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Noncredit Workforce Training, Industry Credentials, and Labor Market Outcomes

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Many public workforce training programs lead to industry-recognized, third-party awarded credentials, but little research has been conducted on the economic benefits of these credentials in the labor market. This paper provides quasi-experimental evidence on the labor market returns to industry-recognized credentials connected to community college workforce noncredit training programs. Based on novel data that includes approximately 24,000 working-age adults enrolled in noncredit workforce training programs at the Virginia Community College System, we employ a comparative individual-level fixed effects model to estimate earnings premia net of fixed attributes and earnings time-trends. Our results indicate that earning an industry-recognized credential on average increases quarterly earnings by approximately $1,000 and the probability of being employed by 2.4 percentage points, although there is substantial heterogeneity in economic return across different program fields. Back-of-the-envelope calculations suggest that the earnings gains associated with the industry credential obtained through the noncredit workforce training would exceed program costs in just over half a year on average.

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I. Introduction

With rapid technological advances, the labor market increasingly exhibits a need for more frequent, ongoing skill development (Carnevale, Smith, & Strohl, 2010; Deming & Noray, 2020). Employers in many fields encounter difficulties finding adequately trained workers to satisfy their labor demand, while many workers remain un- or underemployed. The pandemic has only exacerbated these gaps, with eleven million job openings and six million unemployed workers as of the end of January 2023 (US Bureau of Labor Statistics, 2023). Accordingly, the federal and state governments increasingly prioritize workforce training in their policy agendas. This priority is reflected in the Biden Administration's Talent Pipeline Challenge, which supports partnerships between employers and training providers to build the workforce pipeline, and in the increasing number of states that have enacted legislation to fund targeted workforce development efforts, many of which lead to industry-recognized credentials (Education Commission of the States, 2020).

Training programs that lead to industry-recognized credentials, such as industry certifications or licenses, have been proposed as a strategy to create better alignment between postsecondary education and labor market demand (Deming et al., 2023). These credentials are awarded by third-party organizations or professional associations (such as the American Association of Medical Assistants) for demonstration of competencies specific to a particular occupation. Unlike college-awarded certificates that are typically based on successful completion of a series of required college courses on a variety of topics, industry credentials are heavily focused on skills aligned with standards developed or endorsed by employers or industry associations, and thus signal that an individual possesses a set of skills necessary for a particular position. According to a recent report (Deming et al., 2023), industry-recognized credentials are the most prevalent type of credential associated with training programs eligible for funding under Workforce Innovation and Opportunity Act (WIOA), where over 21,000 programs lead to an industry credential.[1]

As public, open-access institutions, community colleges are at the forefront of providing training that leads to an industry credential, often through noncredit-bearing training programs. These programs are highly focused on skill training that is designed to lead to a specific occupation within a short span of time. Compared with workforce training that community colleges offer for college credit (e.g., leading to a college-issued certificate or degree), noncredit workforce programs are typically shorter in duration and tend to have lower costs. In addition, unlike credit-bearing programs with specific admission requirements, such as a high school diploma or equivalent, noncredit programs tend to have more flexible

[1]While the industry-recognized credential is the most common type of WIOA-eligible program, approximately 12,000 lead to an associate degree and an additional 10,000 lead to a community-college issued certificate.

enrollment criteria, expanding access to postsecondary education among a wider range of learners from diverse backgrounds (Grubb et al., 2003; Lustig, 2005; Xu & Ran, 2020). Furthermore, noncredit programs often operate with greater agility, as they tend to have more flexible accreditation and oversight requirements compared to credit-bearing programs, allowing them to quickly adapt to evolving workforce demands and employer needs. (Arena, 2013; Frentzos, 2005; Grubb, Badway, & Bell, 2003; Harmon & MacAllum, 2003; Hickman & Quinley, 1997; Van Noy & Jacobs, 2009; Waks, 2004). Noncredit training programs are moreover very popular among students: In the academic year of 2020-2021, approximately 4.1 million students enrolled in community college noncredit programs nationally, which represents 40 percent of total enrollment at two-year institutions (American Association of Community Colleges, 2023). Two-thirds of noncredit student enrollments are explicitly focused on workforce training (e.g. D'Amico at al., 2022; D'Amico et al., 2014; Xu et al., 2022).

Despite the importance and popularity of noncredit workforce training programs, however, there has been very little research on the composition of program participants; program success and industry credential attainment rates; or the economic returns to industry credentials associated with these programs.[2] We address this gap in the literature by examining noncredit workforce training programs offered within the Virginia Community College System (VCCS). In 2016, the Virginia legislature launched an innovative pay-for-performance funding mechanism to expand participation in community college noncredit workforce training programs that lead to an industry-recognized credential in one of several high-demand fields identified by the Virginia Workforce Board. Known in Virginia as "FastForward" programs, these workforce training programs offer short-duration training in a variety of fields, typically run between 6-12 weeks, and further lead to an industry-recognized credential if students successfully pass a credential-specific exam.

One important implication of the state funding mechanism is a mandate for systematic, statewide collection of student-level data on program enrollment, completion, industry credential attainment, and labor market data for all individuals enrolled in FastForward since its launch in 2016.[3] We draw on this unique administrative data, which includes approximately 36,000 students enrolled in FastForward between 2016 and 2021, and further link it to employment and earnings data from the Virginia Economic Commission (VEC). To examine the labor market returns to earning an industry credential, we exploit the longitudinal nature of the VEC data, which contain quarterly earnings for all VCCS students before, during, and after their FastForward program participation, and use a comparative individual student fixed effects model (CIFE) to estimate the labor market im-

[2] A primary barrier to this research has been that noncredit programs and subsequent industry credential attainment are typically not included in state and national postsecondary datasets (D'Amico et al., 2017)

[3] Eligible institutions must provide student-level data to the State Council of Higher Education for Virginia (SCHEV) in order to receive funding.

pact of receiving an industry credential after completing a FastForward program on both employment and quarterly earnings.

Our analysis provides several main insights into the labor market returns to industry-recognized credentials. First, we find that earning an industry-recognized credential on average increases conditional quarterly earnings by approximately $1,000. To contextualize this finding, given that the average quarterly earnings of FastForward enrollees in the quarters prior to FastForward enrollment is $8,401, the estimated impact represents around an 11.5 percent increase in quarterly earnings. In addition, industry credentials also increase the probability of being employed by 2.4 percentage points on average. Second, we find substantial heterogeneity in economic returns across different fields, where credentials in the field of "Transportation and Materials Moving" (e.g., "Commercial Driver's License") and "Precision Production" (e.g., training in gas metal arc welding) are associated with the highest returns. Third, credential-earners are significantly more likely to change industries after earning the credential, entering higher-paying industries that are also related to their training program. This finding underscores the potential of promoting industry-recognized credentials through programs like FastForward to increase workforce participation in high-demand sectors. Finally, back-of-the-envelope calculations suggest that earning an industry certificate through the FastForward program is a more cost-effective approach to generating positive labor market returns than most other rigorously-evaluated sub-baccalaureate programs. Specifically, we estimate that the earnings gains associated with the industry credential obtained through FastForward programs would exceed program costs in just over half a year on average.

In addition to these main findings, our results also unveil several insights into the characteristics of noncredit workforce training programs like FastForward that lead to such credentials. First, we find that FastForward programs enroll a substantially different segment of the population, including student groups that are underrepresented in traditional higher education. Specifically, 61 percent of FastForward enrollees have no prior or subsequent enrollment in any credit-bearing programs. Compared to students enrolled in short-duration credit-bearing certificate programs at VCCS, FastForward enrollees are more likely to be Black (34 percent versus 24 percent), males (59 percent versus 39 percent), and older students (76 percent aged 25+ versus 51 percent). In addition, we find very high rates of program completion and credential attainment in FastForward programs: more than 90 percent of the students in the sample successfully completed their FastForward program, and 68 percent of the sample obtained an industry credential. These completion and attainment rates are much higher than we typically observe for VCCS credit-bearing workforce training programs that lead to college-issued short-term certificates.[4]

[4]To put the program completion and industry credential attainment into context, among students enrolled in a short-term certificate credit-bearing program between 2018 fall and 2019 spring at VCCS, 31% earn a college-awarded certificate within two years (200% of normal time).

To the best of our knowledge, our paper is the first to estimate the returns to industry-recognized credentials connected to community college workforce noncredit training programs, a sector that attracts a large proportion of postsecondary enrollment. While there has been substantial work on the economic returns to non-degree credentials (e.g. Carruthers & Sanford, 2022; Darolia et al., 2023; Dynarski, Jacob, & Kreisman, 2017; Jacobson et al., 2005; Jepsen, Troske, & Coomes, 2014; Meyer, Bird, & Castleman, 2020; Stevens, Kurlaender, & Grosz, 2019; Xu & Trimble, 2016), this prior research has exclusively focused on college-awarded credentials through credit-bearing programs, such as college-issued certificates and diplomas. Carruthers & Sanford (2022) provides evidence on the economic returns to certificates and diplomas awarded by noncredit programs through public technology centers, but these non-degree technology centers only enroll less than one percent of students in postsecondary education. Therefore, the evidence we generate on the economic returns to industry-recognized credentials earned through noncredit workforce training programs is both novel and policy-relevant, given how closely these programs align with employer needs, their popularity among students, the low barriers to entry and flexible design. Moreover, by virtue of attracting and enrolling a much different segment of the population, our results show that noncredit workforce training programs may serve as an important contributor to economic mobility for groups increasingly underrepresented in traditional higher education.

II. Background: FastForward Programs in Virginia

A. Unique pay-for-performance funding model

Community colleges in Virginia have a long-standing commitment to providing noncredit workforce opportunities to their students. However, prior to 2016, limited statewide guidance about the quality and goals of noncredit programs was available, and many programs lacked the validation of third party industry credentials. In response to the increasing demand for skilled workers to fill available and emerging jobs in the Commonwealth, the General Assembly passed House Bill 66 during the 2016 session to establish the New Economy Workforce Grant Program (WCG) with the goal of providing a pay-for-performance model for funding noncredit works training through "FastForward programs" that lead to an industry-recognized credential in a high-demand field in the Commonwealth. The Virginia Board for Workforce Development identifies the high-demand fields on an annual basis based on criteria that consider the state's economic development strategy, the degree to which an occupation requires advanced skills as measured by entry-level education, and assessment of annual statewide job openings, with a focus on occupations having more than 50 annual openings. Example occupational fields identified based on these criteria include construction, weld-

ing, certified medical assistant, and commercial driving.[5] Eligible institutions for the WCG — including each of the 23 colleges within the Virginia Community College System – develop or align noncredit workforce training programs to meet the high-demand field criteria and gain approval from their respective boards.

The unique pay-for-performance model for funding FastForward programs, the first of its kind, involves cost sharing among the state, the students, and the training institution, where the specific amount of funding provided by the state is based on student performance. Specifically, upon enrolling, eligible students are required to pay only one-third of the total program cost.[6] If a student successfully completes the program by earning a "Satisfactory" grade, the state and the training institution (the specific community college offering the program) share the remaining costs evenly. If the student does not complete the program within 30 days of the course end date, the student is required to pay another one-third of the total cost to the college whereas the state will pay zero for this training. If the student not only completes the program but also earns the industry-recognized credential within six months of completing the program, the state will fully reimburse the college for the remaining program costs. As a result, this funding mechanism provides significant financial incentives to both the student and the college for the student to complete the program; it also directly incentivizes the college to promote credential attainment.

The unique funding support by the state has made FastForward programs reasonably affordable options for Virginia residents who want to upgrade their skills or acquire new ones. In the fiscal year of 2022, the average tuition for one-third of the training cost was $802, and capped at $1,500. In addition, while the FastForward programs are not eligible for federal financial aid, such as the Pell grant, students enrolled in FastForward may receive additional funding from other state sources, depending on specific eligibility criteria. For example, if a student enrolled in a FastForward program is financially unable to pay any tuition and has a household income no higher than 200 percent of the national federal poverty level, they may qualify for Workforce Financial Assistance (FANTIC) that will cover one-third of the cost of the program if they meet the domicile and other eligibility criteria, therefore exempting the student fully from payment for the training. These financial supports further reduce the cost for FastForward training, making

[5]See Appendix Table 1 for the complete list of high-demand occupational fields and their associated enrollment at VCCS in the fiscal year of 2022. Detailed information about specific FastForward programs offered for various occupational fields at each training institution can be found on the Virginia Career Works website: https://virginiacareerworks.com/workforce-credential-grant/.

[6]To be eligible for tuition assistance from WCG, students were required to meet specific criteria, including being at least 18 years old, possessing a valid social security number, and establishing Virginia domicile status. It is important to note that most FastForward courses also enrolled students who did not meet the eligibility criteria outlined in the FastForward pay-for-performance model. Among all of the students enrolled in FastForward programs, approximately 20 percent did not receive any WCG tuition assistance. Similarly, college staff responsible for overseeing FastForward programs also typically administered other noncredit training programs that did not align with the FastForward criteria. In this context, FastForward was not operated as an independent program with specialized staff but rather as a means to classify and present a collection of sought-after training programs in high-demand fields, offering a distinct funding model for tuition within this framework.

the programs even more accessible.

B. Training duration and alignment with the local labor market

FastForward programs are highly focused on job training and incorporate a combination of classroom instruction and hands-on skill demonstrations. They are designed to be short-term, typically lasting between 6 and 12 weeks. Thus, compared with workforce training offered through credit-bearing programs at VCCS that typically require one year (for short-term certificate programs) to two years of full-time enrollment (for associate degree or diploma programs) to complete, FastForward programs tend to be substantially shorter in duration and in the number of contact hours required. For example, two of the most popular FastForward programs are Commercial Driver's License and Nurse Aid training, which respectively consist of around 168 and 148 contact hours. To put this into context, a short-term credit-bearing certificate program that requires two semesters of full-time enrollment would typically involve approximately 300 contact hours.[7]

A critical feature of FastForward programs is that each program is designed to prepare students to earn a specific workforce credential that is competency-based, industry-recognized, and awarded by a third-party organization.[8] For example, one of the most popular FastForward programs, Nurse Aide, meets the Virginia Board of Nursing's requirement for Nurse Aide Training. Graduating students from the Nurse Aide program are eligible to take the national Nurse Aide Assessment Program (NNAAP) exam required by the Virginia Board of Nursing. Upon passing the NNAAP exam, students are awarded the Certified Nursing Assistant (CNA) credential, which certifies them as qualified nursing assistants and demonstrates their ability to provide quality care to patients. In some programs, the examination is included as part of the program, as the instructors are certified to conduct the exam.[9]

Some of the credentials are also stackable on skills and connect to additional possible training and credential pathways in credit-bearing programs. For example, a student might complete a FastForward Manufacturing Technician program, and later enroll in a credit-bearing program to pursue a short-term certificate in

[7]A subset of workforce training programs are offered through both VCCS's FastForward and credit-bearing sides, which prepare students for the same or similar third-party industry-recognized credentials. For example, both the credit-bearing Nurse Aide Career Studies Certificate Program and the Fastforward Nurse Aide Program prepare students for the Nurse Aide Competency Evaluation and Exams. In a separate work, we will investigate the relative impact of pursuing the training through the credit-bearing versus noncredit programs.

[8]Considering that these credentials are provided by organizations outside of the traditional educational system, we refer to them as "industry credentials" in this paper to distinguish it from college credentials (such as certificates or college degrees) that are awarded by a postsecondary institution.

[9]There are also variations among programs in access to the credentialing database depending on the awarding entity. In many cases, though, the student must share proof of passing the examination from a third party examiner with the college after the program is completed. Colleges are generally diligent in working with the student to get the proof since student credential attainment is directly related to the level of the WCG funding for training institutions.

Mechanical Maintenance and further pursue an Associate degree in Technical Studies.[10]

FastForward programs in Virginia have a clear and explicit focus on engaging local employers in collaborative efforts aimed at training credentialed workers to meet the Commonwealth's workforce demands. These collaborations encompass a diverse array of strategies, all aiming to ensure that the training provided aligns with industry needs and facilitates a seamless transition from training to employment. Several approaches illustrate these collaborative efforts that some colleges pursue, such as customized training (where colleges work closely with local businesses to design training that precisely meets the specific needs of a company), guaranteed interviews (where colleges collaborate with a local business to guarantee job interviews for students who have successfully completed relevant training and industry certifications), and work-based learning opportunities (where employers offer work-based learning experiences to program participants).

C. Rapid growth of program offering and enrollment

Descriptive statistics included in state reports indicate that VCCS noncredit program offerings and participation have substantially expanded since the introduction of FastForward programs (State Council for Higher Education for Virginia, 2023): the state funding support to FastForward programs increased steadily from $5 million in the fiscal year of 2017 to $13.5 million in fiscal year 2022. In the most recent fiscal year of 2022, more than 11,000 individuals were enrolled in training, which represents an 28% increase from the fiscal year of 2021. Although VCCS colleges offer hundreds of FastForward programs, the majority of the enrollments (69%) were in 10 programs, which concentrate in six occupational fields, including Transportation, Health Care, Welding, Construction, Information Technology, and Mechanics. Most of these programs are offered by multiple colleges at VCCS. Using our analysis sample, Appendix Table 2 lists the names of these top 10 FastForward programs, and provides information on the total enrollment in each of the programs during the period of the study, and average program completion rates and industry credential attainment rates. According to the most recent report by the State Council for Higher Education for Virginia (2023), the enrollment in these programs seem to address but not exceed the annual job openings associated with each field based on calculations from the Virginia Employment Commission's short-term 2021-2023 projections, implying that there is room for further growth in enrollment in even the most popular FastForward programs.

[10]More detailed information about sample stackable credentials and career pathways can be found at Virginia's FastForward website: https://fastforwardva.org/career-mapping/sample-career-pathway-in-manufacturing/

III. Data and Sample

A. Data sources

An important implication of HB 66 is that it led to the systematic, statewide collection of student-level data on FastForward program enrollment, program completion, industry credential attainment, and labor market performance. This data collection is important for verifying enrollment and program completion directly related to the WCG funding model as well as to understand the impact of FastForward training on the state's workforce development landscape. As a result, VCCS established a comprehensive data system for FastForward programs that includes four primary sources of data:

VCCS administrative data on FastForward programs. This data includes student-level FastForward enrollment and completion records, beginning in its inception in fall 2016. This data also includes basic demographic information for FastForward students, and whether and when a student completed third-party industry-recognized credentials.[11]

VCCS administrative data from the credit-bearing side. This data includes students' enrollment records, transcript records, and degree attainment records from VCCS's credit-bearing side starting in 2004. By linking in this data, we observe if a FastForward student enrolled in any of VCCS's credit-bearing programs either before or after their FastForward enrollment or earned any credit-bearing degrees or certificates from the credit-bearing side.

National Student Clearinghouse (NSC) data. The college administrative data are matched with enrollment and degree attainment data from the National Clearinghouse, which allows us to track the enrollment of FastForward students at participating higher education institutions outside of the VCCS starting in 2004.

Individual quarterly employment and earnings data provided by the Virginia Employment Commission (VEC), starting in the first quarter of 2005 though the first quarter of 2022. The VEC data, commonly referred to as UI data, encompasses information reported by all employers operating within the Commonwealth of Virginia, as mandated by reporting requirements. However, there are two primary sources of missing earnings data within this dataset. First, a few categories of employment are not included in the UI data, including federal employment, self-employment, and individuals without a social security number (Foote & Stange, 2022). While approximately 4.5 percent of employees are estimated to be federal employees in Virginia (Virginia Employment Commission),[12] this number is likely to be substantially lower among students enrolled in FastForward programs

[11] Note that VCCS offers noncredit programs that are not FastForward programs; these programs are typically less focused on skilled workforce training. We do not observe enrollment in these non-FastForward programs in our data.Similarly, we do not observe any noncredit enrollment prior to the start of FastForward.

[12] Information is retrieved from https://virginiaworks.com/_docs/Publications/Press-Releases-and-Reports/PDF/2019-Benchmark-Report.pdf

which have a strong focus on skill development tailored for regional employers and where the majority of enrollees do not possess a bachelor's degree. Additionally, the issue of missing social security numbers is expected to be limited among FastForward enrollees, as eligibility for WCG tuition assistance requires a valid social security number. Finally, using different sources of earnings data, Foote & Stange (2022) found that self-employment income does not meaningfully differ with credential completion at either two-year or four-year colleges. Accordingly, we expect that the exclusion of self-employment income has minimal impact on our estimates.

A second source of missingness arises from interstate mobility: Since we are only able to retrieve UI data in the Commonwealth of Virginia, we cannot observe students' employment in other states. Nevertheless, studies comparing results based on state-specific UI data and national earnings data plus self-employment income indicate that bias is less pronounced when estimating economic returns for sub-baccalaureate credentials than when estimating economic returns to baccalaureate degrees from four-year institutions. Specifically, the bias for short-term certificates is close to zero and insignificant (Foote & Stange, 2022). The potential issue of missing earnings due to inter-state mobility is even less concerning for FastForward enrollees, given the program's explicit emphasis on the local labor market.

B. Sample and key measures

We focus our analysis on students enrolled in at least one FastForward program from its inception in the 2017 fiscal year (July 2016 to June 2017) until the 2021 fiscal year cohort, for a total sample of 35,910 unique students. Of these FastForward participants, 11% do not have any employment records in the UI data between the first quarter of 2004 and the first quarter of 2022 and are thus removed from our analytic sample. We further restrict our sample to students who began their FastForward enrollment between ages 20 and 50, so that our analysis is focused on working-age adults (this restriction further reduces the sample by 22%). Finally, we remove the students who were enrolled in FastForward as of the first quarter of 2022 because we cannot observe post-program employment and earnings for these individuals (3%). These restrictions lead to a final analytic sample of 23,901 students.

Key Treatment Measures. In our analysis, we define as "treated" by FastForward students who earn the industry credential associated with their program of study. As shown in Table 1, 68 percent of FastForward students in our analytic sample earn a credential. We define our comparison group as students who either: (1) completed the FastForward program but failed to earn the industry credential (23 percent of the analytic sample); or (2) enrolled in but did not complete the

FastForward program (8 percent of the analytic sample).[13] Approximately 13 percent of FastForward students in our analytic sample enrolled in more than one FastForward program during the window of our study. In these cases, we include the student in the "treated" group if the student earned at least one industry credential, and use the information related to the student's most recently enrolled FastForward program in which they earned a credential.

Key Outcome Measures. The two primary labor market outcomes we consider are employment and conditional quarterly earnings. For employment, we create an indicator equal to one if the student had any observed earnings in a particular quarter. For conditional quarterly earnings, we sum all of a student's earnings from all employers within a given quarter (measured in real 2022 dollars), and set the measure to be missing if the student had no observable employment during that quarter. Within a specific individual, we capped quarterly earnings at a ceiling of $73,510, because individuals with higher quarterly earnings are outliers representing less than 0.1% of the sample.[14] Following the recent literature that uses UI data (e.g. Dynarski et al., 2017), we bottom-code any quarterly earnings record of $10 or less to be missing since these records are likely misreported.

To construct each individual's pre-FastForward labor market measures, we drop all quarters that occur prior to an individual's first observed non-zero earning in the VEC data and include a maximum of 10 years of employment records prior to FastForward entry. Considering that most individuals are not active in the labor market below age 18, we impose age restrictions and drop quarters in which an individual was younger than 18. We also exclude quarters during a student's FastForward spell, as our analysis focuses on comparing quarterly records before enrollment with records after exit. Our final analytic sample consists of 708,746 earnings records (77% of which correspond to non-zero earnings records) for a total of 23,901 students.

C. Summary statistics

Leveraging the various sources of information available, we first delineate key facts about the FastForward training programs in Virginia, including the characteristics of students, their enrollment patterns between the noncredit and credit-bearing sectors, program completion and industry credential attainment, and labor market performance. Table 1 presents these characteristics for all FastForward enrollees between July 2016 until June 2021 (N=35,910, column 1), as well as the students included in our analytic sample (N=23,901, column 2).

Panel A in Table 1 shows student demographic characteristics. Overall, the

[13] A small proportion of students earned a credential without completing the FastForward program. These individuals only constitute less than one percent of credential earners. We still include these students in the "credential earners" category.

[14] In a separate robustness check, we also excluded quarterly earnings records that are higher than $73,510. This drops 476 earnings records and 0 students. The results ($976.7 with a standard error of 90.2) are almost identical to those presented in Table 2 ($964.5 with a standard error of 90.2).

characteristics of the analytic sample are fairly comparable to those of the population of FastForward enrollees. Fifty-eight percent of FastForward enrollees in the sample are males. White students consist of around half of the enrollment, followed by Black students for over one-third of the enrollment. The average age of the sample is 33 years old, with more than three quarters of the students aged 25 + at the time of enrollment. To contextualize the demographic characteristics of the FastForward students, Appendix Table 3 presents demographic characteristics among VCCS students enrolled in short-duration, credit-bearing certificate programs between 2016 and 2021. These programs, such as the certificate program in "Advanced Medical Coder" or in "Office Professional Technologies" (which require 20 credits and 16 credits, respectively), also heavily focus on workforce training and typically take one year or less to complete. A comparison between the two tables indicate that FastForward programs seem to attract and enroll a different segment of the population than credit-bearing programs at community colleges. Specifically, compared with credit-bearing certificate programs, FastForward enrolls a substantially higher share of Black students, male students, and older students.

Panel B describes students' enrollment patterns within FastForward programs, as well as individuals' enrollment in the credit-bearing sector prior to and after FastForward enrollment. The vast majority of students (81% of the analytic sample) enrolled in only one FastForward program, with average enrollment duration of 1.5 quarters. To capture students' enrollment between FastForward and credit-bearing programs, we break down students into four distinct categories: (1) FastForward students who never enrolled in any credit-bearing program either prior to or after their enrollment in FastForward programs; (2) FastForward students whose initial enrollment was in a FastForward program and who then enrolled in subsequent credit bearing programs either within or outside of VCCS; (3) FastForward students with a history of enrollment in the credit sector and did not enroll in credit-bearing courses after FastForward enrollment; and (4) FastForward students who enrolled in the credit sector both prior to and after their FastForward enrollment. To provide a longer enrollment tracking period after FastForward program enrollment, we restrict our descriptive analyses on "credit enrollments" in Panel B to only the earliest two cohorts of students in our sample (2016 and 2017 cohorts, N=8,633).

Our analysis demonstrates that the majority of FastForward students — 61 percent of all FastForward enrollees and 54 percent of the analytic sample — have no prior or subsequent enrollment in the credit-bearing sector. While 42 percent of the students in our analytic sample had prior credit-bearing enrollment, less than 20 percent of those students earned a degree or certificate from this prior enrollment. This suggests that FastForward programs may provide a pathway to training and industry credentials for students who were not successful on the credit-bearing side. However, very few FastForward enrollees — less than 12 percent in both the population and in our analytic sample — pursue

subsequent training in the credit-bearing sector, and among these students, only one fifth eventually received any credit-bearing credentials (including Bachelor's degree, Associate, Diploma, or Certificate) by summer 2022. These patterns suggest that there is little student flow from FastForward to additional credit-bearing training despite increasing state efforts to grow the share of workers that "stack" credentials to maintain job-relevant skills in a rapidly transforming labor market (Meyer et al., 2022).

Panel C summarizes the academic outcomes of students enrolled in FastForward programs, including FastForward completion and industry credential attainment. Overall, FastForward programs have an extremely high program completion rate, where 89 percent of all FastForward enrollees and 92 percent of the enrollments in our analytic sample earned a letter grade of "satisfactory." Sixty-five percent of all enrollees and 68 percent of students in our analytic sample further obtained an industry credential. Yet, underlying the overall high industry credential attainment rates is important variation between programs in credentialing. As shown in Appendix Table 2, some highly enrolled programs, like Clinical Medical Assistant, have high industry credential attainment rates (82.5 percent). However, other highly enrolled programs, like Nurse Aide, have much lower attainment rates (51.3 percent). CompTIA A+ has the lowest credential attainment rate at 23.4 percent. While several factors can contribute to the variation in credentialing rates across programs, one potential explanation is that the labor market value of industry credentials may vary depending on the specific fields of occupation, which can result in different incentives for students to complete a credential after their training. We delve deeper into this aspect in Section V.C., where we provide a more detailed exploration of how the labor market values industry credentials in various occupational fields.

IV. Empirical Framework

Our primary aim is to identify the labor market returns to earning an industry credential for students enrolled in the FastForward program.[15] The major challenge to identification is that some individual characteristics, such as motivation and ability, may influence both credential attainment and earnings.[16] To address potential omitted variables bias, we employ a comparative individual fixed effects (CIFE) model that compares changes in an individual's quarterly earnings before versus after receiving an industry-recognized credential relative to changes

[15]Ideally, we would also want to estimate the economic returns to completing the FastFoward program. However, due to the extremely high program completion rate (92 percent of the analytic sample), the comparison group (individuals who did not complete the FastForward training) consists of very few observations, which results in less precision in estimating the treatment effect and also leads to greater difficulties to justify the parallel trends assumption.

[16]Appendix Table 4 presents estimates of the probability of obtaining an industry credential based on available student demographic and pre-enrollment earnings records. The results indicate that white, male, students enrolled in later cohorts, and individuals with higher average quarterly earnings prior to enrolling in FastForward are more likely to receive an industry credential.

for individuals who participated in a FastForward program but did not earn a credential. The comparative individual fixed effects (CIFE) model has been commonly used in the job training literature (Dyke et al., 2006; Jacobson et al., 2005) and has been adapted to examine labor market returns to postsecondary credentials in the last decade (e.g. Meyer, Bird, & Castleman, 2020; Bahr, et al., 2015; Cellini & Chaudhary, 2011; Dadgar & Trimble, 2015; Jepsen, Troske, & Coomes, 2014; Stevens, Kurlaender, & Grosz, 2019; Xu & Trimble, 2016). This approach effectively controls for student characteristics (either observed or unobserved) that remain constant within a student across time, as well as economic shocks that influence earnings trajectories in a similar manner for all individuals.

We specifically estimate the following regression model:

$$
\begin{aligned}
(1) \qquad \text{Outcome}_{iq} = {} & \beta_1 \text{PostFF}_{iq} \times \text{EverEarnedCredential}_i \\
& + \beta_2 \text{CurrentlyEnrolled}_{iq} + \beta_3 \text{Age}_{iq} + \beta_4 \text{Age}_{iq}^2 \\
& + \beta_5 \text{HighestCreditAward}_{iq} + \text{IndividualFE}_i \\
& + \text{QuarterFE}_q + \text{IndividualTimeTrend}_{iq} \\
& + \sum_{q=-j}^{k} \gamma_q \text{PreFF}_{iq} + \sum_{q=m}^{n} \gamma_q \text{PostFF}_{iq} + \epsilon_{iq}
\end{aligned}
$$

Where $\text{Outcome}_{\text{iq}}$ is the labor market outcome for individual i in quarter q. We consider two outcomes: (1) indicator for any employment, and (2) quarterly earnings conditional on employment, measured in real wages (2022$). $\text{PostFF}_{\text{iq}}$ is an indicator equal to one for the quarters after an individual earned a FastForward credential (or after FastForward exit for those who never earned a credential), $\text{EverEarnedCredential}_{\text{i}}$ is equal to one for all individuals i who ever earned their noncredit credential, and $\hat{\beta}_1$ is the estimate of the impact of credential attainment on the employment outcome. $\text{CurrentlyEnrolled}_{\text{iq}}$ is an indicator equal to one for all quarters during which the individual is enrolled in a credit-bearing program (either VCCS or a non-VCCS institution). Note that quarters when an individual is enrolled in FastForward are excluded from the sample. We also control for an individual's age and highest level of credit-bearing credential with $\text{HighestCreditAward}_{\text{iq}}$, which is a set of indicators equal to one for all quarters after the individual earned a certificate, associate degree, bachelor's degree, or graduate degree. Finally, we include individual fixed effects, temporal quarter fixed effects, individual-specific time trends, and quarter-level fixed effects relative to the students entry (time k) and exit (time m) from FastForward (i.e. indicator for one quarter prior to FF enrollment; indicator for five quarters after FF exit). We cluster robust standard errors at the individual-level.

As shown above, 21 percent of FastForward students enrolled in more than one FastForward program during the window of our study, and 13 percent of students

completed more than one credential. The majority of students who enrolled in multiple programs had a gap between enrollment spells of one quarter or less (72 percent). Therefore, for all students, we define their FastForward enrollment period using the beginning date of their first FastForward enrollment and the end date of their last FastForward enrollment. We define $\text{EverEarnedCredential}_{\text{i}}$ based on whether the student earned at least one credential, but not necessarily having earned a credential in every FastForward program they enrolled in.

A key identifying assumption of a CIFE model is the parallel trends of the "treatment" (i.e. credential earners) and comparison group. We therefore produce event studies, presented below in Figure 1, to show that FastForward credential earners had similar earnings trends in the quarters leading up to FastForward participation as FastForward participants who did not earn a credential. To generate the event studies we estimate a version of the above regression model, where we remove $\text{EarnedCredential}_{\text{iq}}$ and include an interaction between the quarterly fixed effects and whether the individual ever earned a noncredit credential:

$$
\begin{aligned}
(2) \quad \text{Outcome}_{iq} = & \sum_{q=-j}^{k} (\gamma_{q1}\text{PreFF}_q + \delta_{q2}\text{PreFF}_q \times \text{EverEarnedCredential}_i) \\
& + \sum_{q=m}^{n} (\gamma_{q1}\text{PostFF}_q + \delta_{q2}\text{PostFF}_q \times \text{EverEarnedCredential}_i) \\
& + \beta_2 \text{CurrentlyEnrolled}_{iq} + \beta_3 \text{Age}_{iq} + \beta_4 \text{Age}_{iq}^2 \\
& + \beta_5 \text{HighestCreditAward}_{iq} + \text{IndividualFE}_i + \text{QuarterFE}_q + \\
& + \text{IndividualTimeTrend}_{iq} + \epsilon_{iq}
\end{aligned}
$$

We then plot the values of $\sum_{q=-j}^{k} \delta_{q2}$ and $\sum_{q=m}^{n} \delta_{q2}$, relative to $\delta_{k2} = 0$ (such that q = k is the term before earning a FF-related credential or exiting FF, and q = m is the first term following the credential attainment or FF exit). For the event study, we center each individual's quarterly panel around their FastForward entry and exit. "Last" is the last quarter before an individual begins the FastForward program. This is the reference quarter for the earnings estimates. "First" is the first quarter after the individual leaves FastForward.

V. Results

A. Event study analysis

Figure 1 shows an event study plot for the analytic sample. The relevant section of the plot to test parallel trends is to the left of the first vertical line, which represents the last period before FastForward enrollment. We also use the event study to graphically explore potential impacts of credential attainment; this is

represented by the section of the plot to the right of the second vertical line, which is the first quarter after FastForward exit. The smaller vertical lines over each quarter are the confidence intervals, using robust standard errors, for the regression estimate of the difference in earnings or employment between credential earners and the comparison group at each time point compared with their difference in the reference period. Accordingly, the point estimates describe the extent to which the post-FastForward earnings gaps between the credential earners and those who did not earn a credential are different from their earnings gaps in the last pre-FastForward quarter.

The results indicate that the estimated coefficients of the 20 pre-program quarters are generally small and statistically indistinguishable from zero. The result from a joint F test on all pre-FF coefficients does not reach statistical significance (p=0.52). This pattern is consistent with the parallel trends assumption: In the absence of the industry-recognized credential, the average quarterly earnings for the two groups of students would likely have evolved in parallel.[17]

In contrast, in the quarters immediately following FastForward exit, we observe a substantial positive increase in average quarterly earnings for credential earners relative to individuals who did not earn a credential. The estimated earnings premium rises through the first two quarters following FastForward exit, and then remains relatively stable for the subsequent two years. This likely reflects the fact that some individuals take one or more quarters after their FastForward exit to obtain an industry credential.

B. CIFE estimates of labor market impacts

In view of the parallel trends and promising graphical evidence on positive impacts of the credential on earnings, we conduct our formal analysis on two outcomes using the CIFE model: earnings conditional on employment, and whether an individual was employed in a given quarter. The results are shown below in Table 2. In addition to analysis on our primary analytic sample (**sample A**, presented in column 1), we further conduct robustness checks on three additional samples to examine the extent to which the results may vary based on different sample restrictions: **sample B** (column 2) restricts to students who have at least 8 non-missing quarters of employment observable in the 3 years prior to their FastForward enrollment and at least 1 non-missing quarter of employment after program exit. These restriction reduces our sample of students by nearly 30% compared to sample A, but enables us to test the parallel trends more effectively by focusing only on individuals with ample earnings records.[18] **Sample C** (column 3) excludes students who received any postsecondary award prior to enrolling

[17]In addition to earnings conditional on employment (i.e. exclude quarters with zero earnings), we have also created event study plots for probability of employment (i.e. whether a non-zero earning is observed in a given quarter). The figures are included in Appendix Figure 1 and the patterns are fairly similar to those presented in Figure 1.

[18]However, it is important to note that this sample restriction would remove individuals who are only sporadically employed prior to FastForward enrollment and may bias the estimates downward for the

in FastForward and students who continued their education in credit-bearing programs after Fastfoward enrollment. This has the effect of evaluating the impact of an industry-recognized credential on labor market outcomes of individuals with limited postsecondary training in the credit-bearing sector. Finally, **Sample D** (column 4) combines the restrictions in samples B and C.

The estimates shown in column 1, based on our primary analytic sample (sample A), indicate that earning an industry-recognized credential on average increases quarterly earnings among those who are employed by $966 (around 10 percent increase from quarterly earnings the quarter before enrollment). In addition, earning an industry credential also increases the probability of being observably employed by 2.4 percentage points (thus increasing the average employment rate from 78% employment in the quarter before enrollment to 80 percent). This suggests that the economic value of earning an industry credential through the FastForward program is driven by both the extensive margin of increasing the probability of being employed and by the intensive margin of increased earnings conditional on employment. The estimates are fairly consistent across columns 1-4, indicating that estimated labor market value of industry credentials are fairly robust to different sample and model specifications.

C. Heterogeneous impacts by different training fields, subgroups of students, and cohorts

Table 3 shows the estimated effects of FastForward programs on earnings conditional on employment and the probability of employment across various fields of study. While the majority of the fields are associated with significant earnings premia, the benefits vary substantially among fields. Among the six main fields examined, "Transportation" seems to produce particularly high earnings gains, where receiving an industry credential in this field is associated with an average quarterly earnings premium of $1,851 (increase of 21% from pre-FastForward earnings among credential completers in this field).

In addition, the probability of employment as a result of earning an industry credential is greater in several fields, reinforcing the notion that FastForward programs may enhance participants' employability in certain industries. These fields encompass a broad spectrum, ranging from technology-related disciplines (e.g. "Computer and Information Sciences") to healthcare (e.g. "Clinical Medical Assistant") and precision production (e.g. "Gas Metal Arc Welding"), providing participants with diverse career options aligned with their interests and aspirations. Lastly, it is important to bear in mind that certain fields, such as "Mechanic and Repair Technologies," enroll fewer students. As a result, the precision of estimates in these fields is somewhat limited due to the smaller sample sizes.

employment outcome (i.e. whether an individual has any nonzero earnings in a given quarter). Thus, we only conduct robustness checks using this restricted sample (sample B) on the outcome of earnings conditional on employment.

We also delve into potential variation in the impact of earning an industry credential among different subgroups, considering factors such as gender, race, and the age at which students enrolled in FastForward. We first document, in Appendix Table 5, substantial sorting by student subgroup across different programs of study. For example, more than 80 percent of students enrolled in "Transportation" programs, the field with the highest earnings, are males. When we run a model to estimate subgroup-specific returns to earning an industry credential and include controls for field of study, we do not find significant demographic variation in earnings returns.This finding suggests that the differential returns across subgroups to FastForward by race, gender, and age are primarily due to student selection into different types of programs.

Finally, considering that the FastForward program has expanded substantially across the VCCS since its inception, it is possible that the labor market returns to earning an industry credential through these programs have changed over time. For example, if the local labor market is saturated with individuals with a particular skill, there might be diminishing returns to earning an industry credential in a relevant field over time. The analysis that breaks down the analytic sample by cohort (defined by the fiscal year when a student entered a FastForward program) yields fairly consistent estimates across cohorts. Still, it is important to note that for the more recent cohorts, the observable time period post FastForward enrollment is quite limited.

D. The Role of industry mobility

One potential mechanism through which earning an industry credential may yield positive economic returns is by increasing individuals' industry mobility and enabling them to transition between different sectors, potentially accessing opportunities in industries with higher average earnings and thus boosting individuals' income levels. Understanding the impact of industry credentials in increasing industry mobility is especially critical for initiatives like the WCG in Virginia, which has an explicit goal to bolster labor supply in high-demand fields.

To explore this possibility, we first identify the primary industries in which industry credential earners work prior to and after enrollment in a FastForward program.[19] We then calculate the average earnings for a given industry using all employment records in that industry in our analytic sample. By comparing the average earnings of a specific industry to the overall average earnings across all employment records in our sample, we can determine whether the industry is associated with earnings that are either above or below the overall average.[20]

[19]Primary industry was defined as the industry a student worked in the most in the periods before and after FastForward. This uses the most common industry in these periods, excluding unemployed quarters. For students who worked multiple jobs across different industries within a single quarter, the industry where they had the largest earnings is used.

[20]An alternative method of calculating the overall average is to average across industries (i.e. weighting each industry equally). This method yields an overall average around 10% higher, but the relative

The descriptive results presented in Appendix Table 6 indicate that industry credential earners tend to flow out of industries associated with below-average earnings and into higher-paying industries. Specifically, industries such as Retail Trade show a net outflow of workers, while industries such as Transportation experience a net influx. For example, prior to enrollment, 17% and 11% of the students work in the industry of "Retail Trade" and "Accomodation and Food Services" as their primary industry, where salaries are 34% and 49% below overall average earnings, respectively. However, after obtaining the credential, these numbers dropped to 7% and 3%. In contrast, the proportion of students working in "Manufacturing" – a high-demand industry with salaries 39% higher than average – increased from 10% to 15%. These descriptive patterns suggest that the economic benefits of industry credentials may be attributed, in part, to facilitating transitions from lower-earning industries to higher-earning ones.

To formally assess the impact of industry credentials on industry mobility, we use the comparative individual fixed effects model (Equation 1) to understand the impact of obtaining an industry credential on two key outcome measures: (i) the average earnings of the industry in which an individual is employed in a given quarter, and (ii) whether the individual is employed in an industry that has an above-average earning. Our results indicate obtaining an industry credential results in, on average, a significant increase of $304 (p¡0.01), or a 3.2% boost in the average earnings of an individual's employment industry. Additionally, earning a credential is correlated with a significant 7% increase in the likelihood of being employed in an industry with above-average earnings.

Using the comparative individual fixed effects model, we further examine how earning an industry credential across different fields of study influences individuals' specific choice of industry. Results shown in Table 4 echo the descriptive patterns shown in Appendix Table 6, where industry credentials earned in multiple different fields meaningfully increase the likelihood of employment in industries that are associated with higher earnings. For instance, individuals who earn a credential in Transportation are 13 percentage points less likely to work in industries with industry-mean salaries well below the average, such as "Administration", "Retail Trade", and "Accommodations and Food". Meanwhile, a substantial portion of individuals transitioning from these lower-paying industries gravitate towards higher-paying sectors like "Transportation" (13% above average) and "Construction" (38% above average). These findings underscore the potential of industry credentials in redirecting individuals towards high-demand industries with better economic prospects.

E. Cost-effectiveness of the FastForward programs

In Table 5 we compare the cost effectiveness of Virginia's FastForward noncredit workforce training programs to other sub-Associate's degree programs that

differences across industries remain the same.

have been rigorously evaluated in prior research. In Appendix Table 7, we supplement this analysis to compare FastForward programs to rigorously-evaluated Associate's degree programs. Specifically, we focus our comparison on studies that employ quasi-experimental evaluation designs and which have been published in peer-reviewed journals. Rows in the table are grouped by the state and years for which a given paper generated estimates (e.g. the first group corresponds to Darolia et al.'s (2023) estimation of the impacts short-term credentials in Kentucky). Each row in the table corresponds to different credit requirements for which the paper estimated labor market returns. For instance, the first row in the Kentucky group corresponds to the estimated return to very short-duration training programs requiring 1-6 credits to complete. For each state*year*credit estimation, we calculate (and display in column 4) an estimated program cost based on current per-credit costs associated with the focal community college systems in each study. While the current costs may differ from the program costs at the time the labor market return was estimated, this approach has the advantage of providing comparable costs across states and time. We report (in column 5) an annualized estimate of the labor market returns for each state*year*credit program based on the impact estimates from the cited papers. Finally, in column 6 we report the years until the labor market returns to each program would exceed program costs, by dividing column 4 by column 5.

The primary insight from this analysis is that, at least in the short-term, the shortest-duration programs, which require the equivalent of a semester or two of credits, tend to have the shortest time period over which earnings gains exceed program costs. Virginia's FastForward program is one of the most cost-effective short-term training programs, with earnings gains exceeding costs in just over half a year. Comparing this table to Appendix Table 7, another notable insight is that associate's degree programs tend to take substantially longer before earnings gains exceed costs.

It is important to note that this analysis does not speak to the potential medium- and longer-term earnings trajectories of sub-associate's versus associate's degree holders. In the case of our FastForward analysis, we are only able to observe earnings gains up to 6 years following credential attainment. But this comparative cost effectiveness analysis does illustrate that non-credit training programs are a particularly cost effective strategy to generate near-term wage gains for less-educated workers.

VI. Discussion and Conclusion

Millions of students actively seek workforce training via noncredit programs at community colleges annually, a sector that attracts a large proportion of postsecondary enrollment but, to date, with little rigorous evidence on program completion rates or labor market impacts. These programs hold the promise of addressing crucial skills gaps in the U.S. economy by providing students the oppor-

tunity to acquire skills closely matched to labor market demands and to prepare them for industry-recognized credentials. Drawing upon the distinctive dataset gathered from the FastForward program in Virginia that links students' industry credential attainment with quarterly earnings data, our study offers novel and policy-relevant evidence regarding the economic returns to industry-recognized credentials associated with short-duration noncredit workforce training programs offered at community colleges.

Employing a comparative individual fixed effects model, our analysis identifies positive and economically meaningful impacts from the acquisition of an industry credential through the FastForward program, both in terms of the extensive margin (i.e., the likelihood of employment) and the intensive margin (i.e., conditional quarterly earnings). Our back-of-the-envelope cost-effectiveness calculation suggests that earning an industry credential through the FastForward programs is a more cost-effective approach to generating positive labor market returns than most other rigorously-evaluated sub-baccalaureate programs in the current literature. We also find that earning an industry credential is more likely to shift individuals away from lower-earning sectors like retail towards higher-earning industries experiencing increased demand for skilled workers. These findings highlight the potential of programs like Virginia FastForward in bolstering workforce engagement in high-demand industries.

Our results raise several important implications both for the purposes of improving human capital development of less skilled workers and for identifying effective policies for increasing the supply of skilled workers in high-demand fields. First, in Virginia and across the nation, persistent difficulties in finding adequately trained workers to satisfy labor demand, combined with record high unemployment, makes it vital to identify effective paths to human capital development for individuals who may be unlikely to receive postsecondary credentials from traditional credit-bearing programs. The substantial economic returns to industry credentials identified in our study suggest that short-duration noncredit workforce programs such as FastForward may provide an important alternative pathway to skills and workforce opportunities for populations traditionally underrepresented in the credit-bearing sector.

Second, the earnings premium resulting from obtaining an industry credential appears to vary substantially across different fields, where the fields of transportation (example FastForward program: "Commercial Driver's License") and precision production (example FastForward program: "Gas Metal Arc Welding") seem to be associated with particularly pronounced earnings premia. While industry credentials in other fields often result in nontrivial earnings gains, they are substantially smaller than these high-return fields. In addition, we also observe substantial heterogeneity in the observed characteristics of students across different fields, but conditional on field of study, no significant subgroup differences. Little is known to date about the factors that inform students' non-credit program choices, or how malleable these choices are; this is an important area

for future work. Third, our analyses have also revealed a few potential areas for improving outcomes among students in noncredit workforce training programs. For example, one of the key findings about FastForward programs was that despite high average industry credential attainment rate, there are meaningful gaps among students from different demographic groups. There is also limited pursuit of further education in the credit-bearing sector after FastForward completion. Understanding why this is the case can provide useful information to help colleges design appropriate interventions, or provide the needed support to mitigate these bottlenecks. Such efforts have the potential to contribute to more equitable outcomes for individuals who have been historically marginalized in postsecondary education.

Finally, with the increasingly diversified pathways for workforce training, understanding the dynamics between individuals, programs, and labor market returns is paramount for informing both college administrators and prospective students. From an institution standpoint, colleges may offer workforce training through both credit-bearing and noncredit sectors. For instance, many community colleges in Virginia offer Nursing Assistant programs either as a noncredit FastForward program or as a credit-bearing Career Studies Certificate (CSC) program, both of which are designed to prepare the student to take a third-party Nursing Assistant credentialing exam. Thus, it is crucial to understand how programs offered through the credit-bearing and noncredit sectors may be associated with different student academic outcomes, industry credential attainment, and labor market performance. From a student standpoint, it is imperative for workforce development policies to prioritize providing transparent information on the labor market returns to different investment choices. While there has been a nationwide push for improved information on labor market returns (Workforce Information Advisory Council, 2018), such information is particularly crucial for workforce training programs, since they are specifically tailored to prepare students for employment in specific industries or occupations. Therefore, having accurate information about potential earnings and job opportunities associated with different training programs is essential for students to make informed decisions about their education investment decisions and career paths.

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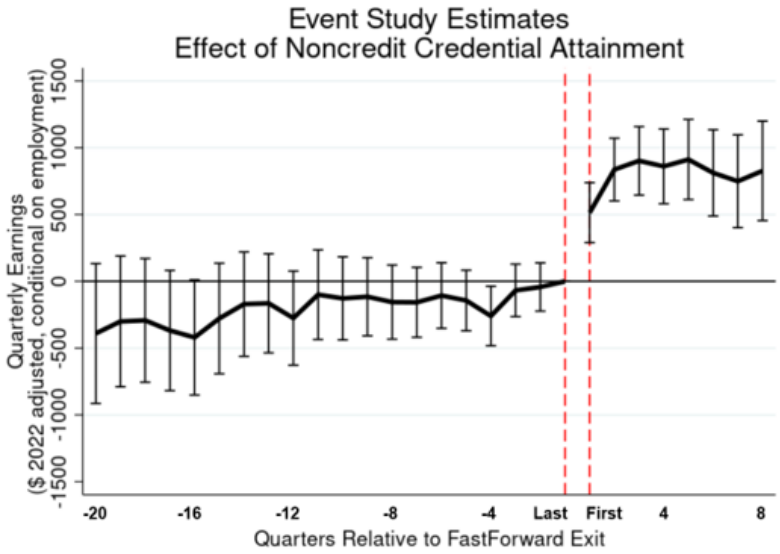
Figure 1. Event Study Plot



Note: This figure plots the estimates of δ_{q2} from Equation 2, with 95 percent confidence intervals. Student-quarter observations outside of the domain of the plot are binned at the endpoints, i.e. x=-20 represents the average effect for all quarters of values -20 or less and x=8 represents the average effect for all quarters of values 8 or more.

Table 1—Student Descriptive Statistics

	Population of FF Enrollees	Analytic Sample
	(1)	(2)
Panel A: Student Characteristics		
Gender		
Female	35%	39%
Male	58%	58%
Unspecified	6%	3%
Race		
White	49%	46%
Black	34%	37%
Hispanic	6%	6%
Asian	4%	4%
Other	8%	7%
Age		
24 and younger	27%	24%
25-34	29%	40%
35-44	22%	26%
45+	22%	10%
mean	34.6	32.7
Panel B: Enrollment Patterns		
Number of FastForward Courses		
1	78%	81%
2	12%	11%
3+	10%	8%
Credit Enrollments (2016 and 2017 cohorts only)		
No Credit enrollments	61%	54%
Credit only after FF	4%	3%
Credit only before FF	28%	33%
Credit before and after FF	8%	9%
Panel C: Academic Outcomes		
Training Completion	89%	92%
Credential Completion	65%	68%
Number of Students	35,910	23,901

Source : Administrative data files provided by the Virginia Community College System.
Note: The first column provides summary statistics for all 35,910 unique students who were enrolled in a FastForward program between July 2016 and June 2021, inclusive. The second column provides summary statistics for the 23,901 students who meet our analytic sample requirements: have some observable employment records in the UI data; began their FastForward enrollment between ages 20-50; and were not actively enrolled in FastForward as of 2022Q1. See text for definition of credit enrollments categories, training completion outcome, and credential completion outcome.

Table 2—Estimated Effects of Attaining an Industry Credential on Employment and Earnings based on Different Samples

	Different Samples			
	A (Full Sample)	B (Restriction on Employment)	C (Restriction on for-credit	D (Both Restrictions)
Outcomes:				
Earnings Conditional on Employment	$964.50 ***	$914.70 ***	$1,065.80 ***	$1,023.80 ***
	(90.2)	(99.1)	(99.0)	(108.5)
Probability of Employment	0.024 ***		0.018 ***	
	(0.006)		(0.007)	
Sample Restrictions:				
At least one post-FF quarter with nonzero earnings		Yes		Yes
At least 8 quarters from 3y pre-FF with nonzero earnings		Yes		Yes
Exclude those with a credit award earned			Yes	Yes
Exclude those with credit enrollments after starting FF			Yes	Yes
Observations				
Number of Unique Students	23,901	16,935	18,739	13,276
N for earnings conditional on employment	547,567	464,248	411,188	349,065
N for employment	710,235		529,883	

Note: This table presents estimates for β_1 in Equation (1), which represent the economic returns to earning an industry-recognized credential through a FastForward program. All columns show estimates of the economic return based the outcome of quarterly earnings conditional on employment (measured in real 2022 dollars); Columns A and C also provide estimates of the economic return based on the binary outcome of any employment. All regression models include the following controls: individual fixed effects, quarter fixed effects, individual-specific time trends, age and age squared, time fixed effects relative to FastForward entry and FastForward exit, an indicator for if a student is enrolled in a credit-program, and indicators for any credit awards earned (certificate, associate, bachelor's and graduate degrees). Each column provides estimates of the same regression model using different analytic samples, as indicated in the table sample restrictions. In all regressions, we exclude the observations corresponding to quarters when a student is enrolled in a FastForward program.

Table 3—Heterogeneous Effects by Program Field

Field of Study (by CIP category)*	Outcome	Estimate	Prior Averages	Student N	Quarter N
Computer and Information Sciences and Support Services (11)	Earnings Conditional on Employment	749.0 (642.2)	9,633	1,891	44,627
Example FastForward Program: "Certified Associate in Python Programming"	Probability of Employment	0.059 ** (0.030)	0.76		60,361
Construction Trades (46)	Earnings Conditional on Employment	583.5 ** (276.6)	11,547	2,796	63,418
Example FastForward Program: "Carpentry Level 1"	Probability of Employment	0.031 (0.019)	0.82		78,221
Mechanic and Repair Technologies/Technicians (47)	Earnings Conditional on Employment	20.9 (444.5)	8,096	1,211	27,596
Example FastForward Program: "HVAC Excellence Employment Ready"	Probability of Employment	0.024 (0.036)	0.80		34,189
Precision Production (48)	Earnings Conditional on Employment	1,058.8 *** (313.9)	8,404	2,202	51,545
Example FastForward Program: "Gas Metal Arc Welding"	Probability of Employment	0.057 *** (0.021)	0.78		65,454
Transportation and Materials Moving (49)	Earnings Conditional on Employment	1851.5 *** (161.5)	8,631	7,329	159,209
Example FastForward Program: "Commercial Driver's License"	Probability of Employment	0.016 (0.011)	0.79		212,126
Health Professions and Related Clinical Sciences (51)	Earnings Conditional on Employment	442.7 *** (126.3)	5,761	6,922	160,970
Example FastForward Program: "Clinical Medical Assistant"	Probability of Employment	0.052 *** (0.011)	0.77		210,138
Other (13, 15, 36, 52)	Earnings Conditional on Employment	284.6 (393.4)	12,284	1,585	39,996
Example FastForward Program: "Teacher License"	Probability of Employment	0.016 (0.020)	0.79		49,699

Note: This table provides field-specific estimates of the economic returns to attaining an industry-recognized credential through FastForward. The estimates (third column) correspond to β_1 in Equation (1), with the regression equation including controls listed in Table 1 notes. The analytic sample aligns with Column A from Table 1. The Prior Averages values conditional quarterly earnings and share employed, averaged over the X quarters prior to FastForward entry. Example programs are examples only and not necessarily representative of all FastForward programs in a given category.

Table 4—Credential Effect by Field of Study on Employment in Most Common Industries

	Industry							
	Professional, Scientific	Manufacturing	Construction	Transportation	Health Care	Administrative	Retail Trade	Accommodation and Food
Average Earnings Compared to Overall Average	*+59%*	*+39%*	*+38%*	*+13%*	*-22%*	*-25%*	*-34%*	*-49%*
Effect by Field of Study								
Computers	0.014	0.001	-0.005	-0.013	-0.024	-0.013	-0.01	-0.003
Construction	-0.006	-0.013	0.020	0.007	0.003	0.000	0.002	**-0.022***
Mechanics	-0.008	**0.242***	-0.035	**-0.032***	-0.005	**-0.089***	0.002	-0.009
Production	-0.018	**0.132***	0.023	0.012	-0.024	0.002	-0.023	-0.008
Transportation	-0.004	-0.003	**0.018***	**0.124***	0.006	**-0.040***	**-0.055***	**-0.028***
Health	-0.006	**-0.014***	-0.003	-0.001	**0.102***	-0.015	**-0.035***	-0.015
Other	-0.005	-0.002	0.013	-0.003	-0.006	-0.008	-0.001	-0.012

Note : The first row shows how average earnings in each industry (labeled in column headings) compares to the overall average earnings. These averages are based on all employment records in our analytic sample. A "+" indicates an industry with higher-than-average wages; a "-" indicates lower-than-average wages. In this table, we include the eight industries that account for 5% of more of employment observations. Note that similar NAICS industry codes have been consolidated (such as Manufacturing codes 31, 32, and 33 into one "Manufacturing" category). In the rest of the table, each cell represents a separate field-of-study-specific regression represented in Equation (1), where the outcome is employment in one of the eight represented industries. We use the Benjamini-Hochberg method at q=0.05 to account for multiple comparison tests to decrease the false discovery rate.

Table 5—Literature Estimates of For-Credit Certificate Costs and Annualized Earnings Effects

	Credits	Average Cost	Earnings Effect	Years until Earnings Gains Exceed Program Costs
	(1)	(2)	(3)	(4)
VCCS FastForward Noncredit Credentials		$2,298	$3,860	0.6
2023 Kentucky	1-6	$679	$1,208	0.56
	7-15	$2,134	$1,200	1.78
	16-36	$4,074	$1,264	3.22
2014 Kentucky	1-15	$1,552	$1,616	0.96
	16-30	$4,462	$9,140	0.49
2015 Michigan	1-15	$1,320	$3,056	0.43
	16-30	$3,795	$3,028	1.25
2015 Washington	1-30	$2,124	-$2,612	N/A
	30-59	$6,097	$6,172	0.99
2016 North Carolina	1-30	$2,031	$1,512	1.34
	30-59	$5,830	$5,182	1.12
2016 Virginia	1-30	$2,465	$832	2.96
	30-59	$7,076	$1,088	6.51
2018 Tennessee	1-49	$2,975	$1,604	1.85
	50	$5,950	$5,684	1.05

Note: Years until earnings gains exceed program costs is not estimated for the short-term (1-30 credits) credentials from the Washington 2015 study because the authors estimate a negative earnings effect. Rows shaded in gray highlight the certificates where the earnings effect is equal to the average cost in under one year.

Appendix

Table A1—Enrollment and Sample Programs by Occupational Field in FY 2022

Occupational Field	Enrolled	Sample Program
Computer and Mathematical	1,061	CompTIA A+
Construction and Extraction	2,380	Highway Construction
Education, Training and Library	75	Teaching License
Healthcare Practitioners and Technical	316	Pharmacy Technician
Healthcare Support	1,591	Certified Nurse Aide
Installation, Maintenance and Repair	1,271	Electrical and electrical systems
Office and Administrative Support	602	Billing and Coding Specialist
Production	1,243	Welding
Public Administration	12	Public Administration Specialist Certification
Transportation and Material Moving	2,982	Commercial Driver's License
All	*11,533*	

Source: New Economy Workforce Credential Grant Annual Report FY2022 (Febrary, 2023) by State Council

Table A2—Ten Most Common FastForward Programs

Program Name	Enrollment		Completed Training	Earned Credential
	Frequency	Percent		
Commercial Driver's License Class A Endorsement	6,392	26.7%	90.2%	76.2%
Clinical Medical Assistant (NHA)	2,163	9.0%	92.6%	82.5%
Certified Nurse Aide	1,512	6.3%	87.4%	51.3%
VDOT Asphalt Field Level 1	1,281	5.4%	97.8%	87.6%
VDOT Asphalt Field Level 2	1,050	4.4%	98.1%	92.4%
CompTIA A+	979	4.1%	93.3%	23.4%
Shielded Metal Arc Welding (SMAW)	907	3.8%	94.8%	80.3%
Phlebotomy Technician (NHA)	828	3.5%	94.6%	76.8%
Core-Introductory Craft Skills	739	3.1%	96.5%	86.3%
VDOT Asphalt - Slurry Seal	554	2.3%	98.0%	93.0%

Note: Based on student by FastForward program level data.

Table A3—Characteristics of Students Enrolled in VCCS Credit-Bearing Sector, by Fall Term

		Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
		(1)	(2)	(3)	(4)	(5)	(6)
Gender							
	Female	62.4%	60.9%	61.3%	62.0%	61.8%	63.7%
	Male	37.5%	39.0%	38.6%	37.8%	38.0%	36.1%
	Unspecified	0.1%	0.0%	0.1%	0.2%	0.3%	0.3%
Race							
	White	59.1%	60.6%	58.4%	55.5%	57.6%	55.6%
	Black	25.1%	23.7%	24.1%	26.4%	24.9%	28.1%
	Hispanic	6.8%	6.8%	7.7%	8.1%	7.7%	5.9%
	Asian	3.9%	4.3%	4.7%	4.9%	4.7%	4.8%
	Other	5.0%	4.7%	5.2%	5.2%	5.1%	5.7%
N		8,650	7,401	7,297	7,346	6,827	7,846

Note: The data used to produce this table was retrieved from the Virginia State Council for Higher Education website: https://research.schev.edu/info/Reports.Guide-to-the-Fall-Headcount-Enrollment-Reports. We include the percent of students enrolled in credit-bearing programs earning awards less than one year. To calculate the proportion of students within each race category, we removed the missing observations. Missing values range from 1% to 4% depending on the year.

Table A4—Variables Predicting FastForward Credential Attainment

	Without Program Fixed Effects	With Program Fixed Effects
	(1)	(2)
Race		
Black	-.13 (.007) ***	-.13(.007) ***
Hispanic	-.07 (.014) ***	-.05(.013) ***
Asian	-.17 (.018) ***	-.05(.016) ***
Other	-.04 (.013) ***	-.07(.012) ***
Missing	-.05 (.011) ***	-0.08(.010) ***
Gender		
Male	.08 (.006) ***	.04(.008) ***
Unspecified	.08 (.016) ***	.07(.015) ***
Cohort		
2018	.03 (.010) ***	.00(.009)
2019	.05 (.009) ***	.03(.009) ***
2020	.06 (.010) ***	-.00(.009)
2021	.05 (.009)	-.03(.009) ***
Age	-.007 (.0032) **	-.003(.003)
Age²	.000 (.0000) *	.000(.000)
Prior Wages ($1000s)	.003 (.0005) ***	.005(.001) ***
No Prior Employment	.08 (.014) ***	.10(.013) ***
N	23,901	23,901

Note: Each column represents a linear regression on industry credential attainment (binary outcome) on the list of student-level characteristics listed in this table. The regression in column (2) also includes FastForward program fixed effects. The omitted race category is White; the omitted race gender category is Female; the omitted cohort category is 2017. Prior Wages are equal to the average of all observable quarterly wages prior to a student's entrance into the FastForward program. No Prior Employment is an indicator equal to one if the student had no observable employment prior to their entrance into the FastForward program. *p<0.1, **p<0.05, ***p<0.01.

TABLE A5—CHARACTERISTICS OF STUDENTS BY FIELD OF STUDY

		Computer and Information Sciences	Construction Trades	Mechanic and Repair Technologies / Technicians	Precision Production	Transportation and Materials Moving	Health Professions and Related Clinical Sciences	Other
Cohort	2017	21.3%	15.6%	5.3%	25.0%	19.5%	18.5%	22.1%
	2018	13.6%	22.0%	7.1%	20.9%	17.9%	15.8%	18.4%
	2019	23.8%	23.6%	28.8%	22.2%	18.3%	20.6%	23.4%
	2020	12.7%	21.6%	32.3%	15.6%	19.7%	19.5%	18.6%
	2021	28.6%	17.2%	26.6%	16.3%	24.6%	25.5%	17.5%
Whether Completed FF Training		94.4%	95.3%	95.6%	94.1%	90.6%	89.9%	95.2%
Whether Earned a Credential		26.9%	81.7%	79.3%	74.9%	77.1%	61.5%	67.1%
Race	White	32.2%	67.2%	42.3%	50.7%	38.6%	45.2%	67.9%
	Black	36.8%	17.9%	47.3%	35.3%	47.5%	37.8%	19.2%
	Hispanic	10.9%	5.5%	3.6%	3.7%	3.8%	7.8%	2.8%
	Asian	14.5%	3.4%	1.4%	0.8%	1.7%	3.7%	2.5%
	Other	5.5%	6.1%	5.5%	9.6%	8.4%	5.6%	7.6%
Gender	female	28.6%	7.0%	24.4%	18.7%	12.6%	91.2%	39.0%
	male	69.7%	87.9%	72.3%	79.5%	82.9%	7.9%	57.8%
	unspecified	1.7%	5.1%	3.3%	1.9%	4.5%	0.9%	3.1%
Age	20-24	15.8%	23.9%	29.7%	28.6%	17.7%	32.9%	11.8%
	25-29	24.7%	21.0%	25.6%	23.0%	22.4%	22.0%	17.4%
	30+	59.5%	55.1%	44.7%	48.5%	59.9%	45.1%	70.8%
	mean	33	33	31	31	33	31	36
Quarterly earnings pre-FF entry	Non-Credential Earners	$9,172.43	$10,828.04	$8,091.45	$8,024.96	$7,850.77	$5,446.39	$13,324.42
	s.d.	(7922)	(8924)	(6846)	(7003)	(6497)	(4591)	(10936)
	Credential Earners	$11,133.68	$11,688.81	$8,097.56	$8,534.12	$8,865.16	$5,952.67	$11,703.86
	s.d.	(9314)	(8544)	(6686)	(6908)	(6873)	(4767)	(9595)
Quarterly earnings post-FF exit	Non-Credential Earners	$13,880.58	$14,310.36	$12,374.11	$10,638.66	$9,711.75	$6,747.45	$17,647.27
	s.d.	(10312)	(9978)	(8424)	(6921)	(7439)	(4731)	(12885)
	Credential Earners	$19,414.62	$15,863.02	$12,088.80	$13,086.06	$12,592.89	$7,665.23	$16,192.78
	s.d.	(12776)	(8993)	(6621)	(8374)	(7496)	(4672)	(11324)
Total Students		7.9%	11.7%	5.1%	9.2%	30.6%	28.9%	6.6%
		1,895	2,802	1,214	2,207	7,345	6,933	1,586

Note: This table shows the characteristics of enrolled students within each FastForward field of study (identified by column headers). Cohorts are defined by the VCCS fiscal year, e.g. cohort 2017 represents enrollments from July 1, 2016 through June 30,2018. All earnings are measured in 2022 dollars, with standard deviations in parentheses.

Table A6—Change in Industry Employments for Credential Earners

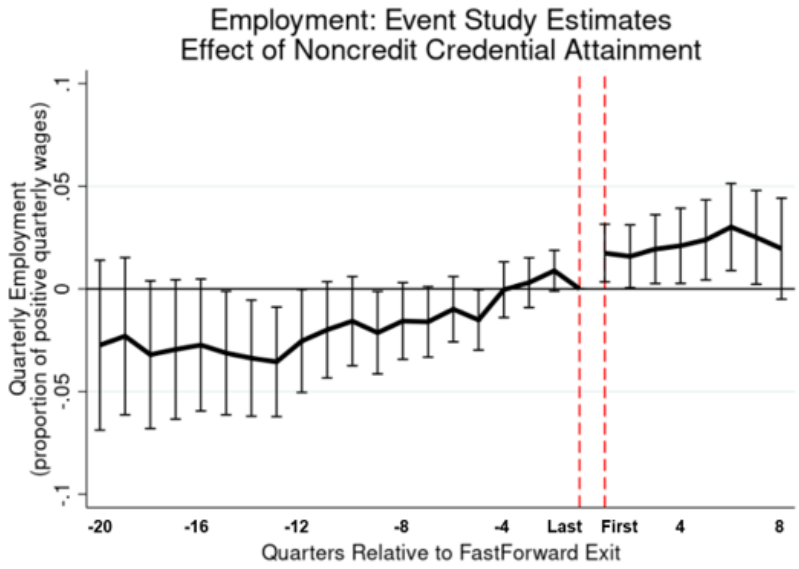
	Before FF	After FF
Professional, Scientific (+59%)	5.31%	6.63%
Manufacturing (+39%)	10.41%	15.09%
Construction (+38%)	10.27%	12.79%
Transportation (+13%)	4.14%	12.01%
Health Care (-22%)	11.07%	16.07%
Administrative (-25%)	10.78%	7.58%
Retail Trade (-34%)	16.65%	7.36%
Accommodation and Food (-49%)	11.45%	3.03%

Note: This table shows the share of students in our analytic sample who were employed in each industry in the quarter immediately before FastForward entry (column 1) and the quarter immediately after FastForward exit (column 2). The percentages in parentheses below the industry labels correspond to the "Average Earngings Compared to Overall Average" row in Table 5

Table A7—Literature Estimates of Associate Degree Costs and Annualized Earnings Effects

	Credits	Average Cost	Earnings Effect	Years until Earnings Gains Exceed Program Costs
	(1)	(2)	(3)	(4)
2014 Kentucky	60	$11,640	$11,140	1.04
2015 Michigan	60	$9,900	$10,128	0.98
2015 Washington	60	$8,220	$3,968	2.07
2016 North Carolina	60	$7,860	$6,830	1.15
2016 Virginia	60	$9,540	$4,203	2.27

Figure A1. Event Study Plot for Probability of Employment



Note: This figure plots the estimates of δ_{q2} from Equation 2, with 95 percent confidence intervals. Student-quarter observations outside of the domain of the plot are binned at the endpoints, i.e. x=-20 represents the average effect for all quarters of values -20 or less and x=8 represents the average effect for all quarters of values 8 or more.