an associate degree (AA) and those who ever transferred. Adding these comparison groups provides a frame of reference to examine whether certificate programs are indeed more likely to enroll a larger proportion of nontraditional students than degree programs in these two community college systems.

In general, students who earned certificates tended to be older than associate earners. Particularly, short-term certificate earners were the oldest on average when they first entered college. To examine the percentage of traditional students across different outcome groups, we further divide students into two groups: those who were age 20 or younger at college entry and those who were older than 20 years. Descriptive statistics indicate that short-term certificate programs tend to disproportionally enroll adult learners: 44 percent and 72 percent of short-term certificate earners were adult learners in Virginia and North Carolina, respectively, compared to 22 percent and 51 percent of associate degree earners.

Moreover, it seems that certificate programs, especially short-term certificate programs, enroll a larger proportion of Black students in both states, as well as a larger proportion of students who received need-based federal financial aid in Virginia. These descriptive characteristics are in line with previous findings showing that, compared to degree programs, certificate programs are more likely to enroll low-income adult learners returning to school to obtain new skills (e.g., Carnevale et al., 2012; Jenkins & Weiss, 2011).

Table 1: Individual Characteristics of Students by Different Academic Outcomes

	Virginia				North Carolina			
	Ever LC	**Ever SC**	**Ever AA**	**Transfer**	**Ever LC**	**Ever SC**	**Ever AA**	**Transfer**
Percent female	60%	57%	60%	56%	59%	45%	62%	60%
Percent Black	14%	22%	12%	21%	18%	24%	13%	24%
Percent Hispanic	6%	3%	6%	6%	3%	3%	3%	3%
Percent White	71%	71%	70%	61%	73%	66%	75%	63%
Percent other race/ethnicity	9%	5%	11%	12%	7%	7%	9%	10%
Age at college entry	21.1	25.0	20.8	20.2	27.8	30.9	26	20.8
Percentage older than 20 at entry	21%	44%	22%	21%	57%	72%	51%	30%
Transfer track (vs. career-technical)	64%	29%	67%	71%	N/A	N/A	N/A	N/A
Dual-enrolled prior to entry	24%	21%	24%	20%	N/A	N/A	N/A	N/A
Federal financial aid recipient	44%	49%	40%	39%	55%	38%	54%	25%
Educational Intent (VA): Occupational Associate	29%	30%	36%	33%	N/A	N/A	N/A	N/A
Educational Intent (VA): Occupational Certificate	19%	45%	9%	9%	N/A	N/A	N/A	N/A
Educational Intent (VA): Arts & Sciences Associate	53%	25%	55%	59%	N/A	N/A	N/A	N/A
Educational Intent (NC): Associate degree	N/A	N/A	N/A	N/A	20%	7%	15%	10%
Educational Intent (NC): Transfer	N/A	N/A	N/A	N/A	23%	10%	46%	36%
Educational intent (NC): Occupational	N/A	N/A	N/A	N/A	91%	99%	66%	22%
Took remedial courses	59%	48%	52%	53%	44%	35%	44%	26%
Observations	**4,932**	**2,675**	**14,498**	**20,434**	**3,319**	**5,698**	**11,582**	**47,029**

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia that matched with at least some Unemployment Insurance records.

There are also some sharp differences between the two states. Notably, students in North Carolina tended to be older at college entry than in Virginia regardless of credential earned. Yet, additional analysis indicates that students who ever transferred to a four-year college were fairly similar in their age at college entry (20.2 years in Virginia and 20.8 years in North Carolina) in the two states. This suggests that sub-baccalaureate programs in North Carolina, particularly certificate programs, may be designed to target adult learners more explicitly than in Virginia. Indeed, additional analysis on student educational intent indicates that certificate earners in North Carolina were much more likely to be occupationally oriented than certificate earners in Virginia. Specifically, 99 percent of short-term certificate earners and 91 percent of long-term certificate earners in North Carolina were occupationally oriented; in Virginia, while the majority of short-term certificate earners (75 percent) were occupationally oriented, fewer than half of the long-term certificate earners (48 percent) were so oriented.

The possibility that the two states may have substantially different approaches and emphases in their certificate programs is further suggested by the distribution of fields[9] in which certificates were awarded.[10] As shown in Table 2, 62 percent of long-term certificates in the analytical sample in Virginia were awarded in the humanities and social sciences, which is a much higher percentage than in North Carolina (11 percent) or nationally (6 percent). According to the VCCS, this is due to a special long-term certificate program of "general education" in Virginia that enables students to receive a diploma based on completion of general education requirements before they transfer or receive an associate degree.

Yet, even within the same field of study, the specific programs offered may be substantially different in each of the two states. Table 3 provides information on the top three programs in each field of study. Results indicate that programs differ noticeably between the states in several fields. For instance, in the field of protective services, short-term certificates in North Carolina overwhelmingly were awarded in basic law enforcement training (81 percent), a program that leads to eligibility for certification as a law enforcement officer within the state; in Virginia, however, short-term certificates in protective services were much more spread across several programs, including law enforcement (29 percent), police science (20 percent), and administration of justice (7 percent) programs.

In addition to between-state differences in program offerings, Table 3 also indicates that even for a particular length of certificate and broad field of study, there may be multiple unique programs. For example, the field of allied health includes a wide range of distinct certificate programs. Some of them, such as dental assisting, are specific in the types of skills that students are required to learn, while others, such as health sciences, take a more general approach. The

[9] We follow existing literature in categorizing field of study based on the Classification of Instructional Programs (CIP) developed by the U.S. Department of Education's National Center for Education Statistics (NCES). We use the same CIP to field-of-study crosswalk as that used in Dadgar and Trimble (2014) and Belfield, Liu, and Trimble (2014).

[10] For individuals who received multiple certificates, all the certificates are taken into account.

variations in program and labor market alignment offered by these distinct programs may provide divergent student experiences, career paths, and economic payoff.

Table 2: Field Breakdown of Long-Term and Short-Term Certificate Ever Received

	North Carolina		Virginia		National	
	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term
Allied Health	25%	10%	10%	26%	18%	17%
Business and marketing	4%	9%	1%	8%	6%	10%
Construction	7%	10%	2%	2%	5%	4%
Cosmetology, culinary, and admin services	8%	11%	3%	3%	11%	7%
Education and Childcare	1%	7%	2%	5%	3%	5%
Engineering sciences	3%	9%	2%	8%	5%	6%
Humanities and Social Sciences	11%	1%	62%	3%	6%	1%
Information science, communication and design	2%	6%	1%	4%	4%	5%
Mechanics, repair and welding	20%	17%	8%	11%	15%	11%
Missing/Other	7%	5%	0%	18%	2%	1%
Nursing	12%	2%	7%	8%	22%	14%
Protective Services	0%	9%	3%	3%	4%	10%
Transportation	0%	4%	0%	3%	1%	8%
N	3,622	6,799	5,276	3,180	141,250	218,171

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia that matched with at least some Unemployment Insurance records. The national data are calculated from the Integrated Postsecondary Data System (IPEDS) using credentials awarded by community colleges, which we define as all public, primarily postsecondary, Title IV-eligible institutions in the 50 U.S. states or the District of Columbia from which at least 90 percent of credentials awarded in 2008 were at the sub-baccalaureate level. For both states and for the national data, fields of each award are determined using a classification mapping from Classification of Instruction Programs (CIP) codes that matches that used by Dadgar and Trimble (2014).

Table 3: Most Common Programs by Field of Study

	North Carolina		Virginia	
	Long-term	**Short-term**	**Long-term**	**Short-term**
Humanities & Social Sciences				
#1 program	Diploma in arts (79%)	Community Spanish interpreter (57%)	General Education (99%)	American Sign Language (39%)
#2 program	Diploma in science (11%)	Professional crafts: Jewelry (19%)	Fine Arts (1%)	Fine Arts (7%)
#3 program	General occupational technology (7%)	Community journalism (6%)	-	Liberal Arts (7%)
N	396	47	3247	83
Information science, communication & design				
#1 program	Information systems (53%)	Information systems (47%)	Printing (24%)	Information Systems Technology (41%)
#2 program	Networking technology (16%)	Networking technology (14%)	Graphic Communications (24%)	Communication Design (13%)
#3 program	Broadcasting & production tech (8%)	Internet technologies (9%)	Information System Technology (17%)	Web Design Manager (3%)
N	64	388	42	121
Engineering sciences				
#1 program	Horticulture technology (29%)	Horticulture technology (24%)	Computer Aided Drafting & Design (31%)	Computer Electronics Technology (7%)
#2 program	Industrial maintenance technology (29%)	Industrial maintenance technology (21%)	Electronics (29%)	Computer Aided Drafting & Design (4%)
#3 program	Mechanical drafting technology (9%)	Computer engineering technology (13%)	Industrial Management (7%)	Marine Engineering Technology (17%)
N	110	609	99	259

Allied health				
#1 program	Dental assisting (33%)	Medical office administration (43%)	Medical Assisting (28%)	Emergency Medical Services (9%)
#2 program	Medical assisting (20%)	Phlebotomy (29%)	Medical office administration (22%)	Health Sciences (4%)
#3 program	Surgical technology (15%)	Medical assisting (10%)	Health Sciences (14%)	Respiratory Therapy (4%)
#4 program			Dental Assisting (11%)	Dental Assisting (3%)
N	907	719	548	817
Nursing				
#1 program	Practical nursing (99.5%)	Nursing assistant (97%)	Practical Nursing (100%)	Nursing (48%)
#2 program	Assoc degree nursing (integrated) (0.5%)	Licensed practical nurse refresher (3%)	-	Practical Nursing (39%)
N	432	108	352	246
Mechanics, repair & welding				
#1 program	Air conditioning, heating, & refrigeration technology (31%)	Air conditioning, heating, & refrigeration technology (29%)	Air Conditioning & Refrigeration (19%)	Automotive (22%)
#2 program	Welding technology (19%)	Welding technology (19%)	Welding (17%)	Welding (18%)
#3 program			Machine Shop	Air Conditioning and Refrigeration (8%)
#4 program	Autobody repair (17%)	Automotive systems technology (13%)	Automotive Analysis & Repair (10%)	
N	740	1,175	411	339
Protective Services				
#1 program	Criminal justice technology (50%)	Basic law enforcement training (81%)	Law Enforcement (49%)	Law Enforcement (29%)
#2 program	Fire protection technology (50%)	Criminal justice technology (9%)	Administration Of Justice (14%)	Police Science (20%)
#3 program		Fire protection technology (9%)	Corrections Science (12%)	Administration of Justice (7%)
N	10	624	164	85

Construction				
#1 program	Electrical/electronics technology (56%)	Electrical/electronics technology (40%)	Electricity (44%)	Electromechanical Control (17%)
#2 program	Carpentry (23%)	Carpentry (20%)	Construction Technology (32%)	Construction Management Technology (3%)
#3 program	Plumbing (12%)	Masonry (15%)	Building Construction (9%)	Electricity (3%)
N	257	649	116	69
Business & marketing				
#1 program	Office systems technology (39%)	Business administration (36%)	Bookkeeping (30%)	Management (65%)
#2 program	Business administration (18%)	Office systems technology (26%)	Accounting (22%)	Marketing (9%)
#3 program	Accounting (18%)	Accounting (19%)	Supervision and Management (9%)	Accounting (13%)
N	131	642	69	240
Education & Childcare				
#1 program	Early childhood associate (95%)	Early childhood associate (72%)	Early Childhood Development (72%)	Early Childhood Development (71%)
#2 program	Teacher associate (5%)	Infant/toddler care (26%)	Child Care (28%)	-
N	41	488	87	145
Transportation				
#1 program	Heavy equipment operator (100%)	Truck driver training (99%)		Truck Driving (71%)
#2 program		Aviation mgmt & career pilot tech (1%)		Heavy Equipment Operation (7%)
N	5	266	0	105

Cosmetology, culinary, & admin services				
#1 program	Cosmetology (89%)	Cosmetology (59%)	Clerical Studies (35%)	Administrative Support Technology (29%)
#2 program	Food service technology (5%)	Esthetics technology (20%)	Legal Assistant (21%)	Clerical Studies (15%)
#3 program	Culinary technology (3%)	Culinary technology (7%)	Culinary Arts (14%)	Culinary Arts (10%)
N	289	763	140	89
Missing/Other				
#1 program	Funeral service education (91%)	Food service technology (99%)	n/a (100%)	n/a (96%)
#2 program	CT & MRI technology (9%)	Outdoor leadership (1%)		Funeral Service (1%)
#3 program				Recreation & Parks (2%)
N	22	136	1	582

Note. This table is based on credentials awarded to first-time students in each state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 academic years in Virginia.

3. Methodology

Individual Fixed Effects Approach

The major challenge in exploring the economic returns to certificates is that some unobserved individual characteristics, such as motivation and ability, may influence both educational outcomes and individual earnings. We might be concerned, for example, that the same students who persist in college long enough to complete a credential are likely to have some positive qualities that also benefit them in the labor market. To address potential problems of omitted variable bias, we take advantage of the panel data structure (which includes multiple wage observations for each student before, during, and after college enrollment) to employ an individual fixed effects model.

$$\begin{aligned} \text{Earnings}_{it} = {} & \alpha_i + \text{Bachelor}_{it} + \text{Associate}_{it} + \text{Lcert}_{it} + \text{Scert}_{it} + (\text{PreExit}_{it} * \text{Award}_{itj}) \\ & + \text{Enroll}_{it} + \pi_t + \pi^2{}_t + \gamma_t + X_{it} + A_{it} + \mu_{it} \end{aligned} \quad (1)$$

The outcome Earnings_{it} represents an individual *i*'s earnings in a given quarter *t*. According to the model, individual quarterly earnings depend on these:

(a) Student-specific fixed effects α_i, which include all observed and unobserved individual characteristics that are constant over time.

(b) The type of award[11] (Bachelor_{it}, Associate_{it}, Longcert_{it}, Shortcert_{it}) a student has attained by the beginning of that quarter, if any.[12] Students who received a certain type of credential in multiple fields (e.g., a short-term certificate in allied health and then another one in nursing) are assigned with a "1" after attaining the first credential. In addition to the two key variables of interest (i.e., Longcert_{it}, Shortcert_{it}), we also control for other types of credentials attained (i.e., Bachelor_{it}, Associate_{it}) to address the concern that some certificate earners may continue their postsecondary education in order to pursue an associate or even a bachelor's degree after certificate attainment, particularly for certificates that have been designed to be stackable. As a result, the effects of certificates in the current study should be interpreted as the additive value of earning a certificate on individual labor market outcomes holding other type of awards received constant.

[11] It is worth noting that these different awards are not mutually exclusive; therefore, a student may have multiple awards (such as both a short-term certificate and an associate degree) during a given quarter.

[12] The sample includes both students who never earn a credential and those who earn credentials at various points during the tracking period.

(c) The opportunity cost Enroll_{it} associated with college attendance, which is measured by the total number of credits enrolled in VCCS or NCCCS colleges during the current quarter and whether the student is enrolled in any college out of the VCCS or NCCCS in that quarter. We use these variables to account for the possibility that schooling may lead to some forgone earnings.

(d) An interaction between whether a student has attained each type of award in a given quarter and a dummy variable indicating whether the given quarter is prior to the student exiting college. This interaction term is included to further address foregone earnings during college enrollment. Although we partly address this problem by controlling for the total number of credits attempted, and whether a student is enrolled in colleges out of the community college system during the current quarter, students may still experience negative short-run returns to certificates before leaving college. This is referred to as a "lock-in" effect in the job-training literature (Andersson, Holzer, Lane, Rosenblum, & Smith, 2013; van Ours, 2004), meaning that participation in training may inhibit students' ability to work to their full wage potential. For example, some students may not take any courses during the summer but may still be subject to foregone earnings by working part-time or by working in a temporary position that does not fully capture their human capital. By including the interaction term between college enrollment and certificate attainment, the main effects in (b) reflect post-exit returns to certificates.

(e) A time trend (π_t) that increases linearly by 1 each quarter and is relative to college entry, a squared term of the time trend (π^2_t) to account for non-linearity, as well as quarter-specific fixed-effects (γ_t) based on calendar year and quarter to account for seasonal or economic shocks.

(f) Observed time-varying demographic characteristics X_{it}. An advantage of the individual fixed effects strategy over a straightforward Mincerian equation is that it controls for non-observable student characteristics in estimating the impact of a credential on labor market earnings. Yet, some of these time-invariant characteristics, such as age at college entry, might interact with the rate of earnings growth. For example, we may expect younger students to follow a different earning trajectory than older students, even without any educational training. This is a threat to internal validity if such time-dependent differences are also correlated with the likelihood of earning a certificate. We can control this threat at least somewhat by controlling for the interaction between these observable characteristics and the time trend. That is, the interaction terms between student characteristics and the time trend allow us to control for the impact of observable student characteristics on the *growth* of earnings over time. Specifically, the variables in the vector of X_{it} are the linear time trend interacted with indicators for gender, race/ethnicity, whether the

student was 25 years of age or older upon initial college enrollment, whether the student has ever been dual enrolled, whether the student is eligible for need-based financial aid, and whether the student is in a transfer track program.

(g) A dichotomous variable for "Ashenfelter's Dip." Existing literature has well documented the phenomenon of Ashenfelter's Dip (e.g., Heckman, LaLonde, & Jeffrey, 1999), in which individuals who experience an income shock (such as after being laid off) are more likely to receive training. From the perspective the data examined in this paper, if community college attendance is a form of training, then students may have depressed earnings on average in the time period immediately prior to college entry.[13] Therefore, we address Ashenfelter's Dip by including indicators for each quarter in the year prior to college attendance, represented by A_{it} in model (1).

In Section 4, we present results for only the full model described in equation (1). However, for reference, a stepwise table that begins with the most basic individual fixed effects model and includes progressively more of the controls described above is provided in Appendix Table A.2.

Outcome Measures

In our main model, quarters with no reported UI earnings are assigned values of zero earnings. However, in addition to understanding the overall effect of certificates on earnings, we are also interested in understanding what is driving the overall impact, since certificate awards could influence earnings in at least two distinct ways: through an extensive margin by influencing one's probability of employment and through an intensive margin by increasing or decreasing wages conditional on employment. Such a distinction is critical to having a meaningful understanding of the potential impacts of certificates on student labor market outcomes: if we find positive evidence for certificates on wages conditional on employment, this would serve as strong evidence that certificates have a positive impact on increasing worker productivity. However, the benefits of certificates on gaining employment may offer a separate but important reward; there may exist individuals for whom gaining employment may be a vital achievement.

Therefore, to disentangle the impact of a certificate at the two margins, we separately estimate a model that identifies the impact of obtaining a long-term or short-term certificate on the probability of employment and a model that identifies the impact of a certificate on actual earnings among those who were employed during that quarter. The employment outcome is a dichotomous variable, and individuals receive a "1" in quarters where wages are greater than

[13] Since students vary in their timing of college enrollment, the Ashenfelter dummies are not redundant with the quarter dummies that have already been included in the model to account for seasonal or economic shocks.

zero, and a "0" in quarters where wages are zero or missing. We used both a linear probability model and a logistic regression to estimate the impacts of certificates on employment, and the results of each follow a similar pattern. Therefore we present the results from the linear probability model for easier interpretation.

Heterogeneity Analyses

In addition to providing estimates on the overall returns to short-term and long-term certificates, we also provide estimates of the returns to certificates in broad fields of study as well as in particular programs. The approach is similar to that summarized in Equation (1) above. In Equation (2), used for the heterogeneity analyses, the single binary indicator for whether student *i* has earned a short- or long-term certificate at time *t* is replaced with a vector of indicators for whether student *i* has earned a short- or long-term certificate in a particular field or program *p* at time *t.*

$$\begin{aligned} Earnings_{it} = {} & \alpha_i + Bachelor_{it} + Associate_{it} + Lcert_{ipt} + Scert_{ipt} + (PreExit_{it}*Award_{ipt}) \\ & + Enroll_{it} + \pi_t + \pi^2{}_t + \gamma_t + X_{it} + A_{it} + \mu_{it} \end{aligned} \quad (2)$$

A first heterogeneity analysis categorizes each credential into a field of study based on the credential's assigned CIP code, following a field classification scheme used in prior literature (Dadgar & Trimble, 2014; Belfield, Liu, & Trimble, 2014). A second heterogeneity analysis uses the state-defined program of each credential. However, because there are many more programs than broad fields of study, in this analysis we only specifically distinguish the fifteen most popular programs at each certificate level in each state (see Appendix Table A.1); all other short- and long-term certificate programs are included in an "other" category.

4. Results

Overall Returns to Certificates

Table 4 presents the effects of receiving a long-term or short-term certificate on quarterly earnings from the individual fixed effects model. The top panel includes all quarters in which a student was aged at least 18 years and no more than 65 years, where a quarter without an earnings record is regarded as earning $0. Since this estimate reflects the combined effect of earning a certificate on the extensive margin (employment) as well as the intensive margin (earnings conditional on employment), we further present the effects of earning a certificate on the probability of employment in the middle panel and use earnings conditional on employment as the dependent variable in the bottom panel.

Table 4: Individual Fixed Effects Estimates of Economic Returns to Certificates

	North Carolina	Virginia
Outcome variable: Quarterly earnings *(in 2010 dollars)*		
Long certificate	857**	346***
	(60)	(22)
Short certificate	293**	222***
	(45)	(23)
R-squared	0.51	0.54
Observations	3,868,703	1,839,893
Outcome variable: Probability of employment		
Long certificate	0.104**	0.068***
	(0.007)	(0.004)
Short certificate	0.064**	0.027***
	(0.005)	(0.004)
R-squared	0.42	0.36
Observations	3,868,703	1,839,893
Outcome Variable: Non-zero Quarterly Earnings *(in 2010 dollars)*		
Long certificate	654**	201***
	(69)	(32)
Short certificate	7	249***
	(55)	(34)
R-squared	0.55	0.72
Observations	2,328,999	847,420

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The model is based on the individual fixed effects equation (1) in this paper; additional controls include receipt of an associate degree or a bachelor's degree or higher, a linear time trend, a quadratic time trend, a control for the Ashenfelter dip, quarter fixed effects, demographic variables interacted with the linear time trend, current credits enrolled in the community colleges, a binary indicator for whether the student was enrolled elsewhere, and an interaction between credential receipt and pre-exit status.

*** $p < .01$, ** $p < .05$, * $p < .1$.

The estimates from the basic individual fixed effects specification (Equation 1) are presented separately for North Carolina and Virginia. In general, attainment of either short-term or long-term certificates on average is associated with significant wage increases in both states compared with attending a community college but exiting without earning any credential. In North Carolina, earning a long-term certificate is associated with an $856 increase in quarterly earnings once a student exited college. Although this number is also significantly positive in Virginia, the magnitude is much smaller—the earning of a long-term certificate leads to an increase in quarterly earnings of only $346. Such between-state differences in returns to long-term certificates, as shown in the next section, are largely driven by variations in the distribution of field of study and program of study. In contrast, the economic returns to short-term certificates are much more consistent between the two states. Receiving a short-term certificate is associated with an increase in quarterly earnings of $293 in North Carolina and $222 in Virginia.

Additional analysis on employment indicates that the overall positive impact of certificates on earnings is partly due to the increased probability of employment after earning either a long-term or short-term certificate, and the between-state variations resemble the pattern observed in the top panel of Table 4. Specifically, earning a long-term certificate is associated with an increased probability of employment of 10 percentage points in North Carolina and 7 percentage points in Virginia; earning a short-term certificate is associated with an increased probability of 6 and 3 percentage points in North Carolina and Virginia respectively.

In terms of quarterly earnings conditional on employment, both short-term and long-term certificates have positive impacts in both states, although the estimate is not statistically significant for short-term certificates in North Carolina. Specifically, a long-term certificate is associated with an increase in earnings of $655 in North Carolina and $201 in Virginia; a short-term certificate does not have a significant impact on earnings among those who are employed in North Carolina, but is associated with an increase of $249 in Virginia. These positive estimates indicate that certificates in general increase individual labor market outcomes both by increasing students' probability of employment and by improving their productivity.

Heterogeneity Across Different Fields of Study

Prior research on certificates has differentiated returns across broad fields of study. Here we replicate that analysis by decomposing the overall impacts for each type of certificate into a vector of long-term and short-term certificates by academic fields. (In the next section, we then take this analysis a step further by decomposing the overall impacts for each type of certificate into a vector of long-term and short-term certificates by *specific program.*)

Table 5 presents the average returns to each field of study. Overall, there is a high degree of variation in returns both (a) across fields within states and certificate levels and (b) across levels and states within fields. For example, in Virginia long-term certificates in mechanics, repair, and welding yield returns almost as high as long-term certificates in nursing. But this is not the case in North Carolina, where the returns to long-term certificates in mechanics, repair,

and welding are not nearly so high. And short-term certificates in this field do not yield high returns in either state. As a second example, in North Carolina short-term certificates in protective services by far yield the highest returns out of all short-term certificates. However, this is not true in Virginia, where instead long-term certificates in protective services yield relatively high returns.

However, despite variations across states, fields, and length of study, we are also able to identify some consistent patterns between the two states. Specifically, we find strong returns to certificates in health-related fields. In both states, long-term certificates in nursing yield the highest returns, and both long-term and short-term certificates in allied health seem to yield positive returns (although the North Carolina results are not statistically significant). One rational explanation for such consistently high returns to health-related certificates observed in the current study as well as in previous studies is that these certificates are closely linked to health-related jobs with often high average earnings. As a result, attaining a certificate in the health-related field may provide substantial economic benefit to students by enabling them to enter health-related industries and in particular, by switching from a lower-earning industry to a higher-earning industry.

Table 5: Heterogeneity by Academic Fields of Study (Dependent Variable: Quarterly Earnings in 2010 Dollars)

	North Carolina		Virginia	
	Long-term	Short-term	Long-term	Short-term
Allied health	1,818**	253	294***	526**
	(124)	(135)	(60)	(161)
Business and marketing	–276	–463**	–221	–469**
	(240)	(137)	(157)	(135)
Construction	179	–8	–740***	–166**
	(217)	(108)	(123)	(85)
Cosmetology, culinary, and admin. services	–186	–424**	–64	872***
	(144)	(98)	(98)	(48)
Education and childcare	–600	–577**	–358	97
	(397)	(158)	(138)	(86)
Engineering sciences	–13	126	–325	302***
	(369)	(142)	(131)	(68)
Humanities and social sciences	–355	859	–256***	–268
	(230)	(529)	(34)	(160)
Information science, communication, and design	–820**	–144	–262	100
	(296)	(205)	(205)	(137)
Mechanics, repair, and welding	170	40	1714***	–204**
	(141)	(135)	(62)	(90)
Missing/other	461	57	–2153**	184**
	(1,042)	(136)	(990)	(51)
Nursing	3,451**	159	1767***	–96
	(190)	(323)	(67)	(119)
Protective services	–1,376	2,460**	1182***	–268
	(969)	(172)	(103)	(160)
Transportation	1,084	–707*		171
	(1,855)	(279)		(95)

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The model is based on the individual fixed effects equation (2) in this paper; in addition to individual fixed effects, controls include receipt of an associate degree or a bachelor's degree or higher, a linear time trend, a quadratic time trend, a control for the Ashenfelter dip, quarter fixed effects, demographic variables interacted with the linear time trend, current credits enrolled in the community colleges, a binary indicator for whether the student was enrolled elsewhere, and an interaction between credential receipt and pre-exit status. The effects reported in this model are based upon a vector of indicators for whether student i has earned a short- or long-term certificate in a particular field p at time t.

*** $p < .01$, ** $p < .05$, * $p < .1$.

To explore this possibility, we identify the industries where these health-related certificate earners worked before and after college enrollment and present them in Table 6.[14] The results indicate that among individuals who earned either a short-term or long-term certificate in either the field of allied health or nursing, the percentage working in the industry of "health care and social assistance" surged from 21 percent before college enrollment to 52 percent after college; in a similar vein, in Virginia, the corresponding figures are 14 percent before college and 41 percent after college. In contrast, the proportion of individuals working in the industries of "retail and wholesale trade" and "services," industries with comparatively lower average earnings, substantially decreased after students left college.

For example, the proportion of students working in the industry of "services" dropped from 22 percent before college to 9 percent after college in North Carolina, and from more than 40 percent to 25 percent in Virginia. In both states, the industry of "health care and social assistance" is associated with much higher earnings than average across all industries (34 percent higher in North Carolina and 20 percent higher in Virginia)[15] while the earnings in industries of "retail and wholesale trade" and "services" are both substantially below average. These descriptive patterns suggest that the positive economic returns to certificates in health related fields may be partly attributed to helping individuals switch from a lower-earning industry to health-related jobs with higher average earnings.

In contrast, for certificates that are linked to industries with lower average earnings, they may not necessarily lead to increased earnings. Indeed, Table 5 suggests that several fields of study appear to lead to zero and sometimes even negative returns, and such results have also been found in previous studies (Dadgar & Trimble, 2014; Jepsen et al., 2014;). For example, no certificates in the "education and childcare" field result in significant, positive earnings returns in either state. The industry most closely associated with this field of study is "educational services" (which includes day care services). For the analytical sample, the average earnings in this industry were 21 percent lower in North Carolina and 20 percent lower in Virginia than the overall average quarterly earnings across all industries. As a result, the education and childcare certificate programs may be doing a good job at getting their graduates into this industry without necessarily increasing students' earnings.

[14] Ideally, we would match each field with its related industry and occupation and then explore whether earning a certificate in a particular field could help individuals to secure a job in a related industry and occupation. However, we do not have data on occupation, so one challenge to this analysis is that there may not be clear match between a particular field and an industry. Yet, this challenge is somewhat attenuated for the fields of allied health and nursing, which have comparatively more salient matches to an industry.

[15] Calculation based on all wage records available for the analytical sample.

Table 6: Industry Breakdown of Nursing and Allied Health Certificates

	North Carolina		Virginia	
	Before College	After College	Before College	After College
Administrative and support and waste	4%	6%	4%	4%
Construction	1%	1%	2%	1%
Educational services	3%	3%	6%	5%
Health care and social assistance	21%	52%	14%	41%
Information and finance	5%	6%	6%	5%
Manufacturing	17%	3%	3%	2%
Public administration	2%	2%	3%	4%
Retail and wholesale trade	14%	11%	20%	12%
Services	22%	9%	40%	25%
Others	11%	8%	2%	1%
N	1,747	1,580	1,217	1,268

Note. This table is based on first-time students in each state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The industry categories are derived using a mapping scheme from the North American Industry Classification System (NAICS) codes, where childcare services are coded into the educational services category.

Additional analysis that indicates the industry where education-related certificate earners worked before and after college enrollment provides evidence to support this hypothesis. As shown in Table 7, in both states, the proportion of students working in "educational services" increased substantially after program completion (by 13 percentage points in North Carolina and 19 percentage points in Virginia). Moreover, the proportion of students working in "manufacturing"—an industry with relatively high earnings (118 percent higher in North Carolina and 93 percent higher in Virginia than average earnings across all industries)—decreased drastically. The manufacturing industry, despite its high average pay, has been volatile during the period of this study, with many employees threatened with layoffs. According to the U.S. Census Bureau's Statistics of U.S. Businesses,[16] the absolute number of people employed in the manufacturing industry decreased by 29 percent in North Carolina and by 22 percent in Virginia between 2004 and 2011.

[16] Data retrieved from https://www.census.gov/econ/susb/

Table 7: Industry Breakdown of Education and Childcare Certificates

	North Carolina		Virginia	
	Before College	After College	Before College	After College
Administrative and support and waste	3%	5%	4%	3%
Construction	2%	0%	1%	0%
Educational services	30%	43%	33%	52%
Health care and social assistance	8%	10%	5%	9%
Information and finance	4%	5%	6%	3%
Manufacturing	17%	3%	11%	1%
Public administration	2%	3%	2%	1%
Retail and wholesale trade	9%	5%	15%	2%
Services	17%	14%	24%	8%
Others	10%	14%	0%	1%
N	364	242	122	118

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The industry categories are derived using a mapping scheme from NAICS codes, where childcare services are coded into the educational services category.

These sharp decreases in individuals working in "manufacturing" before and after college enrollment provide support to the argument that community colleges, particularly occupationally oriented programs, may enroll a large proportion of displaced workers returning to school for job retraining (e.g., Jacobson et al., 2005) as well as students trading high earnings for increased job stability or satisfaction by switching to the educational services sector. For these individuals, gaining employment may be an end in and of itself; therefore information about the impacts of certificates on the probability of employment may be at least as meaningful as information about an earnings benefit.

In Table 8, we summarize the percentage point increase in probability of employment for each field of study and credential level in each state. These results are substantially different from those presented in Table 5 in some fields. For example, education and childcare certificates significantly increase students' likelihood of being employed in Virginia. In North Carolina, the comparable estimates are also positive though not statistically significant.

Table 8: Heterogeneity by Academic Fields of Study (Dependent Variable: Probability of Employment)

	North Carolina		Virginia	
	Long-term	Short-term	Long-term	Short-term
Allied health	0.201**	0.144**	0.077***	0.071***
	(0.015)	(0.018)	(0.01)	(0.008)
Business and marketing	0.103**	0.026	0.007	–0.004
	(0.034)	(0.019)	(0.028)	(0.016)
Construction	0.127**	0.055**	–0.064**	0.107***
	(0.027)	(0.014)	(0.021)	(0.024)
Cosmetology, culinary, and admin. services	0.019	–0.031	0.095***	0.063**
	(0.027)	(0.017)	(0.017)	(0.023)
Education and childcare	0.028	0.041	0.06**	0.048**
	(0.082)	(0.028)	(0.024)	(0.021)
Engineering sciences	0.023	0.049**	–0.012	–0.009
	(0.045)	(0.017)	(0.023)	(0.015)
Humanities and social sciences	–0.011	0.144	0.000	0.079**
	(0.035)	(0.079)	(0.006)	(0.028)
Information science, communication, and design	–0.054	0.063**	0.014	0.005
	(0.051)	(0.024)	(0.036)	(0.024)
Mechanics, repair, and welding	0.094**	0.049**	0.144***	0.009
	(0.016)	(0.013)	(0.011)	(0.012)
Missing/other	0.135	0.123**	–0.307*	0.05***
	(0.069)	(0.028)	(0.173)	(0.009)
Nursing	0.232**	0.150**	0.178***	–0.039**
	(0.023)	(0.048)	(0.012)	(0.015)
Protective services	–0.035	0.208**	0.169***	–0.068**
	(0.214)	(0.017)	(0.018)	(0.028)
Transportation	0.012	–0.061*		0.018
	(0.110)	(0.027)		(0.017)

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The model is based on the individual fixed effects equation (2) in this paper; in addition to individual fixed effects, controls include receipt of an associate degree or a bachleor's degree or higher, a linear time trend, a quadratic time trend, a control for the Ashenfelter dip, quarter fixed effects, demographic variables interacted with the linear time trend, current credits enrolled in the community colleges, a binary indicator for whether the student was enrolled elsewhere, and an interaction between credential receipt and pre-exit status. The effects reported in this model are based upon a vector of indicators for whether student *i* has earned a short- or long-term certificate in a particular field *p* at time *t*.

*** $p < .01$, ** $p < .05$, * $p < .1$.

Heterogeneity Across Different Certificate Programs

In addition to by-field analysis, we further estimate returns to specific certificate programs to explore whether there are substantial variations across programs within a particular field of study. Table 9 summarizes returns to the fifteen most popular programs in each state for long-term and short-term certificates, respectively, where programs are listed with the field of study with which they are associated.

Results from the program-level analysis demonstrate that aggregating programs within fields of study, as in Table 5 and previous studies, may mask substantial variation in the economic benefit of particular programs: fields with many popular programs, such as "allied health" and "mechanics, repair, and welding," offer varied returns across the programs within them. For instance, the long-term certificate program in dental assisting is associated with high earnings returns across both states ($2, 991 in North Carolina and $693 in Virginia), both of which are much higher than the field average in each state ($1,818 in North Carolina and $294 in Virginia); In contrast, there are also programs such as the short-term certificate program in medical office administration in North Carolina (nonsignificant returns) and both the long-term and short-term certificate programs in health sciences in Virginia (–$243 return for long-term certificate and –$507 return for short-term certificate) that are associated with low or even negative returns. However, in Table 5, the returns for these programs were averaged together into the single field of "allied health."

Moreover, the program-level analysis helps explain some of the striking differences between the two states in terms of returns to certificates in some of the fields shown in Table 5. For example, in the field of protective services, returns for short-term and long-term certificates are radically different between the two states: in North Carolina, there are nonsignificant negative returns to long-term certificates but particularly high and significant returns to short-term certificates; in Virginia there are significant high returns to long-term certificate but insignificant negative returns to short-term certificates.

The program-level results in Table 9 suggest that the basic law enforcement training (BLET) program drives the returns to the short-term certificate program in North Carolina. This program, offered at many colleges across North Carolina, is regulated to align with training requirements for a particular career path. One community college in North Carolina describes on its website that the BLET program "prepares students for entry-level employment as law enforcement officers with state, county, or municipal governments, or with private enterprise. The Academy offers the Commission-mandated 620 hour program (BLET Course Content). Some colleges also offer 124 additional hours of training in officer survival, public speaking, and related topics, for a total of 744 hours." Thus, this program is tightly aligned to allow students to succeed in a specific career path, and it provides hands-on training that serves as a clear indicator to local employers of the type of skills that graduates can be expected to possess. While this program requires less than one year of study and is therefore considered a short-term certificate, it yields among the highest returns to certificates in any length and field of study.

Table 9: Heterogeneity by Program of Study (Dependent Variable: Quarterly Earnings in 2010 Dollars)

	North Carolina			Virginia		
Field	**Program**	**Long-Term**	**Short-Term**	**Program**	**Long-Term**	**Short-Term**
Allied health	Medical assisting	1,407**		Medical assisting	179*	
		(209)			(102)	
	Medical office administration	125	275	Medical office administration	288**	
		(282)	(177)		(103)	
	Phlebotomy		1,128**	Medical laboratory technology		390**
			(251)			(164)
	Surgical technology	2,620**		Health sciences	–243*	–507**
		(353)			(133)	(180)
	Pharmacy technology	1,506**		Respiratory therapy		1,355***
		(374)				(196)
	Dental assisting	2,992**		Dental assisting	693***	
		(182)			(171)	
	Therapeutic massage	216		Emergency Medical Services		1,997
		(344)				(131)
Business and marketing	Business administration		–142	Management		11
			(188)			(89)
	Office systems technology		–823***			
			(182)			
Construction				Construction Technology	–823***	
					(182)	

	Electrical/electronics technology	363 (301)	363 (197)	Electricity	–470** (158)	
Cosmetology, culinary, and admin. services	Cosmetology	–44 (150)	–393** (118)	Clerical studies	–661*** (143)	
	Esthetics technology		–241* (135)			
Education and childcare	Early childhood associate		–216 (165)	Early childhood development	–241 (135)*	–9 (110)
Engineering sciences	Horticulture technology		–294 (209)			
Humanities and social sciences	Diploma in arts	–875** (249)		General education	–196 *** (25)	
				American Sign Language		–23 (225)
Information science, communication, and design	Information systems		34 (182)	Information systems technology		–684 *** (167)
Mechanics, repair, and welding	Air condit., heat., & refrig. Technology	–49 (237)	–579* (259)	Air conditioning & refrigeration	568 *** (135)	56 (199)
	Welding technology	934** 280	904** (260)	Welding	755*** (145)	461 (148)**
	Automotive systems technology		506* (215)	Automotive		–219 (188)

	Autobody repair	–32 (284)		Automotive analysis & repair	1,633*** (175)	
	Machining technology	1,070* (525)		Machine shop	4413*** (176)	
	Carpentry	634 (397)				
Nursing	Practical nursing	3,662** (194)		Practical nursing	1,222 *** (59)	–77 (111)
				Nursing		257** (104)
Protective services	Basic law enforcement training		2,647** (183)	Law enforcement	1,199*** (141)	–647** (266)
Transportation	Truck driver training		–385 (279)	Truck driving		–62 (111)
Missing/other	Missing/other	257* (127)	268** (73)	Missing/other	215*** (42)	225*** (26)

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia. The model is based on the individual fixed effects equation (2) in this paper. The effects reported in this model are based upon a vector of indicators for whether student *i* has earned a short- or long-term certificate in a particular program *p* at time *t*.

*** $p < .01$, ** $p < .05$, * $p < .1$.

In Virginia, comparable programs to the BLET program in North Carolina are generally offered as long-term certificates that take one year or more of full-time study but prepare graduates for a similar career pathway. Similarly, the "law enforcement" program in Virginia also has a strong emphasis on labor market alignment. For example, one college on its website indicates that their law enforcement program "has been developed in accordance with the need of local law enforcement agencies and personnel," and some colleges that offer the program also provide advisory services, where students are advised about which courses are most applicable to the type of jobs that a student is most interested in. In these cases, the specific program and labor market linkages appear to be far more influential to student earning success than whether the certificate is "short-term" or "long-term."

5. Discussion and Conclusion

In order to understand whether earning a certificate has any substantial impact on individual employment and wage earnings, the current study analyzes the economic returns to long-term and short-term certificates across two large community college systems. Using the same research methodology applied to two separate datasets from two distinct state contexts, the main purpose of this paper is to identify patterns of returns that are consistent across the states and to illustrate the extent of variation in certificate program offerings and returns between the states.

Overall, we find clear differences in both certificate program offerings and economic returns between North Carolina and Virginia. North Carolina seems to have a stronger emphasis on vocational programs, particularly for long-term certificates. In contrast, the majority of long-term certificates in Virginia are general education certificates that are designed to prepare students for further education in degree programs rather than preparing them for direct entry into the labor market. As a result, the economic returns to certificates, especially long-term certificates, are noticeably higher in North Carolina than in Virginia overall. While such between-state differences in returns to certificates are largely driven by variations in the distribution of programs, we also find considerable between-state differences in labor market returns even within the same program of study. These findings underscore the importance of evaluating program earnings relative to the institutional context and the local labor market rather than solely relying on national averages or evidence from other states. Therefore, our study draws attention to the necessity for colleges and systems to conduct their own analyses to assess the economic value of their certificate programs when contemplating program elimination, expansion, and reform.

Despite such between-state differences, however, we have identified several consistent patterns in the labor market returns to certificates in both states. First, we find significant, positive impacts of attaining a short-term certificate and of attaining a long-term certificate on

earnings overall. This is in contrast to some results from prior research conducted in other states over different time periods that found a lack of benefits for short-term certificates (Dadgar & Trimble, 2014). Additional analysis that disentangles the impacts on employment and the impacts on earnings conditional on employment indicates that certificates overall have positive impacts on both students' probability of employment and on earnings conditional on employment (except for North Carolina short-term certificates). The positive impacts on the latter are particularly encouraging, as they serve as strong evidence that earning a certificate increases worker productivity. Such positive evidence for certificates on individual labor market outcomes supports nationwide efforts to increase the visibility and availability of certificate programs, especially for adult learners.

In addition to the positive returns to certificates overall, we find substantial variations across fields of study. In line with existing studies, we find consistently higher returns to allied health and nursing in both states. Yet, even within the same field of study, such as allied health, we find considerable variation in returns to specific programs, suggesting that important information is lost when programs are grouped together for general analysis. Due to differences in content, focus, rigor, and labor market alignment, certificates awarded by different programs, even those categorized in the same field of study, can lead to diverse career paths with sharp contrasts in labor market outcomes. While some researchers (e.g., Van Noy et al., 2012) have suggested this possibility, this study provides the clearest evidence of it yet available. Considering that a large number of enrollees in certificate programs are adult learners attempting to increase their earnings or their chances of landing a job, our results highlight the importance of colleges providing detailed program-level information to students contemplating a program choice. Similarly, for college administrators who are considering the elimination or expansion of certificate programs, such detailed program-level information is also particularly important, as our results suggest that combining multiple certificate programs into a single broad category by field of study obscures their highly varied labor market outcomes and masks the benefits that some programs may offer.

We also find suggestive evidence that the returns to certificates are closely related to their labor market alignment. Specifically, certificate programs with clear indicators of the type of skills that graduates must possess and with explicit ties to particular jobs in the local labor market—such as the dental assisting programs in the field of allied health—resulted in particularly strong earnings increases. In contrast, programs that offer only a general approach to entering the labor force with obscure indictors of potential skills that graduates may possess—such as the health sciences program in the same field of study, allied health—generally led to lower returns. These findings suggest that colleges and college systems should encourage certificate programs to build direct links to local employers and career pathway opportunities.

Finally, similar to prior studies, we also identify zero returns and occasionally even negative returns to certificates in some fields of study. Additional analysis of the industry of employment before and after college enrollment indicates that while many certificate earners switched from industries with lower average earnings (such as services) to industries with high

earnings (such as allied health) after they left college, a non-trivial proportion of individuals did the opposite, which dragged the estimates on earnings downward. Yet, we find that even certificates in low-return fields of study sometimes boost graduates' probability of employment, particularly in the industry related to their certificate program. This finding suggests that while certificates in some fields, particularly those linked to an industry with lower average earnings, may not be able to increase students' earnings, they may offer other benefits to graduates, such as improving the likelihood of employment and gaining access to a desired industry that may confer benefits other than high wages, such as flexibility, stability, or promoting the social good.

Such benefits may be particularly meaningful during an economic recession, where many individuals face the potential of layoffs in unstable industries such as manufacturing. These individuals, many of whom end up as displaced workers, may enroll in a certificate program in order to gain entry into an industry that has lower average earnings but that offers other benefits, such as increased probability of employment, stability, or work satisfaction. Our results therefore point to the importance of including multiple measures to evaluate the benefits of a certificate program, rather than merely evaluating its impact on overall earnings. Policies that tie funding or other benefits to the earnings of program graduates alone may unfairly penalize programs that provide implicit economic benefits to students or that improve students' lives in other important ways.

References

ABC News. (2012, October 16). Second presidential debate transcript. Retrieved from: http://abcnews.go.com/Politics/OTUS/2012-presidential-debate-full-transcript-oct-16/print?id=17493848

Andersson, F., Holzer, H. J., Lane, J. I., Rosenblum, D., & Smith, J. (2013). *Does federally-funded job training work? Nonexperimental estimates of WIA training impacts using longitudinal data on workers and firms* (NBER Working Paper No. 19446). Cambridge, MA: National Bureau of Economic Research.

Bailey, T., Kienzl, G. S., & Marcotte, D. E. (2004). *The returns to a sub-baccalaureate education: The effects of schooling, credentials, and program of study on economic outcomes*. Washington, DC: U.S. Department of Education, National Assessment of Vocational Education. Retrieved from: http://www2.ed.gov/rschstat/eval/sectech/nave/subbac-ed.pdf

Bailey, T., & Belfield, C. R. (2013). Community college occupational degrees: are they worth it? In L. W. Perna (Ed.), *Preparing today's students for tomorrow's jobs in metropolitan America* (pp. 121–145). Philadelphia, PA: University of Pennsylvania Press.

Bahr, P. R. (2014). *The labor market return in earnings to community college credits and credentials in California.* Ann Arbor: University of Michigan, School of Education, Center for the Study of Higher and Postsecondary Education. Retrieved from http://www.soe.umich.edu/people/profile/peter_riley_bahr/

Bahr, P. R., Gross, J. L., Slay, K. E., & Christensen, R. D. (2013). First in line: Student registration priority in community colleges. *Educational Policy*. Advance online publication. doi:10.1177/0895904813492381

Belfield, C., Liu, Y. T., & Trimble, M. J. (2014). *The medium-term labor market returns to community college awards: Evidence from North Carolina* (CAPSEE Working Paper). New York, NY: Center for Analysis of Postsecondary Education and Employment.

Berkner, L., & Choy, S. (2008). *Descriptive summary of 2003–04 beginning postsecondary students: Three years later* (NCES 2008-174). Washington, DC: U.S. Department of Education, National Center for Education Statistics, Institute of Education Sciences.

Bosworth, B. (2010). *Certificates count: An analysis of sub-baccalaureate certificates.* Retrieved from Complete College America website: http://www.completecollege.org/docs/Certificates%20Count%20FINAL%2012-05.pdf

Carnevale, A. P., Rose, S. J., & Hanson, A. R. (2012). Certificates: Gateway to gainful employment and college degrees. Washington, DC: Georgetown University, Center on Education and the Workforce.

Dadgar, M., & Trimble, M. J. (2014). Labor market returns to sub-baccalaureate credentials: How much does a community college degree or certificate pay? *Educational Evaluation and Policy Analysis.* Advance online publication. doi:10.3102/0162373714553814

Dyke, A., Heinrich, C. J., Mueser, P. R., Troske, K. R., & Jeon, K. S. (2006). The effects of welfare-to-work program activities on labor market outcomes. *Journal of Labor Economics, 24*(3), 567–607.

Grubb, W. N. (1995). *The returns to education and training in the sub-baccalaureate labor market: Evidence from the Survey of Income and Program Participation, 1984–1990* (MDS-765). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Heckman, J. J., LaLonde, R. J., & Smith, J. A. (1999). The economics and econometrics of active labor market programs. In O. Ashenfelter and D. E. Card (Eds.), *Handbook of Labor Economics, Vol. 3* (pp. 1865-2097). Amsterdam, Netherlands: North-Holland.

Hollenbeck, K. (1993). Postsecondary education as triage: Returns to academic and technical programs. *Economics of Education Review*, *12*(3), 213–232.

Jacobson, L., LaLonde, R., & G Sullivan, D. (2005). Estimating the returns to community college schooling for displaced workers. *Journal of Econometrics*, *125*(1), 271–304.

Jacobson, L., & Mokher, C. (2009). *Pathways to boosting the earnings of low-income students by increasing their educational attainment*. Retrieved from Hudson Institute Center for Employment Policy website: http://pchr.hudson.org/files/publications/Pathways%20to%20Boosting.pdf

Jenkins, P. D., & Weiss, M. J. (2011). *Charting pathways to completion for low-income community college students* (CCRC Working Paper No. 34). New York, NY: Columbia University, Teachers College, Community College Research Center.

Jepsen, C., Troske, K., & 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., & 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.

Kasper, H. T. (2003). The changing role of community college. *Occupational Outlook Quarterly*, *46*(4), 14–21.

Kerckhoff, A. C., & Bell, L. (1998). Hidden capital: Vocational credentials and attainment in the United States. *Sociology of Education*, *71*(2), 152–174.

Lumina Foundation. (2013). *A stronger nation through higher education: Visualizing data to help us achieve a big goal for college attainment*. Retrieved from Lumina Foundation website: http://www.luminafoundation.org/publications/A_stronger_nation_through_higher_education-2013.pdf

Marcotte, D. E., Bailey, T., Borkoski, C., & 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.

McPhail, C. J. (2011). *The completion agenda: A call to action*. Retrieved from American Association of Community Colleges website: http://www.aacc.nche.edu/Publications/Reports/Documents/CompletionAgenda_report.pdf

Mincer, J. A. (1974). Schooling, experience, and earnings. New York, NY: Columbia University Press.

National Governors Association (2010). Complete to compete. Retrieved from National Governors Association website: http://www.nga.org/files/live/sites/NGA/files/pdf/10GREGOIREBROCHURE.PDF

Rivera-Batiz, F. (1998). *A profile and analysis of students in vocational training: Literacy skills, demographics, and socioeconomic characteristics* (MDS-809). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Van Noy, M., Weiss, M. J., Jenkins, D., Barnett, E. A., & Wachen, J. (2012). *Structure in community college career-technical programs: A qualitative analysis* (CCRC Working Paper No. 50). New York, NY: Columbia University, Teachers College, Community College Research Center.

van Ours, J. C. (2004). The locking-in effect of subsidized jobs. *Journal of Comparative Economics, 32*(1), 37–55. doi:10.1016/j.jce.2003.10.002

Appendix

Table A.1: Most Popular Certificate Programs in North Carolina and Virginia

	North Carolina		Virginia	
Rank	**Program Name**	**N**	**Program Name**	**N**
Long-term certificates				
1	Practical nursing	430	General education	3206
2	Diploma in arts	314	Practical nursing	352
3	Dental assisting	295	Medical office administration	106
4	Cosmetology	256	Medical assisting	92
5	Air condit., heat., & refrig. Tech	232	Law enforcement	80
6	Medical assisting	178	Health sciences	76
7	Electrical/electronics technology	145	Air conditioning & refrigeration	69
8	Welding technology	144	Welding	67
9	Surgical technology	137	Early childhood development	63
10	Autobody repair	128	Electricity	51
11	Pharmacy technology	102	Clerical studies	49
12	Machining technology	85	Dental assisting	45
13	Therapeutic massage	70	Machine shop	43
14	Medical office administration	64	Automotive analysis & repair	42
15	Carpentry	59	Construction technology	34
	Missing/other	983	Missing/other	792
Short-term certificates				
1	Basic law enforcement training	508	Management	149
2	Cosmetology	447	Nursing	119
3	Early childhood associate	351	Early childhood development	98
4	Air condit., heat., & refrig. Tech	346	Practical nursing	97
5	Medical office administration	308	Truck driving	75
6	Truck driver training	264	Emergency medical services	74
7	Electrical/electronics technology	259	Welding	58
8	Business administration	228	Information systems technology	44
9	Welding technology	227	Medical laboratory technology	38
10	Phlebotomy	212	Automotive	35
11	Information systems	182	Health sciences	34
12	Office systems technology	167	Air conditioning & refrigeration	28
13	Esthetics technology	156	Respiratory therapy	28
14	Automotive systems technology	148	American sign language	27
15	Horticulture technology	145	Law enforcement	24
	Missing/other	2851	Missing/other	2185

Notes: This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia.

Table A.2: Individual Fixed Effects Estimates With Progressively More Controls

	North Carolina				Virginia			
	M1	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
Long-term certificate	1,119***	931***	1,043***	857***	398***	100***	89***	346***
	(60)	(59)	(59)	(60)	(15)	(15)	(15)	(22)
Short-term certificate	367***	203***	411***	293***	637***	201***	280***	222***
	(43)	(43)	(43)	(45)	(19)	(19)	(19)	(23)
Individual fixed effects	X	X	X	X	X	X	X	X
Linear time trend		X	X	X		X	X	X
Quadratic time trend		X	X	X		X	X	X
Ashenfelter dip		X	X	X		X	X	X
Quarter fixed effects		X	X	X		X	X	X
Demographic variables interacted with time trend			X	X			X	X
Credits enrolled in CC, dummy for enrolled elsewhere				X				X
Interaction between credentials and pre-exit status				X				X
R-squared	0.50	0.50	0.51	0.51	0.53	0.54	0.54	0.54

Note. This table is based on first-time students in the state's community colleges during the 2006–2007 and 2007–2008 academic years in North Carolina and the 2006–2007, 2007–2008, and 2008–2009 years in Virginia.