

# Postsecondary certificates and faculty composition

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## Abstract

Short-term and vocational certificate programs have proliferated in the United States, spurred by prominent policy initiatives and student demand. Nationally, postsecondary institutions distribute about one million short-term certificates annually, constituting approximately about 25% of postsecondary credentials awarded. Certificate programs are distinct from degree programs in a variety of ways, including often having a more applied focus on discrete vocational skills. These features of certificate programs may mean that as these programs grow, so too will the value of having a greater proportion of faculty with applied experience, changing the composition of faculty bodies' educational backgrounds and job titles. We examine whether the growing popularity of certificates in the two-year sector corresponds to changes in faculty composition. A focal state is Kentucky, which is a national leader in certificate granting and where certificate and applied training is a prominent policy emphasis. Our results indicate that in two-year public institutions where certificates are a larger share of credentials conferred, faculty were less likely to have graduate degrees, be in non-tenure-track role, or have a professorial title.

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## 1. Introduction

Over the past twenty years, the number of sub-associate certificates granted by public postsecondary institutions has more than doubled. Currently, US postsecondary education institutions distribute about one million certificates annually, constituting approximately one out of every four postsecondary credentials awarded.<sup>1</sup> There are a number of potential implications of certificate and vocational programs becoming an increasingly prominent part of the higher education landscape, including questions about the returns to such programs and about the role of public funding used to support these pursuits. In this study, we investigate a different potential consequence of the rise of certificate programs and ask whether the rise of these programs link to the changes in the composition of faculty. Faculty can affect students and student outcomes, including student learning experiences, success in future courses, and graduation (e.g., Bettinger & Long, 2010; Carrell & West, 2010; Ehrenberg & Zhang, 2005; Jacoby, 2006; Ran & Xu, 2019).

Certificate programs are distinct from degree programs in a variety of ways, including typically a more applied focus on discrete vocational skills. These features of certificate programs means that as these programs grow, so too will the value of having a greater proportion of faculty with applied experience and potentially leading to changes to the educational and professional backgrounds of faculty, and altering the distribution of faculty job titles. We examine whether the growing popularity of certificates in the two-year sector corresponds to changes in faculty composition nationally and in the state of Kentucky.

We document the rise in certificate awards nationally, and also we use Kentucky as a focal context given its attention in policy debates and the rate of short-term credential seeking in the state. Kentucky has historically had the highest rate in the country of certificates awarded per capita (nearly twice the national average), public sector certificates awarded per capita (almost three times the national average), and less than one-year certificates awarded per capita. Further, there have been high profile recent examples of important policymaking in Kentucky that likely affected the supply of and demand for short-term credentials.

We show that the share of faculty on the tenure track, with a professorial title, has declined in recent years. These trends are consistent with the documented rise in

the proportion of contingent and non-tenure-track faculty members in U.S. colleges and universities in recent years (e.g., AAUP, 2018; Hurlburt & McGarrah, 2016; Kezar & Maxey, 2012).<sup>2</sup> These shifts happen concurrently with a notable surge in certificates as a share of total credentials awarded in these institutions. The growth in certificates did not correspond to growth in the total number of faculty, however. This may be because though certificate awards grew, enrollment and credits completed per credential contemporaneously declined.

## 2. Background

### 2.1 Faculty

The nature of faculty roles has changed over time. In Figure 1, we present the national trend in full-time and part-time faculty for degree-granting institutions that grant associate or higher degrees over the past 30 years. Both the number of full-time and part-time faculty has grown substantially. Full-time faculty grew consistently over the past 30 years, rising by approximately 56%. The number of part-time faculty has increased at an even higher rate, by nearly 125% over that same period. In 2011, the number of part-time faculty nationally roughly equaled the number of full-time faculty but has since begun to decline. This decline likely corresponds to the contraction of the for-profit college sector starting in 2011 that employed a notable share of part-time faculty members and difficult economic conditions that arose with the ending of the Great Recession. Recent years have been affected by the COVID-19 pandemic, which may further lead to an erosion in the number of part-time faculty. In future work, we will expand our scope to analyze these potential effects.

In Figure 2, we present the trend of faculty ranks among full-time faculty (data on part-time faculty was not available) for two- and four-year degree-granting institutions using national data. Here we see that the composition of faculty ranks has also changed over time. Professors continue to be the most common title over the past 30 years, though the share of faculty that are

1 See Digest of Education Statistics, Table 318.40. Includes bachelor and associate degrees, and certificates below the associate degree level, but not graduate degrees.

2 For ease of exposition, we use the term “tenure-track” to include both tenured faculty and faculty on the tenure track.

Professors has declined from 28% to 22% from 1991 to 2020. Because the rank of Professor is typically conferred to faculty based on accomplishments and experience that can take some time to accumulate, it might be possible that this decline simply reflects a changing demographic of the tenured and tenure-track workforce. However, this does not appear to be the case, as the share of Associate Professors (24% to 21%) and Assistant Professors (22% to 19%) has also declined. The share of faculty with the title “Instructor” remained relatively flat over the past 30 years, with a slight increase in the 2000s followed by a slight decline. The most notable increase belongs to “other faculty,” which includes non-instructional faculty, primarily research or public service faculty, as well as faculty without ranks. This group more than doubled in share, growing from about 8% of all full-time faculty in 1991 to nearly 20% of all faculty by 2020. Since the data available for this figure only include full-time faculty, and because part-time faculty are more likely to hold instructor or non-ranked titles, these trends indicate a general shift not only from full-time roles to part-time roles, but also reveal a greater emphasis on instructors and faculty who are less likely to be tenured or on the tenure track.

There is clear evidence that faculty matter for numerous instructional and scientific reasons, and their importance may be even greater for marginalized student subgroups (e.g., Cole, 2007; Hoffman & Oreopoulos, 2009; Hurtado et al., 2011; Kezar & Maxey, 2014; Umbach & Wawrzynski, 2005; Umbach, 2006). However, the research literature is mixed on whether faculty backgrounds, roles, or titles affect students’ educational outcomes, which may reflect challenges in identifying causal effects of faculty due to the non-random sorting of students and faculty to courses, fields, and institutions. Some researchers presented evidence suggesting that non-tenure track faculty are negatively linked to students’ academic outcomes, such as graduation, transferring from two-year to four-year colleges, retention, academic challenge, and success in future courses (Carrell & West, 2010; Eagan & Jaeger, 2009; Ehrenberg & Zhang, 2005; Harrington & Schibik, 2004; Jacoby, 2006; Jaeger & Eagan, 2011; Johnson, 2011; Ran & Xu, 2019; Umbach, 2007). However, findings of other studies indicate a potentially positive effect of non-tenure track faculty on student learning (Bettinger & Long, 2010; Figlio, Schapiro, & Soter, 2015). One reason for this benefit is that many contingent faculty’s primary responsibility is teaching, so they can devote themselves to their

teaching craft without pressure to publish or seek grants. Also, part-time faculty who concurrently work outside academia, or who have had substantial related work experience, can bring knowledge that they built through professional experiences into the classroom (Leslie & Gappa, 1995).

Having a greater number of contingent faculty may bring greater organizational flexibility because institutions often hire these faculty without long-term commitments (Brewster, 2000; Cohen & Braver, 2008; Christensen, 2008; Levin, Kater, & Wagoner, 2006). However, the shift to an increasing number of contingent faculty, which corresponds to other trends like the erosion of tenure, has implications for faculty themselves and for the broader academy and scientific enterprise. Tenure can help protect academic freedom, free inquiry, and open discussion, enabling scientific pursuits and instructional models that may be less subject to pressures that can be imposed by political whims and power structures. The increased reliance on contingent faculty who do not have these kinds of protection can threaten the academic freedom and independence of all faculty and higher institutions.

Contingent, adjunct, and part-time faculty also often face numerous challenges, including relatively low pay, limited access to benefits, and little job security (e.g., Curtis & Thornton, 2013; Hurlburt & McGarrah, 2016; Monks, 2007). Survey evidence reveals that adjunct faculty are less likely to report being satisfied with their careers than tenure track faculty, and also have notable concerns about financial security (Yakoboski, 2015).

Researchers have presented several reasons that possibly explain the growth in the share of contingent faculty, including growing financial pressures faced by colleges and universities to lower costs and expand offerings (e.g., Kezar & Gehrke, 2016; Monk, Dooris, & Erickson, 2009). Kezar and Gehrke (2016) presented three factors that conceivably affect faculty personnel decision making (i.e., external pressures, values, and strategic organizational processes) building on the broader decision-making literature (Clark, 1998; Priem, Rasheed, & Kotulic, 1995). External pressures include elements that are out of the control of institutions such as economic conditions, political influence, and legislation. Personnel decisions can be made in a way that mitigate the effects of external pressures or crises on institutions. Another factor these authors describe is values, whether personal or organizational. Organizational values indicate the core ethics or principles by which

institutions abide, with such values often reflected through mission statements or standards. The last element is strategic organizational processes, which are a set of strategies that leaders or institutions choose to achieve better performance or outcomes.

## 2.2 Certificates

In our context, we consider the drastic growth in certificate programs to be an external pressure (the first dimension identified by Kezar and Gehrke, 2016) that has the potential to affect faculty compositions, especially at community colleges that grant the majority of certificates. The number of sub-baccalaureate certificates in the United States has grown nearly 80% over the past 20 years, currently totaling about one million credentials per year. This growth has been particularly notable among public institutions, with the number of certificates granted annually up over 140%, as displayed in Figure 3A. Presently, public sector certificates account for about 70% of all certificates granted nationally, which is up from about 55% from two decades earlier. For-profit institutions grant about a quarter of all certificates currently, though they used to grant nearly as many certificates as publics until the 2010-2011 academic year. After this peak, their share has significantly declined, following broader trends in the decline of the for-profit sector. Meanwhile, private nonprofit institutions grant less than 3% of all certificates, which is down from about 5% in the 2000-2001 academic year. As shown in Figure 3B, shorter-term certificates—those with programs of less than a year—account for roughly 60% of certificates granted in recent years.

The growth in certificates can be linked to several drivers. There has been a growing emphasis nationally and within states to align higher education more directly to employment and to focus on paths that do not necessarily lead to two-year or four-year degrees. Many states have dedicated substantial financial support to promoting workforce-driven educational programs, especially for sub-baccalaureate degrees and certificates, such as the Workforce Development Scholarship Program in Minnesota, the Skilled Workforce Student Grant Program in North Carolina, the West Virginia Invests Grant Program, the Work Ready Kentucky Scholarship, and the “Get There Faster” initiatives in Florida (Rogers, 2021; SREB, 2019). These efforts also at times correspond to statewide initiatives that promote post-secondary education credentialing among its population—such as Tennessee’s Drive to 55, Texas’

and Kentucky’s 60X30 goals, Wisconsin’s 60 Forward plan, or Hawaii’s 55 by 25—with many of these initiatives counting postsecondary attainment as credentials of any type, not just degrees.

As more students seek out certificates, and especially shorter-term certificates, this has the potential to affect teaching needs, especially at community and technical colleges where many of these programs have proliferated.<sup>3</sup> Short-term certificates are commonly vocationally oriented, which has the potential to boost demand for faculty who can bring professional experiences and practical knowledge into the classroom, as opposed to more traditional research-heavy academic backgrounds. As a result, increased demand for certificates may lead to a higher proportion of faculty who do not have advanced degrees, such as a master’s degree or PhD. Also, by employing professionals who work outside of academia in their respective fields and cannot make a full-time commitment to teach, colleges might be able to bring their expertise into classrooms through part-time positions (Kezar & Sam, 2010).

Moreover, these trends might give rise to contingent faculty. Enrollments in short-term certificate programs are at risk for fluctuating in response to economic and labor market conditions, since student demand is harder to forecast and because student interests are likely to follow changing employment opportunities and in-demand field dynamics. Therefore, postsecondary institutions may try to preserve their ability to more quickly expand or contract its faculty as enrollment fluctuates. In sum, a growing emphasis on postsecondary credentialing and aligning postsecondary education and employment, coupled with student demand, has led to a proliferation of certificate awards. Such changes in credentials may lead to more pronounced hiring of faculty with applied non-research heavy backgrounds and a greater reliance on contingent faculty. These actions may minimize institution’s costs and maximize their hiring flexibility, but at the same time, may have negative consequences for students and faculty themselves.

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3 There has also been a notable increase in certificates at four-year institutions, though the two-year sector still grants the majority of these credentials.

### 3. Kentucky context and data

Though a policy focus on short-term certificates is increasingly common in many states and nationally, Kentucky is an important context to study short-term credentials given its attention in policy debates and the rate of short-term credential seeking in the state. Kentucky has historically had the highest rate in the country of certificates awarded per capita (nearly twice the national average), public sector certificates awarded per capita (almost three times the national average), and less than one-year certificates awarded per capita. Certificates awarded in the state have expanded substantially in recent years: from the 2014-15 to 2018-19 academic years, short-term certificates awarded by the Kentucky community college system increased by nearly 30%. The ratio of short-term certificates to associate degrees also increased by nearly 30% and is approaching three certificates awarded for each associate degree granted.

High-profile policy interventions in Kentucky, including incentives in the state's performance-based funding system and state-funded scholarships, likely affected the supply of and demand for short-term credentials. Amid growing emphasis on postsecondary degree attainment, the Kentucky state government set up the goal of increasing the percentage of its population with postsecondary degrees and certificates to up to 60% by 2030. Moreover, starting in 2016, state officials implemented the Work Ready Scholarship Program, boosting the availability and generosity of scholarships for students who pursue certificates in one of the five "high demand" workforce sectors, which currently includes Advanced Manufacturing, Business & IT, Construction Trades, Healthcare, and Transportation & Logistics. Because these scholarships substantially lower the cost of earning a certificate in these fields, they are likely to increase the demand for certificates which are more vocationally oriented.

To address our research questions, we integrated three datasets. The first set of data come from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). The current study draws data from IPEDS for the academic years 2013-14 to 2019-20 (note that in the graphs and text, we denote the year by the beginning year, e.g., we denote the 2013-14 academic year as 2013 and the 2019-20 academic year as 2019). IPEDS contains information on total degree completions and employment status and rank for

full-time instructional faculty. Using this information, we examine trends in tenure- and non-tenure-track faculty composition and degree completion for state public two-year and four-year institutions.

The second set of data comes from administrative postsecondary system records from the state of Kentucky that include information about credentials granted and the students who pursue them (both full-time and part-time) at one of 16 community colleges with more than 70 locations across the state. Specifically, through analysis of Kentucky postsecondary system records, we are able to measure completion or pursuit of certificates and associate degrees and courses taken on the pathway toward these credentials as well as demographic and background information for students who enrolled in the public community college system between 2012 and 2018.

The final set of data contains public information about faculty in the community college system. We constructed a faculty dataset by scraping available information on faculty published in college catalogs between 2015 and 2021. The catalogs include a yearly roster of each faculty member at each college, including their title (e.g., instructor, lecturer, assistant professor, professor). Importantly, these data also contain information on the educational background of each faculty member included in the catalog.

#### 3.1 Trends in faculty composition

Between 2013 and 2019 (i.e., academic years 2013-14 through 2019-2020), the number of total faculty members in the Kentucky public community college system decreased from 1,617 to 1,547, which appears to be largely driven by a decline in faculty members who are on the tenure track (See Figure 4A). In 2013, a little more than half (52%) of faculty members at the public community college system had tenure-track appointments. By 2019, however, the proportion of faculty members who were tenured or working on the tenure track declined by approximately 35%, such that about a third of faculty were tenure track. In comparison, the number of non-tenure-track faculty members saw a gradual increase during this period, growing nearly 30%, which comprised about two-thirds of faculty. Correspondingly, much of the growth in non-tenure track faculty looks to be from faculty with a rank of instructor (see Figure 4B). The number of instructors increased roughly 150% from 2013 to 2019, such that they grew their share of all faculty from 10% to 25%. At the

same time, the number of assistant professors (-26%), associate professors (-24%), and professors (-15%) all declined during the same period.

Though four-year institutions are distinct in many important ways from two-year institutions, for comparison, we display trends for faculty composition among four-year institutions in Kentucky in Figure 5. While we observe somewhat similar trends directionally—i.e., an increase in non-tenure track faculty and an increase in instructors—the magnitude of these changes is relatively muted as compared to the two-year sector (in four-year institutions, tenure track faculty went from 75% of faculty appointments to 71%; instructors grew by 11%).

We next turn to data on faculty educational backgrounds we derived from public community college catalogs. Not every faculty member is listed in the catalog, such that the data from this source is lower relative to that reported in IPEDS. The proportion of faculty members with doctoral degrees held relatively steady from 2015 to 2021 at about 13%-14%. Faculty with a master's degree makes up the largest proportion of faculty in the public community college system. In 2015, about 64% of the faculty had a master's degree, which dropped slightly to 59% in 2021. We display trends in educational background among faculty without an advanced degree in Figure 6. The proportion of faculty members with a bachelor's degree held relatively steady from 2015 to 2021 at about 13%. Though they make up the smallest number of faculty, the proportion of faculty with a certificate (from 1% to 3%) or associate degree (from 8% to 11%) as their highest level of education increased. In sum, the share of faculty with an advanced degree declined about 5%, whereas the share of faculty with a bachelor's degree or lower increased about 18%.

These trends indicate that in recent years, faculty in the Kentucky public community college system were more likely to be non-tenure track and have a title of Instructor instead of Assistant Professor, Associate Professor, or Professor; these trends further correspond to a diminishing share of faculty with advanced degrees. In a later section, we examine the extent to which these faculty changes link to credential trends in the state.

### 3.2 Trends in credentials granted and enrollment

In this section, we explore how trends in credential seeking at community colleges changed between 2013 and 2019. In Figure 7, we show trends in the number of certificates and associate degrees granted in the two-year system in Kentucky (see panel A). We display

the number of certificates conferred between 2013 and 2019 with red vertical bars. We observe that the number of certificates awarded grew by almost a third, whereas the number of associate degrees (dark blue vertical bars) awarded remained relatively flat. As a result of this growth in certificates and stagnation of associate degrees, in the most recent two years, about 75% of credentials conferred by community colleges were certificates in 2019. For comparison, we display a corollary national graph in Figure 7B. In contrast to Kentucky, about 55%-60% of sub-baccalaureate credentials awarded nationally in recent years were associate degrees. While the number of certificates awarded nationally also grew over this time period, and at a greater rate than the growth in national associate degrees, national certificate growth was substantially slower than in Kentucky.

Despite the growth of both associate degrees and certificates in Kentucky, we observe a decrease in enrollment during this period. We display trends in enrollment at public 2-year colleges in Kentucky between the 2013 and 2019 academic years in Figure 8A.<sup>4</sup> Community colleges in Kentucky experienced a steady decrease in fall enrollment during this period: the number of students enrolled in the public community college system dropped by about 15% from 2013 to 2019. This corresponds to a national decline of about 18% over this same period, as shown in Figure 8B. Therefore, even as the number of credentials granted increased, enrollment did not follow suit.

We also examine credits completed by students, using administrative postsecondary system records from the state of Kentucky since these data are not available in IPEDS. A limitation of these data, however, is that we currently have fewer years of data from this source, though we will update these data to a more recent year as data become available. These data indicate that in addition to enrollment declines, the total number of credits in which students enrolled in the Kentucky community college system declined by about 12% between 2014 and 2018. Credit trends differed by credential type. Between 2014 and 2018, the number

4 For consistency across years, we use fall enrollment from IPEDS.

of credits completed for certificates increased by 18%. During the same period, the number of credits completed for associate degrees dropped by 29%.

Overall, our analysis of trends in enrollment and credentials granted in the Kentucky public community college system indicates that there has been a shift in the academic credential pursuit of many community college students. The number of certificates conferred by the public community college system substantially increased whereas the number of associate degrees remained relatively flat. These changes were likely driven by the community colleges in Kentucky increasingly playing a larger role providing shorter and more discrete vocational education and job training programs. At the same time, however, enrollment in community colleges declined. As a result of these trends, the average number of credits completed per credential also declined. As such, even in the face of a growing number of certificates granted, the instructional burden on faculty may not have increased to the same degree.

## 4. The link between faculty composition & certificates granted

### 4.1 Sample summary statistics

We present summary statistics of our public community college samples from Kentucky and nationally in Table 1. These are weighted by institution (i.e., the moments are the average across all institutions, but not weighted for student enrollment). Kentucky institutions have slightly fewer total faculty and a greater percentage of non-tenure track faculty, but these differences are relatively small. The difference in the share of faculty who have the title of instructor is larger—about 17% of public community college faculty have the title of instructor in Kentucky, but the national rate is over two times larger. About a quarter of faculty in Kentucky do not have an advanced degree, and we do not have corollary national information on this characteristic. As described earlier, Kentucky institutions have a relatively high rate of certificate conferring, both in absolute number and in the share of credentials granted. Compared to their national peers, Kentucky institutions tend to have student bodies that have smaller shares of Black and Hispanic students, and a greater share of Pell Grant students.

### 4.2 Bivariate plots

Our primary goal is to understand the answer to the research question—*How did faculty change as credential attainment in short-term credential programs increased?*

We first construct bin scatter plots and display them in Figure 9. We organize the variable on the x-axis (number of certificates in panel A, % certificates in panels B, C, and D) into 20 equally sized groups, with each marker representing the average x-variable (number or percent certificates) and average y-variable (number of faculty, % non-tenure track, % instructors, or % without an advanced degree) within each bin. We also fit a quadratic line through the markers. First consider panel A, where we plot the number of faculty against the number of certificates. Unsurprisingly, we see that in places where there are more certificates, there are also a greater number of faculty; however, we cannot infer from this plot whether this positive relationship is driven by certificates specifically or if it could simply reflect colleges with larger enrollments. We dig deeper into this by controlling for enrollment and other types of credential awards in the next section.

Next consider panels B, C, and D where we plot the relationship between the percentage of credentials granted at the college that are certificates against the share of faculty that are non-tenure track, instructors, or without an advanced degree, respectively. In each of these cases, we note positive relationships: in places where there is a relatively high proportion of certificates granted, there are also greater proportions of tenure track professors, instructors, and faculty without an advanced degree. We present similar bin scatter plots for national public two-year institutions in Figure 10 and find similar descriptive relationships.

### 4.3 Estimation

To account for other factors that could affect our outcome variables, we next estimated a series of multivariate linear regressions. First, we analyzed the total count of faculty members, and next we examined three measures of the composition of faculty. For the latter, we specifically looked at the share of non-tenure track faculty, the share of faculty who have the title of Instructor (as opposed to Assistant Professor, Associate Professor, or Professor), and the share of faculty without advanced degrees (i.e., that has a certificate, associate degree, or bachelor's degree, as opposed to a master's degree or a doctoral degree).

We examine how trends in these measures of faculty correspond to credentials awarded. As more students pursue certificates, both in absolute value and as a share of total credentials, we would expect the workforce at these institutions to respond. We estimate specifications

of the following general form:

$$(1) Y_{ct} = \alpha + \beta_1 D_{ct} + \eta X_{ct} + d_t + d_c + \varepsilon_{ct}$$

where  $Y_{ct}$  is our measure of faculty at college  $c$  in year  $t$ . The primary independent variable of interest is  $D_{ct}$ , the number of certificates granted, which we standardize to have a mean of one and a standard deviation of zero. In alternative specifications, we also estimate fits where we convert this measure into shares (i.e., shares of certificates granted as a proportion of total credentials granted).

Our estimated parameter of interest,  $\beta_1$ , represents an estimate of how faculty change as the short-term certificate context changes. In the X-vector, with parameter vector  $\eta$ , we control for the following time-varying college characteristics: the total number of students enrolled; the share of the student body that identifies as female; the share that identifies as Black; the share that identifies as Hispanic; the share of full-time students and the share that received a Pell Grant. We include year fixed effects,  $d_t$ , to account for statewide trends that are common across colleges.  $\varepsilon_{ct}$  is the error term that we will cluster by college and  $\alpha$  is the intercept.

In some specifications, we add college fixed effects,  $d_c$ , to account for unobserved school characteristics that are stable over time. Though this addition has benefits for mitigating potential bias, it also comes at a cost of removing the interesting cross-institution variation from our analysis. Even though credentials granted have grown substantially over our time period, faculty changes have not been as rapid. Among our outcome variables of interest, about 88-93 percent of the variation in our Kentucky data is cross-sectional, while only about 5-7 percent is within institution variation over time (the remaining variation is the contribution of the national time trend). The exception to this is the instructor share, where we see larger within institution variation (roughly 28 percent). Therefore, while institution fixed effect estimates have nice features for mitigating some unobserved bias, they also come at the cost of absorbing much of the interesting cross-institution variation in our context.

Though we account for observed college characteristics and difference out college-specific time invariant characteristics through the college fixed effect in some specifications, bias could remain because of dynamic unobserved factors that could affect both the outcome and credential seeking. Therefore, we are careful not to ascribe causality to our findings. However, even

though further work is needed to be able to draw causal inference, we believe that findings from our analysis provide an important descriptive picture of how changes in credential seeking relate to changes in the higher education workforce.

#### 4.4 Results

In Table 2, we present the results of our regressions where we examine the link between the number of certificates and associate degrees conferred (in thousands) to the total number of faculty in community colleges in Kentucky (in columns 1 and 2) and nationally (in columns 3 and 4). In the first column, we report results from an estimate with controls related to the student body and year fixed effects. As the number of certificates granted increases, so too does the number of faculty at that institution. Specifically, for every standard deviation change in certificates (approximately 716 certificates), there are about 1.9 additional faculty, though this result is not precisely estimated. We see a larger link for associate degrees, with an unexpected sign: for every one standard deviation of additional associate degrees (approximately 317 associate degrees), there are 4.8 fewer faculty, but again, this estimate is not statistically significant. In column (2), we report the results of estimates from a regression with institution fixed effects. Here, the estimate for certificates attenuates to -0.4 more faculty with every standard deviation of certificates, and the coefficient gets larger for associate degrees, though neither parameter is estimated with precision. Recall that the unconditional link between awards and number of faculty is positive (see Figure 9), so the flipped signs suggest that a different factor may matter greatly, and in this setting, it appears to be enrollment.

The number of students enrolled seems to matter greatly for the number of faculty, and these results suggest that teaching loads likely matter more than credentials granted for the total number of faculty employed. Since in Kentucky awards have escalated while enrollment has generally declined, as previously documented, the growth in certificate awards seems to have not affected the total number of faculty, at least in the short term. Turning to national estimates without institution fixed effects in column 3 we see that the number of certificates is positively related to the number of faculty, though this result effectively becomes zero in column 4 with the addition of institution fixed effects. In national estimates, we also observe that the number of associate degrees



is positively related to the total number of faculty, as are enrollment and the proportion of full-time students.

In Table 3, we present estimates of faculty composition, specifically the percentage of non-tenure track faculty members, the percentage of instructors, and the percentage of faculty members with a degree at bachelor's level or lower.<sup>5</sup> Here we see evidence that in places with more prominent certificate granting, faculty is less likely to be tenure track, have an advanced degree, or have a professorial title. In Kentucky, a one percentage point change in the share of certificates conferred is associated with a 1.54, 0.53, and 0.62 percentage point change the share of non-tenure track faculty members, the share of faculty without a professorial title, and the share of faculty members without an advanced degree, respectively (see columns 1, 3, and 5). For all of the outcomes, these point estimates correspond to about three percent of the sample average. When adding institution fixed effects, all of these estimates attenuate to become closer to zero and are not statistically significant at conventional levels. We display corollary national estimates in the last four columns of the table. Here we see directionally similar relationships as in Kentucky, but the magnitude of these estimates is smaller: a one percentage point change in the share of certificates conferred is associated with a 0.47 and 0.27 percentage point change the share of non-tenure track faculty members and the share of faculty without a professorial title, respectively (see columns 7 and 9). As with the results from Kentucky, these results approximate zero when adding institution fixed effects.

#### 4.5 Limitations

Because there is no true exogenous variation in our setting, and because of threats earlier articulated, further research is needed to further eliminate potential bias to be able to draw casual inference in this setting. In ongoing work, we are exploring how plausibly exogenous state policies affected certificate granting and subsequently faculty composition. We also plan to supplement data on faculty in future analyses to better understand the implications of the rise of certificates on more detailed faculty characteristics (including part-time faculty),<sup>6</sup> job conditions and expectations (such as teaching online), and subsequently the composition of faculty bodies.

## 5. Discussion

This study broadens our understanding of conditions that can drive changes in faculty composition by analyzing data nationally and from Kentucky. Kentucky experienced a substantial growth in the number of short-term and vocational certificates awarded in recent years. Because certificate programs are commonly vocationally oriented, this trend has the potential to boost demand for faculty who can bring professional experiences and practical knowledge into the classroom, as opposed to more traditional research-heavy academic backgrounds. Further, enrollments in certificate and vocationally oriented short-term programs are likely to fluctuate in response to dynamic economic and labor market conditions. Therefore, postsecondary institutions may try to preserve their ability to adjust personnel as enrollment changes.

We found evidence suggesting that the growth in certificate programs is associated with a higher proportion of non-tenure-track faculty members, a higher share of faculty members without an advanced degree, and a higher percentage of instructors. The effect of such a shift on student outcomes is a ripe area for further exploration. However, having an increasing number of contingent faculty, has potentially negative implications for faculty, and more broadly scientific progress.

While the popularity of certificates appears to be linked to faculty composition changes, it did not correspond to growth in the total number of faculty. This may be because though certificate awards grew, enrollment and credits completed per credential contemporaneously declined. In such ways, it is possible that teaching demands—at least as measured by total number of students taught—did not change in our setting as credential offerings transformed. This does not mean, however, that instructional burdens declined, and more

5 In robustness checks, we estimate results using samples where we remove schools that have all of their faculty who take on a certain type (e.g., 100% of faculty are non-tenure track or 0% are instructors). Results from estimates without this restriction are typically attenuated relative to the unrestricted samples, though are directionally similar. These results are available upon request.

6 The analyses of faculty rank and tenure status are only applicable to full-time faculty composition because IPEDS provides information on faculty rank and tenure status only for full-time instructional faculty.

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than likely obligations increased for academic support staff (including advisors, financial aid professionals, and student affairs officers), many of which who were already stretched thin. This corresponds to prior work

that indicates that shifting to contingent faculty may save costs on faculty compensation but may not reduce overall compensation costs for institutions (Desrochers & Kirshstein, 2014; Hurlburt & McGarrah, 2016).

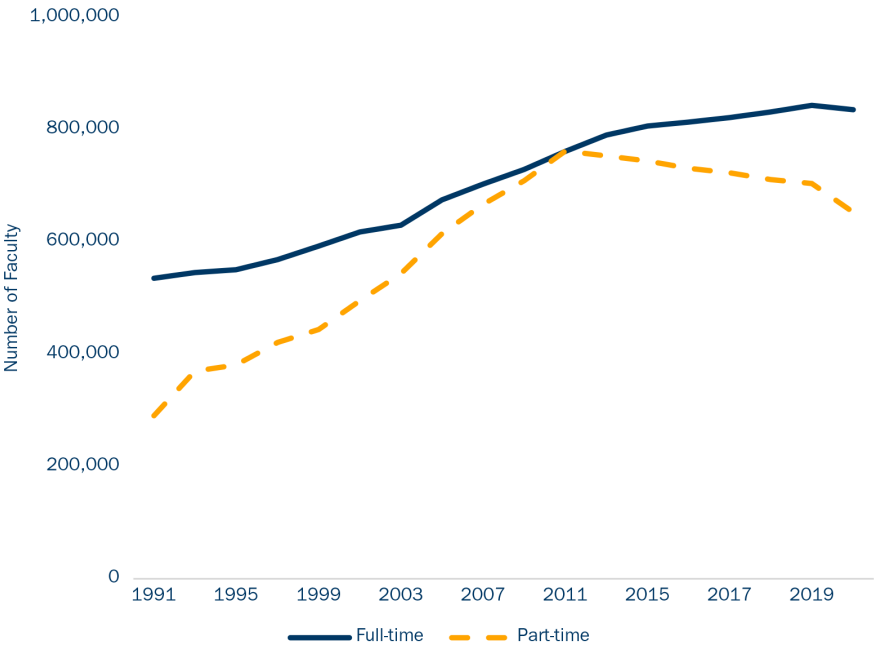
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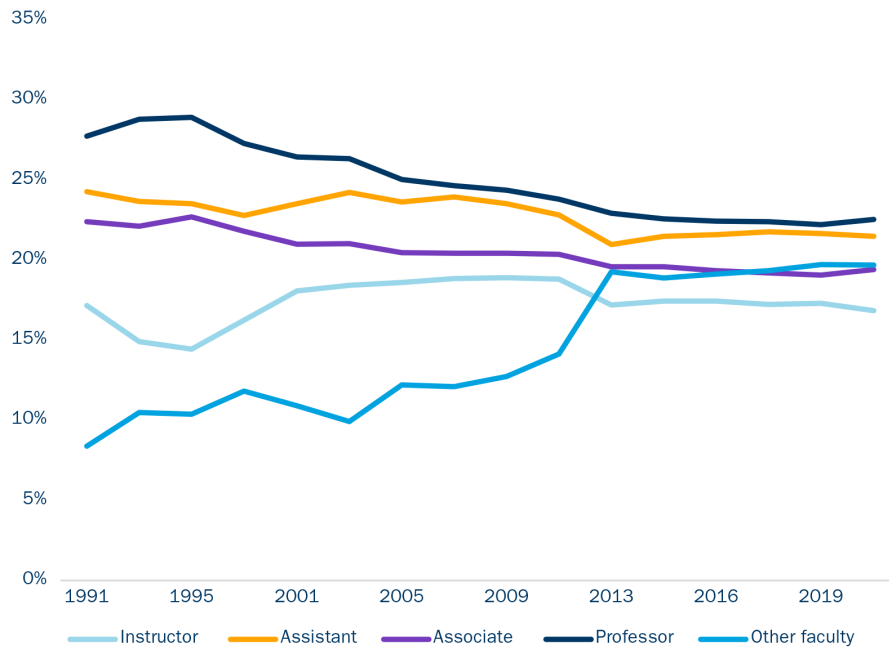
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Figure 1. National trend of full-time and part-time faculty



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), from 1991 to 2020. See Digest of Education Statistics, table 315.10. Note: This figure includes faculty members with the title of professor, associate professor, assistant professor, instructor, lecturer, assisting professor, adjunct professor, or interim professor (or the equivalent) for degree-granting institutions that grant associate's or higher degrees and participate in Title IV federal financial aid programs. Excludes graduate students with titles such as graduate or teaching fellows who assist senior faculty. Data prior to 2007 exclude institutions with fewer than 15 full-time employees.

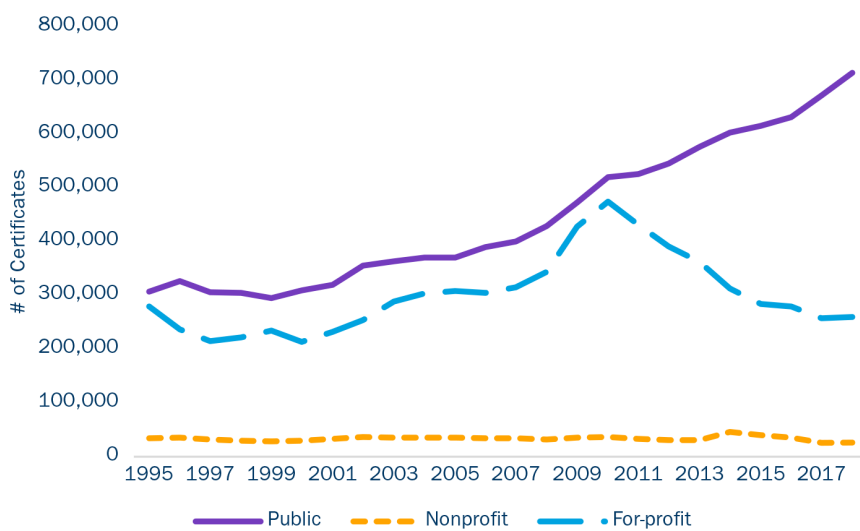
**Figure 2. National trend of full-time faculty rank**



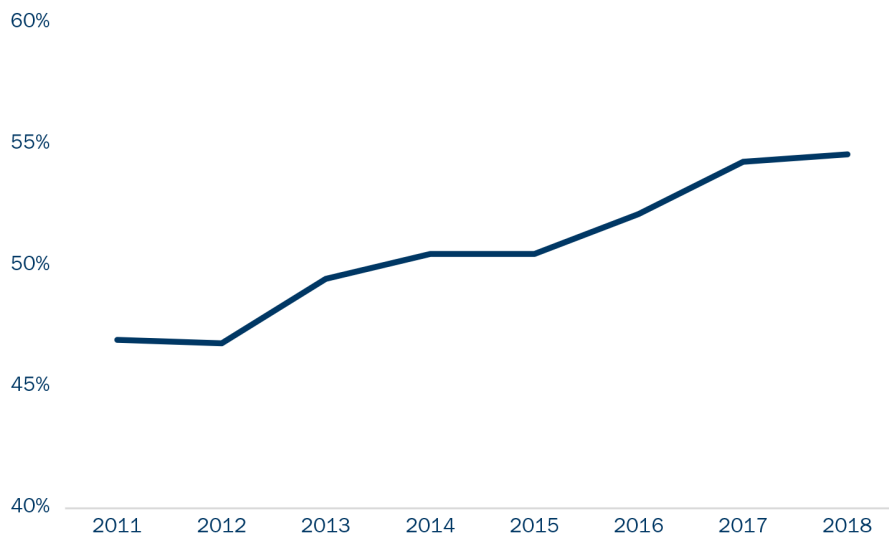
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 1991 to 2020. See Digest of Education Statistics Table 315.20. Note: The figure includes the number of full-time instructional faculty by rank for institutions that grant associate's or higher degrees and participate in Title IV federal financial aid programs. Primarily research and primarily public service faculty, as well as faculty without ranks, appear under "other faculty."

**Figure 3. National certificates trends**

(A) Certificates granted nationally



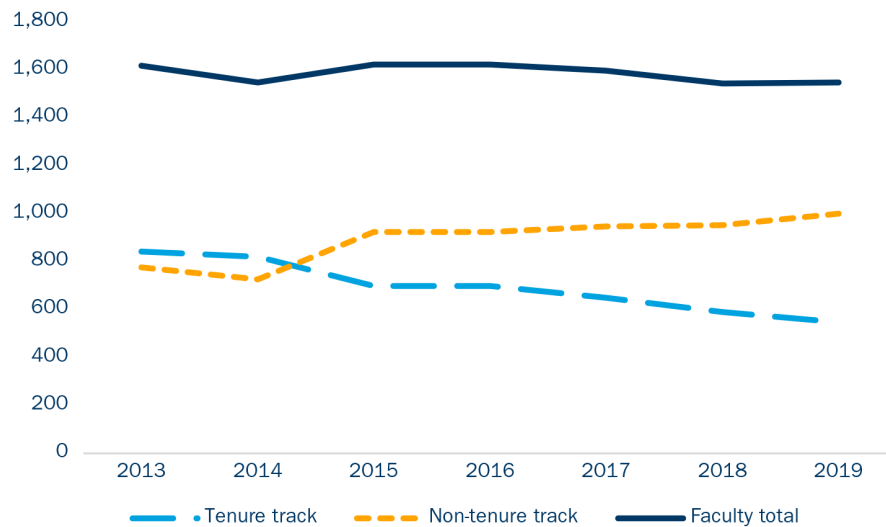
(B) Share of <1-year certificates granted nationally by length



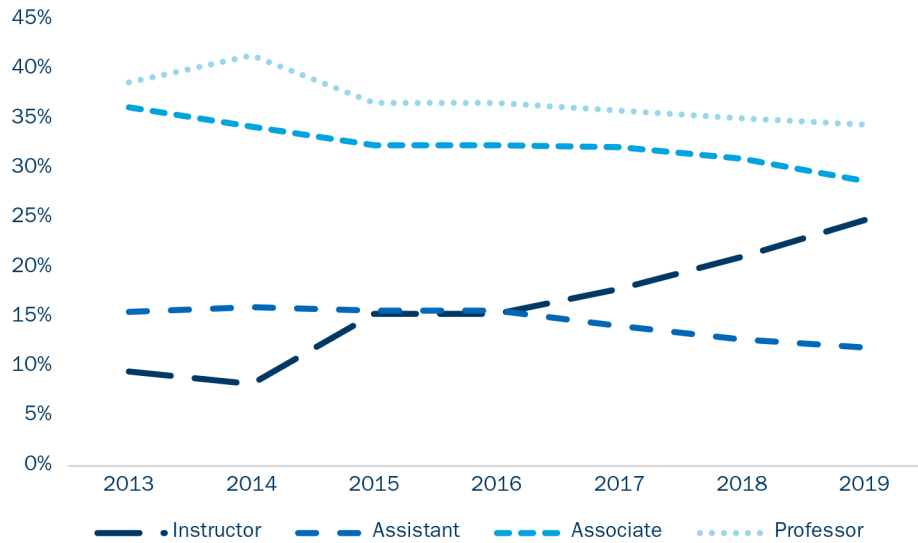
Source: Data for figure (A) comes from the Digest of Education Statistics 2020, Table 318.40. Data for figure (B) is from Digest of Education Statistics, Table 320.10 for each year. Note: The top figure presents trends in the number of certificates granted by institution type. The bottom figure presents trends in the number of certificates granted by certificate length. These figures include only postsecondary institutions that participate in Title IV federal financial aid programs. Certificate counts include both degree- and non-degree-granting institutions.

**Figure 4. Trends in faculty composition in the Kentucky two-year public institutions**

(A) Number of faculty members by appointment type



(B) Share of faculty members by rank

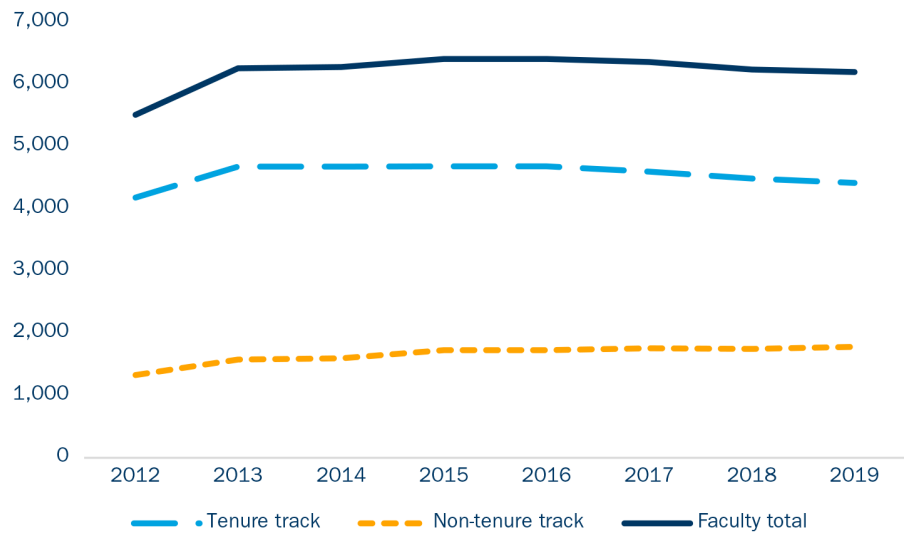


Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2013 to 2019. Note: The top figure presents trends in the number of faculty members by employment status in the Kentucky public community college system. The bottom figure presents trends in the number of faculty members by rank in the Kentucky public community college system.

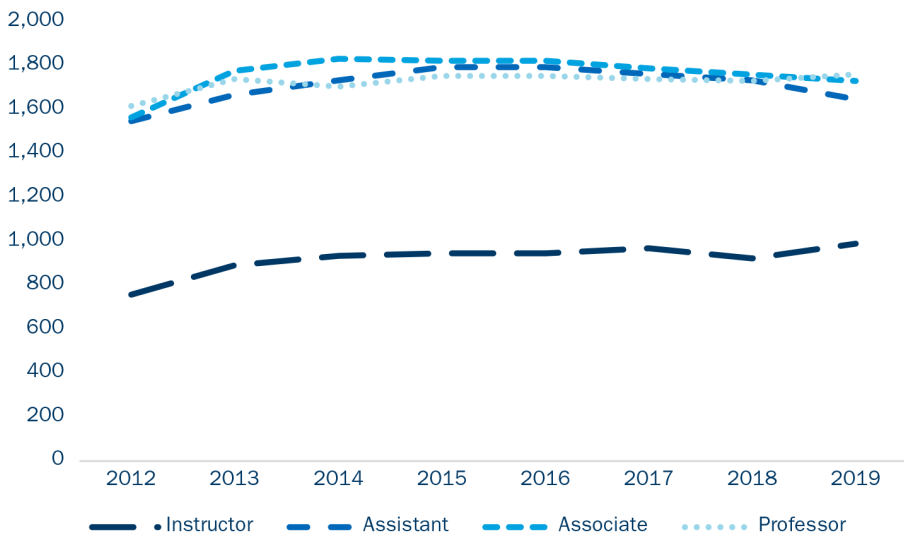


**Figure 5. Trends in faculty compositions in Kentucky four-year public institutions**

(A) Number of faculty members by appointment type

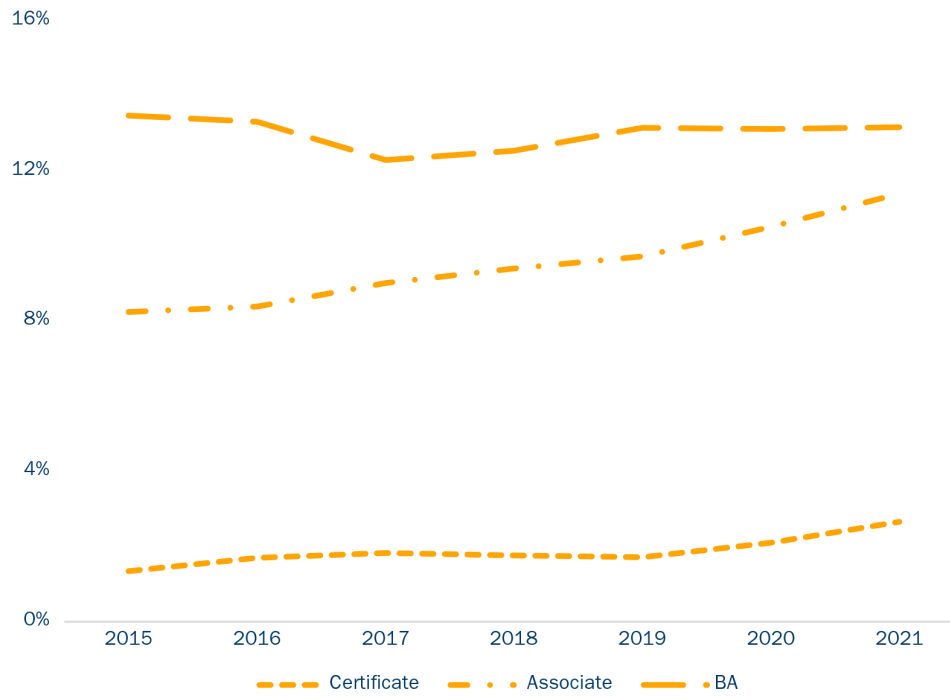


(B) Number of faculty members by rank



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019. Notes: The top figure presents national trends in the number of faculty members by employment status between 2012 and 2019. The bottom figure presents national trends in the number of faculty members by rank between 2012 and 2019.

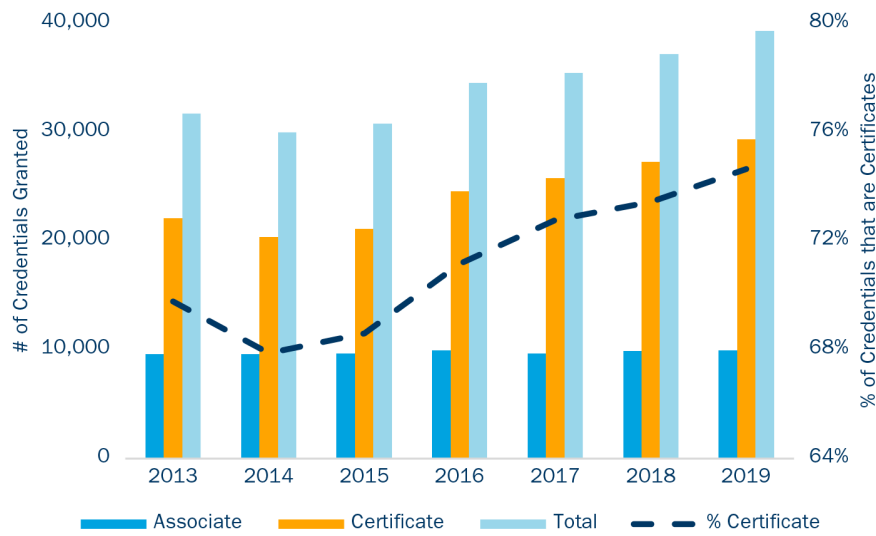
**Figure 6. Share of faculty members without an advanced degree in Kentucky two-year public institutions**



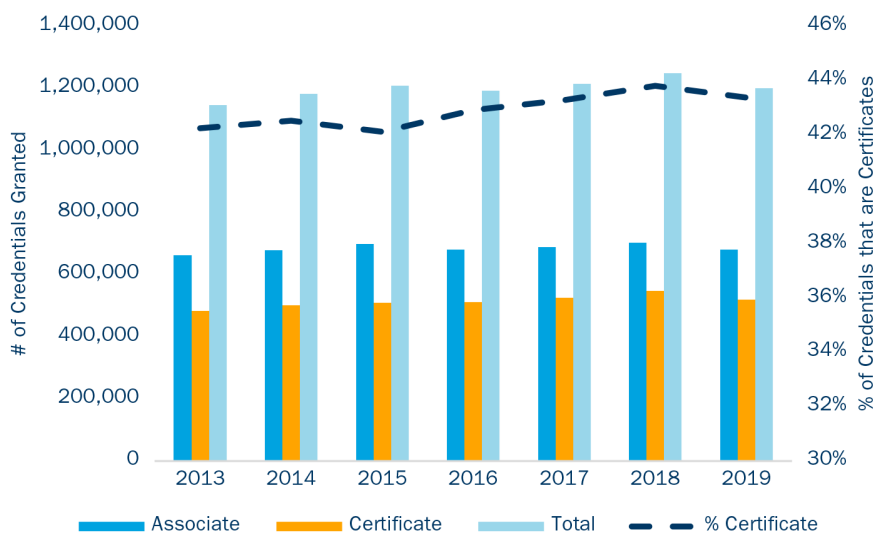
Source: Author calculations based on data from the Kentucky public community college system catalogs from 2015 and 2021. Share of Note: The figure presents trends in the share of faculty members by the highest degree they earned in the Kentucky public community college system between 2015 and 2021.

**Figure 7. Credentials granted by two-year public institutions**

(A) Kentucky



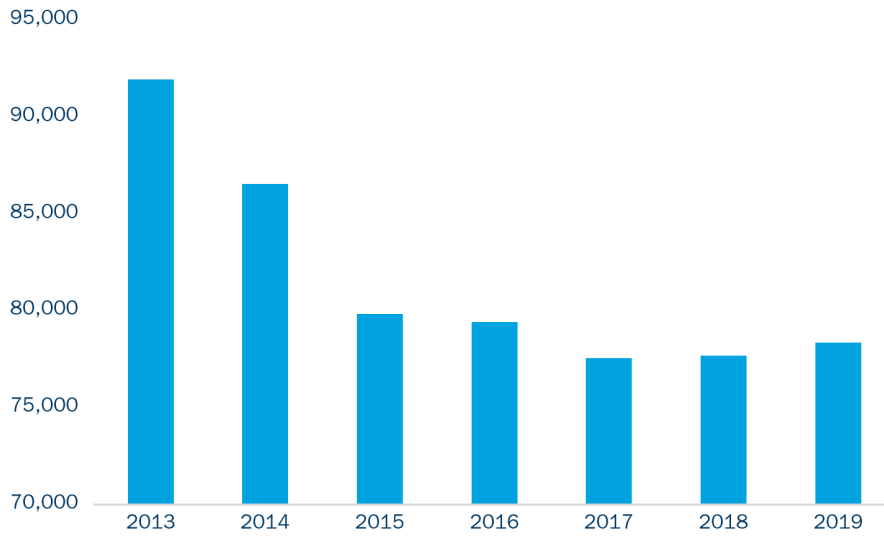
(B) National



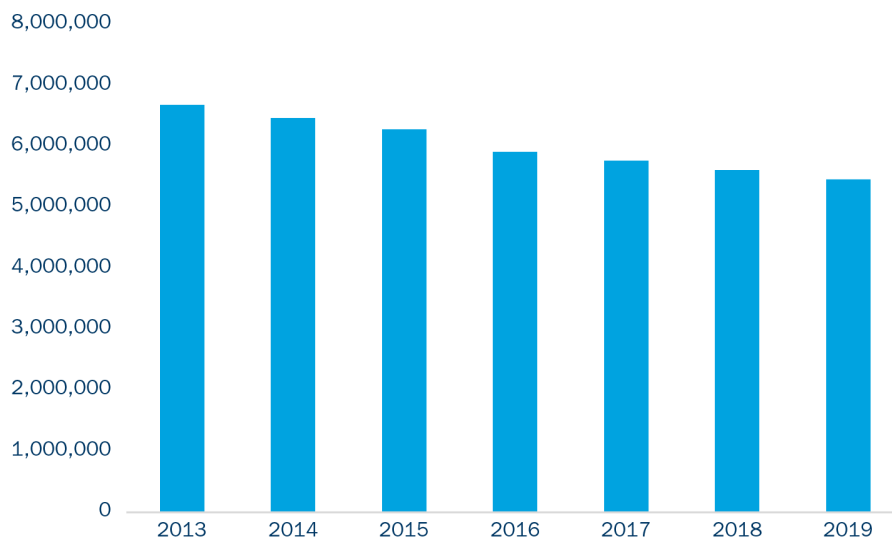
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2013 to 2019. Note: The top figure presents trends in the number of certificates and associate degrees and the percentage of certificates conferred by two-year public institutions. The bottom figure presents national trends in the number certificates and associate degrees and the percentage of certificates conferred by two-year public institutions. Calculations are based on the numbers of certificates in proportion to the total number of credentials by year.

**Figure 8. Fall headcount enrollment in two-year public institutions**

(A) Kentucky



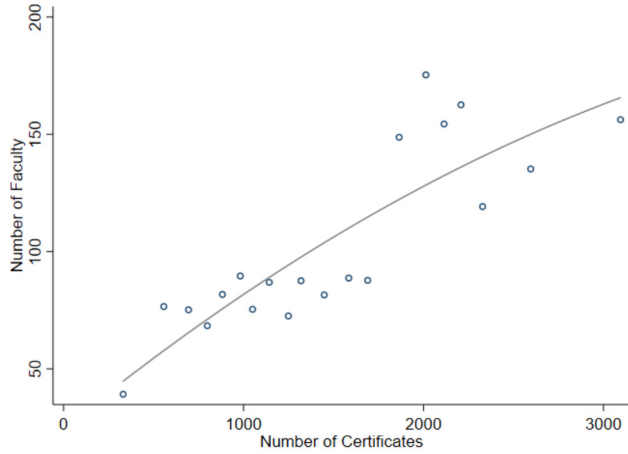
(B) National



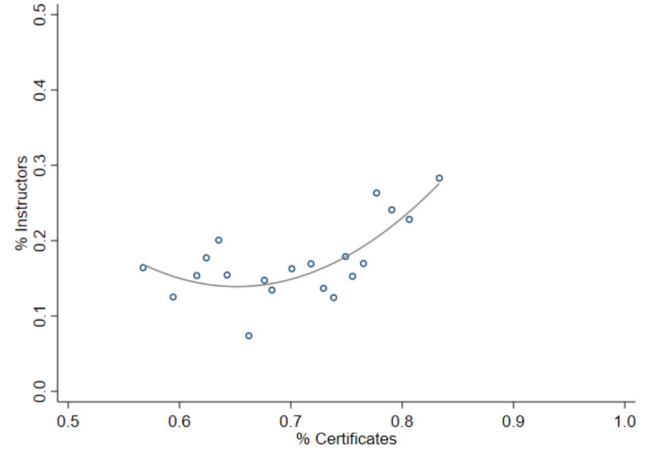
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2013 to 2019. Note: The top figure presents a trend in headcount enrollment in the Kentucky public community college system between fall 2012 and fall 2019. The bottom figure presents a national trend in headcount enrollment in two-year public institutions.

**Figure 9. Bin scatter plots - Kentucky two-year public institutions**

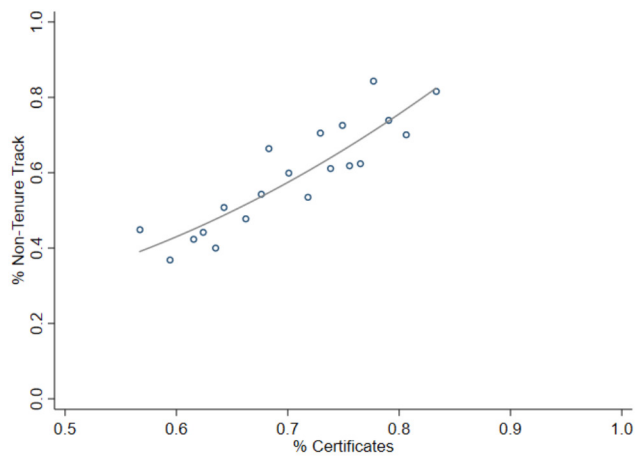
(A) Number of faculty



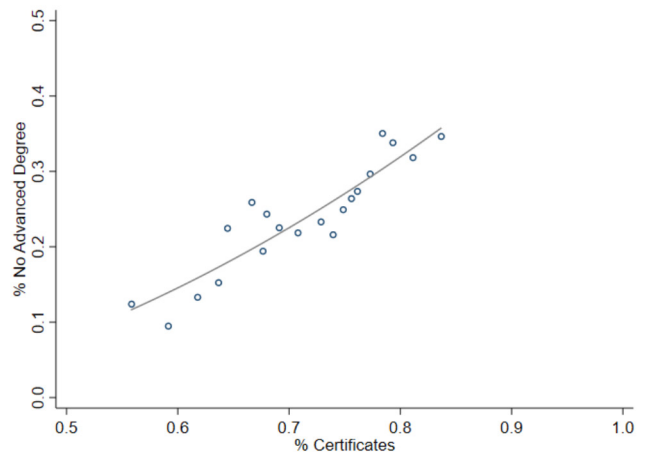
(C) % Instructors



(B) % Non-tenure track



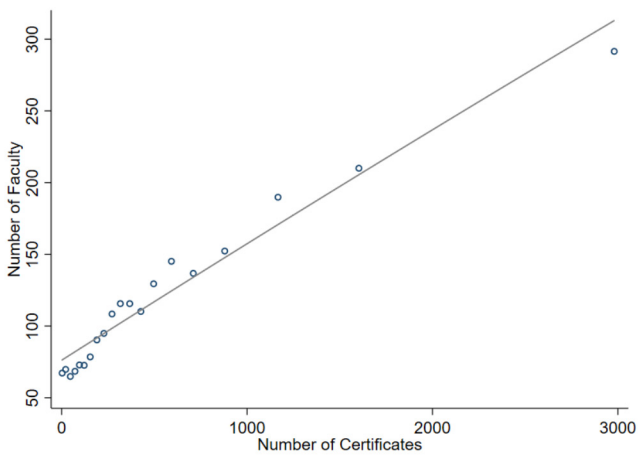
(D) % No advanced degree



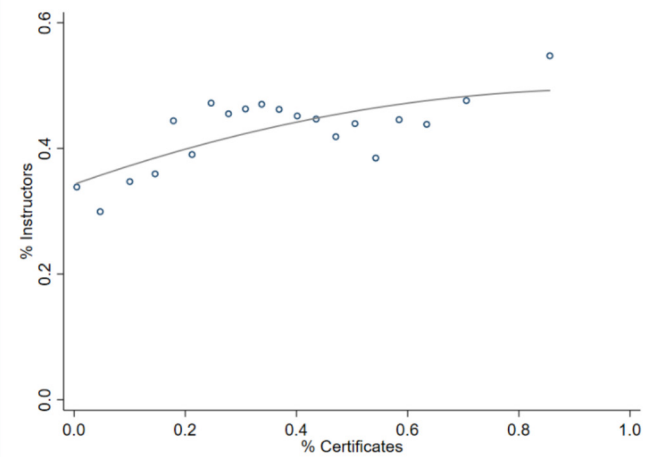
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019.  
 Notes: Line is a quadratic fit of 20 equally sized bins of the x-axis variable.

**Figure 10. Bin scatter plots – National two-year public institutions**

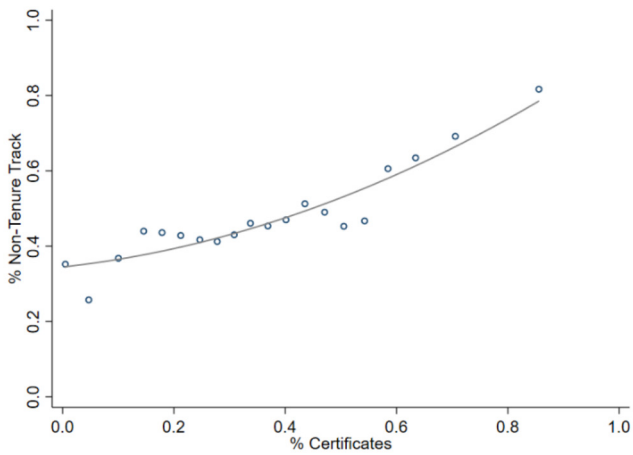
(A) Number of faculty



(C) % Instructors



(B) % Non-tenure track



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019.  
 Notes: Line is a quadratic fit of 20 equally sized bins of the x-axis variable.

**Table 1. Sample summary statistics – Two-year public institutions**

	Kentucky		National	
	Mean	Std. Dev.	Mean	Std. Dev.
# of Faculty	103	48	119	112
% Non-tenure track	59	21	48	46
% Instructors	17	10	43	43
% BA or Below	24	10	-	-
% Certificates	70	7	43	28
# Certificates	1484	716	508	771
# Associate Degrees	603	317	681	823
Enrollment	5226	2892	6119	7365
% Female	57	5	57	10
% Black	7	7	13	16
% Hispanic	3	2	16	19
% FT students	39	7	43	18
% Pell Grant	67	10	56	15

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019. The educational background of faculty comes from public community college system catalogs from 2015 to 2019.

**Table 2. Estimates of the number of faculty in two-year public institutions**

	Kentucky		National	
	(1)	(2)	(3)	(4)
# Certificates (std)	1.9	-0.4	5.7**	0.7
	(1.7)	(2.3)	(1.2)	(0.9)
# Associate Degrees (std)	-4.8	-10.3	20.9**	9.1**
	(5.1)	(6.0)	(3.4)	(2.3)
Enrollment (000s)	18.2**	17.6**	10.9**	4.7**
	(1.9)	(3.0)	(0.5)	(0.7)
% Female	0.9**	-0.1	0.2	0.0
	(0.2)	(0.4)	(0.1)	(0.1)
% Black	0.1	0.1	0.3**	-0.2
	(0.6)	(1.5)	(0.0)	(0.1)
% Hispanic	-3.2	-6.0**	-0.3**	0.3**
	(1.7)	(1.8)	(0.0)	(0.1)
% FT students	0.8**	1.6**	0.7**	0.3**
	(0.2)	(0.3)	(0.1)	(0.0)
% Pell	0.1	-0.3	0.0	-0.1*
	(0.2)	(0.3)	(0.0)	(0.0)
Year FE	X	X	X	X
Institution FE		X		X
Observations	128	128	6,508	6,508
R-squared	0.95	0.97	0.85	0.99

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019. The educational background of faculty comes from public community college system catalogs from 2015 to 2019. Notes: Each coefficient is from a separate linear regression. # Certificates and # Associate Degrees have been rescaled to have a mean of zero and a standard deviation of one. Robust standard errors are in parentheses.

\*\* p<0.01, \* p<0.05



**Table 3. Estimates of the composition of faculty in two-year public institutions**

	Kentucky						National			
	% Non-Tenure		% Instructors		% BA or Below		% Non-Tenure		% Instructors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
% Certificates	1.54**	0.19	0.53**	0.27	0.62**	0.01	0.42**	0.00	0.27**	0.03
	(0.23)	(0.14)	(0.11)	(0.20)	(0.12)	(0.11)	(0.02)	(0.01)	(0.02)	(0.03)
Enrollment	-2.33**	2.89*	-0.85**	0.77	-0.10	-1.23	0.11	0.27**	-0.16*	0.67**
	(0.51)	(1.30)	(0.24)	(1.30)	(0.26)	(1.33)	(0.08)	(0.07)	(0.07)	(0.20)
% Female	-0.98**	0.13	-0.03	0.14	-0.39*	-0.51*	0.69**	-0.16*	-0.45**	0.04
	(0.30)	(0.21)	(0.14)	(0.24)	(0.18)	(0.21)	(0.08)	(0.08)	(0.08)	(0.14)
% Black	-0.27	2.07*	0.50*	-0.21	-1.35**	0.43	-0.09*	0.03	-0.38**	0.18
	(0.69)	(0.87)	(0.24)	(0.89)	(0.45)	(0.58)	(0.04)	(0.06)	(0.04)	(0.15)
% Hispanic	3.01	0.82	0.59	0.39	2.63*	-1.48	-0.59**	-0.13	0.40**	0.04
	(1.92)	(1.20)	(0.59)	(1.40)	(1.19)	(0.74)	(0.03)	(0.08)	(0.03)	(0.12)
% FT students	0.40	-0.05	0.04	0.24	0.38**	-0.27	0.01	-0.04	0.12*	0.20**
	(0.26)	(0.17)	(0.09)	(0.18)	(0.13)	(0.15)	(0.04)	(0.03)	(0.05)	(0.07)
% Pell	-0.32	-0.06	-0.23**	-0.11	-0.09	-0.18	0.55**	0.04	0.02	-0.12*
	(0.19)	(0.21)	(0.08)	(0.25)	(0.10)	(0.15)	(0.04)	(0.02)	(0.05)	(0.06)
Year FE	X	X	X	X	X	X	X	X	X	X
Institution FE		X		X		X		X		X
Observations	128	128	128	128	80	80	6,506	6,506	6,506	6,506
R-squared	0.47	0.96	0.63	0.74	0.63	0.96	0.18	0.98	0.08	0.90

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) from 2012 to 2019. The educational background of faculty comes from public community college system catalogs from 2015 to 2019. Notes: Each coefficient is from a separate linear regression. Robust standard errors are in parentheses.

\*\* p<0.01, \* p<0.05

## About the authors

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Authors are alphabetically listed, and authorship is equally shared. Chuanyi Guo and Lucas Taulbee were instrumental in assisting with data and other research topics. All errors are our own. We are grateful for the generous support from the TIAA Institute. This research was supported by funding from the TIAA Institute. The content, findings and conclusions are the responsibility of the author(s) and do not necessarily represent the views of TIAA or the TIAA Institute.

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