

Leveled Playing Field: Higher Education during the COVID-19 Pandemic

A Study of College Scorecard Data

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Using data from the U.S. Department of Education’s College Scorecard, we examine retention and graduation outcomes for four-year institutions from 2017 to 2022. First-year retention declined by approximately 0.5 percentage points after the COVID, whereas six-year graduation rates increased by about 0.8 percentage points. Compared with the pre-COVID years, private institutions experienced significantly larger retention declines—approximately 1.5 percentage points more than public institutions during the initial post-pandemic year. Highly selective institutions also saw sharper disruptions, with greater selectivity associated with lower retention and graduation outcomes. In addition, higher-cost and resource-intensive institutions experienced disproportionately larger declines in student outcomes, suggesting that traditional institutional advantages did not translate into greater resilience during the pandemic. Overall, the findings highlight that the global pandemic temporarily leveled the playing field in higher education, as expensive and high-touch institutional support systems failed to provide resilience during this unprecedented shock.

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I. INTRODUCTION

The COVID-19 pandemic disrupted nearly every aspect of higher education, creating an unprecedented shock to instructional delivery, student support systems, and institutional operations. Beginning in March 2020, U.S. colleges and universities rapidly transitioned to remote learning, suspended in-person activities, and adapted to severe financial and logistical constraints. Faculty were required to redesign courses for online delivery with limited preparation, while students faced disruptions in housing, access to technology, and

learning environments. These abrupt changes posed significant challenges to student engagement and academic performance, particularly given the well-documented importance of in-person interaction in effective learning environments (Sun & Xu, 2018; Xu & Kumar, 2014). Consistent with these disruptions, prior studies report increased student attrition, psychological stress, and academic disengagement during the pandemic period (Aucejo et al., 2020; Means & Neisler, 2020).

Institutions responded with a range of adaptive strategies, including expanding online learning infrastructure, providing

emergency student support services, and implementing flexible grading policies. For example, more than 80% of institutions adopted expanded pass–fail options in Spring 2020 (AACRAO, 2020), and many introduced “hold harmless” policies to mitigate academic risk. While these measures helped stabilize student outcomes in the short term (Springer, 2023), their effectiveness varied substantially across institutions. Emerging evidence suggests that institutional characteristics—such as size, technological capacity, and organizational structure—played a critical role in shaping the ability to adapt to pandemic-related disruptions (Kim & Tamborini, 2021; Xu et al., 2022). These heterogeneous responses raise an important question: how do institutional features influence performance outcomes under large-scale disruptions?

From an operations and supply chain perspective, higher education institutions can be viewed as complex service systems that transform inputs—students, faculty labor, instructional resources, and support services—into outputs such as student retention and degree completion. The COVID-19 pandemic represents an exogenous shock that simultaneously disrupted multiple interconnected operational processes, including instructional delivery, student support, labor allocation, and campus infrastructure. Similar to disruptions observed in manufacturing and healthcare supply chains, the sudden shift to remote instruction exposed bottlenecks, coordination challenges, and capacity constraints in systems heavily reliant on in-person interactions. Within this framework, retention and graduation rates can be interpreted as operational performance metrics analogous to service throughput, quality, and system reliability. Examining how these outcomes respond to large-scale disruptions enables an assessment of institutional resilience, defined as the ability

of a system to absorb shocks, adapt processes, and recover performance (Christopher & Peck, 2004; Sheffi & Rice, 2005). Despite growing interest in resilience within operations and supply chain management, little empirical work has examined these concepts in the context of higher education service systems.

This study investigates the impact of the COVID-19 pandemic on retention and six-year graduation rates among four-year U.S. higher education institutions. Utilizing comprehensive institutional data from the U.S. Department of Education’s College Scorecard (U.S. Department of Education, 2023), the analysis spans the academic years 2017–2018 through 2022–2023 (AY2017-18 to AY2022-23), enabling a systematic comparison of pre- and post-pandemic trends. By focusing on full-time, first-time undergraduate students, the study identifies the effects of various institutional characteristics—such as size, selectivity, faculty composition, and financial indicators—on student persistence and degree completion.

We find that despite the challenges posed by the pandemic, first-year retention rates only display a modest drop of about 1% in AY2021-22, while graduation rates rose steadily in the post-pandemic period. Our panel regressions with institution fixed effect find that the average impact is approximately 0.5% decline in the retention rate, and 0.8% increase in the graduation rate in the post-COVID period, compared to the pre-COVID level. This pattern suggests that short-term persistence was more vulnerable to pandemic-related disruptions than long-term degree completion, which may have benefited from institutional flexibility and policy accommodations.

Beyond estimating the average impact of the COVID-19 pandemic, this study reveals substantial heterogeneity in how institutional characteristics shaped

student outcomes during and after the crisis. In particular, private, smaller, highly selective, and higher-cost institutions experienced sharper disruptions in both first-year retention and six-year graduation outcomes, whereas larger public institutions were comparatively less affected. Interaction estimates indicate that higher tuition levels amplified pandemic-related losses: a \$10,000 increase in total cost of attendance magnified the post-COVID decline in first-year retention by approximately 0.2 percentage points and was also associated with a 0.5 percentage point reduction in six-year graduation rates. Similarly, resource-intensive institutions experienced larger setbacks—higher instructional expenditures, faculty salaries, and tuition revenues were associated with steeper post-COVID declines in both retention and graduation outcomes. Highly selective institutions also faced disproportionate disruptions, with greater selectivity linked to lower retention and graduation rates in the post-pandemic period. In contrast, institutional size mitigated pandemic effects, as larger institutions retained and graduated more students during the immediate post-COVID years. Notably, faculty composition, measured by the share of full-time instructors, did not significantly moderate either retention or graduation outcomes. Taken together, these findings suggest that the COVID-19 pandemic temporarily leveled the playing field in higher education, diminishing the traditional advantages of wealth, selectivity, and high-touch in-person support systems under an unprecedented institutional shock.

This study contributes to literature in several ways. First, it extends operations and supply chain research by conceptualizing higher education institutions as complex service systems and examining their resilience under a large-scale exogenous shock. Second, it provides new empirical evidence on institutional characteristics—

such as cost structure, resource intensity, and organizational design—shape performance outcomes during and after disruption, using panel data with institution fixed effects to account for unobserved heterogeneity. Third, it documents substantial heterogeneity in institutional responses, showing that resource-intensive and highly selective institutions are more vulnerable to disruption, while larger institutions exhibit greater resilience. These findings offer new insights into how operational configurations influence system performance and adaptability under extreme uncertainty.

The remainder of the paper proceeds as follows. Section 2 reviews relevant research. Section 3 formulates research questions and hypotheses. Section 4 describes the sample and research design. Section 5 presents empirical results. Section 6 provides a conclusion and possible directions for future work.

II. LITERATURE REVIEW

Research on student persistence has been shaped by several complementary theoretical perspectives. Tinto's (1993) integration model emphasizes the role of academic and social integration in shaping student retention, while Astin's (1984) involvement theory highlights the importance of student engagement in academic and social activities. Extending these student-centered frameworks, organizational perspectives argue that institutional environments play a critical role in shaping student outcomes. In particular, Berger (2001–2002) and Berger and Milem (2000) conceptualize colleges and universities as organizations whose structural and resource characteristics influence students' opportunities for integration and success. More broadly, resource dependence theory suggests that organizational behavior is shaped by external constraints and resource

availability (Pfeffer & Salancik, 1978), providing a useful lens for examining how institutional characteristics influence performance outcomes.

Empirical research consistently shows that student-level characteristics—such as academic preparation, socioeconomic status, and financial aid—are key determinants of retention and graduation outcomes (Astin, 1993; Pascarella & Terenzini, 2005; DesJardins et al., 2002). Building on this foundation, a growing body of research has examined how institutional characteristics shape student persistence. Studies of structural features generally find that institutional size, selectivity, and control are associated with student outcomes, with more selective institutions exhibiting lower dropout rates and higher completion rates (Titus, 2004, 2006a; Kim, 2007; Gansemer-Topf & Schuh, 2006). However, these effects are often sensitive to model specification and may weaken once student composition and additional institutional factors are taken into account (Chen, 2012), suggesting that commonly used indicators such as selectivity may capture underlying differences in student populations or resource endowments rather than exerting independent causal effects.

A second stream of research focuses on institutional financial resources and expenditure patterns. While some studies find that spending on instruction and academic support improves retention and graduation outcomes (Ryan, 2004; Gansemer-Topf & Schuh, 2006), others report no significant effects (Titus, 2006a; Chen, 2012). Evidence on student services expenditures is particularly inconsistent, with findings ranging from positive effects on persistence (Astin, 1993; Webber & Ehrenberg, 2009) to negative or null effects depending on institutional context and empirical specification (Ryan, 2004; Gansemer-Topf & Schuh, 2006). Taken

together, these results suggest that institutional performance is shaped not only by the level of resources available but also by how those resources are allocated and integrated within organizational processes.

Empirical evidence on faculty composition remains limited. Some studies suggest that a higher reliance on part-time faculty is associated with lower retention rates (Ehrenberg & Zhang, 2005; Schibik & Harrington, 2004), but these findings are not consistently supported across settings. In addition, institutional cost factors—such as tuition levels and total cost of attendance—have received comparatively less systematic attention, despite their potential importance in shaping student persistence decisions and institutional performance.

Despite these advances, existing literature faces several important limitations. First, empirical findings remain fragmented and sometimes contradictory, reflecting differences in data sources, empirical strategies, and model specifications. Second, many studies rely on cross-sectional or short-panel designs, limiting the ability to capture dynamic responses to large-scale disruptions. Third, concerns regarding self-selection remain central. As noted by Chen (2012), students self-select into institutions based on unobserved characteristics such as ability, preferences, and financial constraints, while institutions differ in ways that are difficult to fully observe. Although multilevel and longitudinal approaches partially address these issues, fully accounting for selection bias remains challenging.

In addition to methodological constraints, prior research is also limited by data availability. Much of the existing literature relies on cohort-based datasets, such as the Beginning Postsecondary Students (BPS) surveys, which track a single cohort over a relatively short time horizon (e.g., Chen, 2012; Titus, 2004). While these datasets provide detailed student-level

information, they offer limited ability to examine how institutional characteristics evolve over time or how institutions respond to system-wide shocks. As a result, existing studies provide limited insight into how institutional structures and resource configurations affect performance under conditions of large-scale disruption.

These limitations highlight the need for a more comprehensive examination of how institutional characteristics shape performance outcomes in dynamic and uncertain environments. In particular, there is a need for research that integrates institutional-level operational factors with longitudinal data to better understand how system design, resource allocation, and organizational structure influence resilience and performance under large-scale disruptions. Building on these gaps, this study examines how the COVID-19 pandemic, as an exogenous shock, affects key performance outcomes in higher education, including both short-term persistence (first-year retention) and long-term outcomes (six-year graduation rates), as well as how these effects vary across institutional characteristics.

III. RESEARCH QUESTIONS AND HYPOTHESES

This study examines the effects of the COVID-19 pandemic on key measures of institutional performance in U.S. higher education. We focus on both short-term student persistence and long-term degree completion, which allows for the heterogeneity across institutional characteristics.

The two main research questions are as follows:

Q1. What is the effect of the COVID-19 pandemic on first-year retention rates at four-year U.S. higher education institutions?

Q2. What is the effect of the COVID-19 pandemic on six-year graduation rates at four-year U.S. higher education institutions?

To answer the above two questions, we formulate the following hypotheses:

H1. First-year retention rates declined in the post-COVID period relative to the pre-COVID period.

This hypothesis captures the average pandemic effect on short-term student persistence, corresponding to the coefficient on the *POST* indicator, which equals to one for academic years occurring after March 2020 and zero otherwise.

H2. The impact of the COVID-19 pandemic on first-year retention rates varies systematically with institutional characteristics, including institutional size, sector, selectivity, faculty composition, and financial resources.

This hypothesis motivates the interaction terms between *POST* and institutional characteristics in the retention model.

H3. Six-year graduation rates did not decline—and may increase—in the post-COVID period relative to the pre-COVID period.

This hypothesis reflects the delayed and potentially buffered response of long-term degree completion to pandemic disruptions.

H4. The impact of the COVID-19 pandemic on six-year graduation rates varies systematically with institutional characteristics, including size, sector, selectivity, faculty composition, and financial resources.

This hypothesis corresponds to the interaction specifications in the graduation-rate model.

IV. SAMPLE AND RESEARCH DESIGN

4.1. Sample and Data

This research draws upon the U.S. Department of Education's College Scorecard (U.S. Department of Education, 2023), a nationally recognized database that has been widely used in higher education research to study institutional performance, student success, and equity outcomes. The College Scorecard dataset provides annual measures of student access, cost of attendance, financial aid, institutional resources, and student outcomes. The database is particularly valuable for policy research because it standardizes reporting across institutions and years, which allows consistent comparisons and panel-data analysis.

For this study, we restrict our attention to four-year institutions where the bachelor's degree is the predominant credential. This restriction is critical for two reasons. First, the retention and six-year graduation metrics are most consistently reported for four-year institutions. Second, community colleges and certificate-granting schools often serve students with different enrollment patterns (part-time, transfer-

intended, commuter populations), which makes retention and graduation definitions less comparable. Similarly, graduate-only institutions are excluded because their outcome measures do not align with undergraduate persistence and completion.

The final sample period covers AY2017–18 through AY2022–23. This window allows us to capture multiple pre-pandemic years, the onset of COVID-19 in March 2020, and three full academic years afterward. By structuring the analysis this way, we distinguish between pre-pandemic baseline trends, immediate disruption effects, and medium-term adjustments made by institutions. Each academic year is labeled using the convention "AY". For example, AY2020-21 includes both Fall 2020 and Spring 2021 academic terms, which is the first full academic year shaped by COVID-19 campus closures, online instruction, and modified student services. Our final merged sample has 8945 observations, and 1568 institutions.

The following table summarizes the key sample selection process:

Selection Criteria	Description
Original Database	All Title IV participating institutions from the College Scorecard Database
Restriction to Four-year Undergraduate Primary Degree Institutions	Retain only institutions classified as four-year programs, with a primary focus on undergraduate degrees, not certificates, or graduate degrees.
Sample Period Restriction	Restrict to academic years included in the study (AY2017-18 to AY2022-23)
Exclusion of Missing Key Variables	The final sample contains 8,945 observations, and 1,568 institutions

4.2. Key Dependent Variables

Two primary dependent variables (operational performance indicators) are used to evaluate institutional performance:

1. Retention Rate

Retention is measured as the proportion of first-time, full-time

undergraduate students who remain enrolled in the institution one year after entry. It is a leading indicator of institutional quality and student engagement, as well as a predictor of long-term completion. For instance, the AY2020-21 retention rate captures students who began in the Fall 2019 and were still enrolled in Fall 2020, meaning they

experienced the transition into pandemic conditions only in Spring 2020. Conversely, AY2021-22 retention reflects students who began college during the pandemic itself (Fall 2020 and Spring 2021) and were still enrolled in Fall 2021. These measures provide an important test of how institutions supported new entrants under unprecedented events.

2. Six-Year Graduation Rate

Graduation rates are calculated as the proportion of first-time, full-time undergraduates completing a bachelor's degree within 150 percent of program time, or six years for a four-year degree programs. While this measure is slower to respond to shocks such as COVID-19, it captures the ultimate outcome of persistence and institutional effectiveness. Analyzing six-year graduation rates allows us to assess whether the pandemic-related disruptions in

instructional delivery, campus operations, and student support ultimately translated into long-term completion deficits.

4.3. Key Explanatory Variables

The empirical models investigating the determinants of student retention and six-year graduation rates employ a set of institutional, financial, and structural explanatory variables. These variables are primarily sourced from the U.S. Department of Education's College Scorecard (U.S. Department of Education, 2023) and are chosen for their theoretical and empirical relevance to higher education outcomes in the pre- and post-COVID-19 context.

The following table summarizes the list of institutional characteristics used in this study.

Category	Variable	Definition	Relevance to Study
Institutional Selectivity	<i>Admission Rate</i>	The proportion of applicants admitted relative to the total number of applicants in a given academic year.	Serves as a common proxy for institutional selectivity. Lower rates indicate more competitive institutions, which may correlate with stricter academic requirements and higher student preparedness.
Institution Size	<i>Undergraduate Enrollment</i>	The total headcount of undergraduate students enrolled in the prior academic year.	Captures the absolute scale of the student body.
Institution Size	<i>Size</i>	The natural logarithm of undergraduate enrollment.	Used to correct for skewness in the distribution.
Institution Type	<i>Private</i>	A binary indicator variable (1 = Private institution, 0 = Public institution).	Institutional control (public vs. private) shapes mission, governance, and funding, which has historically influenced student persistence and may mediate

			an institution's response to crisis.
Campus Type	<i>Main</i>	A binary indicator variable (1 = Main or primary campus of institution, 0 = Satellite or branch campus).	Main or satellite campuses may differ in instructional resources.
Cost of Attendance	<i>Total Cost</i>	The average annual total cost of attendance for full-time, first-time undergraduates, encompassing tuition/fees, books/supplies, and living expenses.	A critical determinant of student decision-making and persistence. COVID-19 likely amplified student sensitivity to financial burdens.
Institutional Resources	<i>Instructional Exp</i>	Instructional spending per full-time equivalent (FTE) student.	Reflects investment in teaching quality and academic infrastructure. Expected to correlate positively with student outcomes, though its role may have shifted during the transition to online learning.
Institutional Resources	<i>Pct_FT Faculty</i>	The percentage of faculty employed full-time.	Full-time faculty are typically more engaged in teaching and advising. Pre-pandemic evidence links higher proportions to better student outcomes, an effect potentially moderated during COVID-19.
Institutional Resources	<i>Faculty Salary</i>	The average monthly faculty salary.	Serves as a proxy for faculty quality, location costs, and institutional prestige, with likely indirect effects on student outcomes.
Institutional Resources	<i>Tuition Rev</i>	Tuition revenue (net of discounts/allowances) per FTE student.	Captures an institution's reliance on tuition and financial strength derived from tuition. This dependency may have influenced strategic responses (e.g., financial aid) during the pandemic.

4.4. Model Specifications

To examine the effect of the COVID-19 pandemic on institutional performance in higher education, we estimate a series of fixed-effects panel models using institution-level data. This framework allows us to isolate the impact of the pandemic while accounting for persistent differences across institutions that may jointly influence student outcomes and institutional characteristics.

For first-year retention rates, we estimate the following baseline and extended specifications:

$$\begin{aligned} \text{RETENTION RATE}_{i,t} &= \alpha + \beta \text{POST} + \gamma X_{i,t-1} + \mu_i \\ &+ \varepsilon_{i,t} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{RETENTION RATE}_{i,t} &= \alpha + \beta \text{POST} + \gamma X_{i,t-1} \\ &+ \theta(\text{POST} \times X_{i,t-1}) + \mu_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Similarly, for six-year graduation rates, we estimate the following models:

$$\begin{aligned} \text{GRADUATION RATE}_{i,t} &= \alpha + \beta \text{POST} + \gamma X_{i,t-1} + \mu_i \\ &+ \varepsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned} \text{GRADUATION RATE}_{i,t} &= \alpha + \beta \text{POST} + \gamma X_{i,t-1} \\ &+ \theta(\text{POST} \times X_{i,t-1}) + \mu_i + \varepsilon_{i,t} \end{aligned} \quad (4)$$

In these equations, i indexes higher education institutions and t indexes academic years. $\text{RETENTION RATE}_{i,t}$ and $\text{GRADUATION RATE}_{i,t}$ denote first-year retention rates and six-year graduation rates, respectively. POST is an indicator variable equal to one for academic years occurring after March 2020 and zero otherwise. The vector $X_{i,t-1}$ contains lagged institutional characteristics, including admission rate, undergraduate enrollment size, institutional control (public versus private), total cost of attendance, instructional expenditures per full-time equivalent student, the percentage of full-time faculty, average faculty salary, and net tuition revenue per student. The

interaction terms in equations (2) and (4) allow the effect of the COVID-19 pandemic to vary systematically with institutional characteristics, capturing heterogeneous institutional responses to the crisis.

The inclusion of institutional fixed effects, denoted by μ_i , is a central feature of the empirical strategy. These fixed effects control for all time-invariant institutional attributes—such as mission, governance structure, geographic location, historical reputation, and long-standing academic culture—that may influence both student outcomes and institutional resources. By absorbing these persistent characteristics, the fixed-effects specification ensures that identification relies on within-institution changes over time, thereby substantially reducing omitted-variable bias and improving causal interpretation. On the other hand, the R-squared values reported for the fixed-effects panel models primarily reflect within-institution variation over time, which is naturally limited in samples with relatively short time horizons or variables that exhibit little time variation.

Standard errors are clustered at the institutional level to account for potential serial correlation and heteroskedasticity in the error terms within institutions over time. In a panel setting where student outcomes such as retention and graduation rates exhibit strong persistence, failing to cluster standard errors could lead to underestimated standard errors and overstated statistical significance. Clustering by institution provides valid inference by allowing arbitrary correlation of the error terms within each institution across years.

All institutional control variables are lagged by one academic year to mitigate concerns about simultaneity and reverse causality. Institutional characteristics such as enrollment size, instructional expenditures, and faculty composition are typically

determined prior to the realization of student outcomes and therefore more accurately represent the institutional environment faced by students when persistence and completion decisions are made. Lagging these controls also strengthens the temporal ordering

between explanatory variables and outcomes, reinforcing the interpretation of estimated coefficients as reflecting the impact of pre-existing institutional conditions rather than contemporaneous adjustments.

V. EMPIRICAL RESULTS

5.1. Summary Statistics

The first step in our empirical analysis is to develop an overall understanding of the key variables used in the study. Panel A of Table 1 reports summary statistics for the dependent and independent variables. The table reports the mean, standard deviation, median, and the 25th and 75th percentiles of the variables. On average, the retention and graduation rates across all institutions are 75.5% and 57.3%, respectively. The mean admission rate is 68.1%, and 66.3% of the institutions in the sample are classified as private. The average undergraduate enrollment is 5,305 students per institution. The average annual total cost of attendance is \$37,984, while net tuition revenue per full-time equivalent (FTE) student averages \$14,144 and instructional expenditure per FTE student averages \$11,365. On average, 67.4% of faculty members are employed full-time, and the average faculty salary is \$8,122 per month.

Panel B reports annual averages of institutional performance and attribute variables from AY2017-18 to AY2022-23. Retention rates remained relatively stable during the pre-COVID period, ranging from 75.5% to 75.8%. They declined by 1% to 74.8%

in AY2021-22 but recovered to the pre-COVID level of 75.4% in AY2022-23. Six-year graduation rates increased by two percentage points, from 55.5% in AY2017-18 to 57.7% in AY2019-20. The rate remained stable at 57.7% in AY2020-21, then rose slightly to 58.1% in AY2021-22 and 58.2% in AY2022-23, respectively. From AY2017-18 to AY2020-21, average undergraduate enrollment rose steadily, but it began to decline in the post-pandemic period, showing the sharpest decrease of approximately 99 students per institution between AY2021-22 and AY2022-23. Admission rate data remained stable prior to AY2020-21 and then increased by approximately 2.5% per year during AY2021-22 and AY2022-23. The total cost of attendance increased steadily over the sample period, rising from \$35,667 in AY2017-18 by approximately \$1,000 per year through AY2021-22, before stabilizing in AY2022-23. Instructional expenditures per FTE also rose throughout the period, with the largest increase occurring between AY2019-20 (\$8,090) and AY2020-21 (\$8,235). Net tuition revenue per FTE followed a similar upward trend. Because the latter two variables are measured on a per-FTE basis, part of their increase may reflect the decline in the number of FTE students rather than higher total spending or revenues.

TABLE 1. SUMMARY STATISTICS
PANEL A STATISTIC

	<u>N</u>	<u>Mean</u>	<u>Std.Dev.</u>	<u>p25</u>	<u>p50</u>	<u>p75</u>
<i>Retention Rate</i>	8945	0.755	0.123	0.685	0.763	0.837

<i>Graduation Rate</i>	8945	0.573	0.181	0.451	0.569	0.696
<i>Admission Rate</i>	8945	0.681	0.205	0.568	0.711	0.831
<i>Private</i>	8945	0.663	0.473	0.000	1.000	1.000
<i>Main Campus</i>	8945	0.968	0.175	1.000	1.000	1.000
<i>Undergrad Enrollment</i>	8945	5305	7881	1107	2180	5919
<i>Size</i>	8945	7.830	1.219	7.009	7.687	8.686
<i>Total Cost</i>	8945	37.984	16.385	23.507	36.249	49.741
<i>Instructional Exp</i>	8945	11.365	9.327	7.042	9.285	12.582
<i>Pct_FT Faculty</i>	8945	0.674	0.251	0.490	0.687	0.907
<i>Faculty Salary</i>	8945	8.122	2.494	6.497	7.715	9.377
<i>Tuition Rev</i>	8945	14.144	7.725	8.406	12.881	17.912

PANEL B STATISTIC

	AY2017	AY2018	AY2019	AY2020	AY2021	AY2022
<i>Retention Rate</i>	0.755	0.756	0.758	0.759	0.748	0.754
<i>Graduation Rate</i>	0.555	0.566	0.577	0.577	0.581	0.582
<i>Undergrad Enrollment</i>	5,273	5,313	5,344	5,336	5,330	5,231
<i>Admission Rate</i>	0.654	0.664	0.668	0.676	0.701	0.725
<i>Total Cost</i>	35.667	36.731	37.690	38.705	39.616	39.573
<i>Instructional Exp</i>	7.806	7.932	8.090	8.235	8.283	8.398
<i>Tuition Rev</i>	13.820	14.016	14.180	14.243	14.375	14.241

The rising admission rates and declining enrollments have been observed and reported during the years immediately after the pandemic. After the COVID-19 pandemic, the U.S. experienced a significant labor shortage that coincided with a steep drop in college enrollment. According to the National Student Clearinghouse Research Center (2023), undergraduate enrollment fell by nearly 1.4 million students between 2019 and 2022, with community colleges seeing the sharpest decline—down almost 21%. Many young adults opted to enter the workforce directly, drawn by rising wages and abundant job openings in industries like

retail, logistics, and healthcare. The College Board (2023) also reported that college-going rates among high school graduates dropped notably in 2020 and 2021, reflecting a shift in priorities as families grappled with financial uncertainty and pandemic-related disruptions.

To counteract these enrollment losses, universities across the country increased their admission rates in an effort to stabilize tuition revenue and maintain operational viability. Institutions expanded outreach, relaxed standardized testing requirements, and admitted more students to avoid falling below financially sustainable thresholds. Despite these efforts, total undergraduate

enrollment remained below pre-pandemic levels, with only a modest 1.2% rebound in 2023–2024 (Higher Education Today, 2024; Urban Institute 2024). The combination of labor market dynamics and shifting student preferences forced higher education

institutions to respond strategically to sustained enrollment pressures.

TABLE 2. PERSON CORRELATIONS

	<i>Tuition Rev</i>	<i>Faculty Salary</i>	<i>Pct_FT Faculty</i>	<i>Instructional Exp</i>	<i>Total Cost</i>	<i>Size</i>	<i>Main</i>	<i>Private</i>	<i>Admission Rate</i>	<i>Graduation Rate</i>
<i>Retention Rate</i>	0.391	0.586	0.156	0.460	0.362	0.361	0.132	-0.032	-0.287	0.746
<i>Graduation Rate</i>	0.548	0.637	0.148	0.534	0.577	0.277	0.162	0.131	-0.337	1.000
<i>Admission Rate</i>	-0.319	-0.363	-0.085	-0.476	-0.320	-0.016	-0.063	-0.160	1.000	
<i>Private</i>	0.544	-0.191	-0.138	0.093	0.688	-0.618	-0.013	1.000		
<i>Main Campus</i>	-0.032	0.028	0.139	0.094	0.083	0.134	1.000			
<i>Size</i>	-0.087	0.554	0.140	0.124	-0.219	1.000				
<i>Total Cost</i>	0.804	0.361	-0.007	0.467	1.000					
<i>Instructional Exp</i>	0.477	0.657	0.124	1.000						
<i>Pct_FT Faculty</i>	-0.062	0.113	1.000							
<i>Faculty Salary</i>	0.447	1.000								

We performed a Pearson correlation analysis on the variables used in this study. As shown in Table 2, the correlation between the first-year retention rate and the six-year graduation rate is 0.75, suggesting that although these two indicators capture distinct dimensions of institutional performance, they share a considerable degree of common variation. Measures of institutional resources, such as instructional expenditures per FTE, net tuition revenue per FTE, and average faculty salaries, are positively associated with both retention and graduation rates. These results suggest that better-resourced institutions are able to provide higher-quality instruction, stronger student support services, and more developed academic infrastructure, all of which promote student persistence and degree completion. Admission rates are negatively correlated with both retention and graduation rates, indicating that more selective institutions—those admitting a smaller proportion of applicants—tend to achieve higher levels of student retention and

degree completion. Total cost of attendance is also positively associated with both performance measures, implying that institutions with higher tuition and living costs may offer superior academic resources and student support. Although private institutions exhibit weaker correlations with both performance measures, they also tend to be smaller in size and characterized by higher costs and greater tuition revenue per student.

5.2. Regression Study: Retention Rates

This section examines the impact of COVID-19 and institutional characteristics on the performance measure of *Retention Rate* (Hypotheses 1 and 2), following equations (1) and (2), using the entire six-year sample, which includes three years prior (AY2017-18, AY2018-19, and AY2019-20), and three years (AY2020-21, AY2021-22 and AY2022-23) after the COVID event in March 2020. The results are reported in Tables 3, 4 and 5.

We first examine Hypothesis 1 (H1), which predicts a decline in first-year retention rates in the post-COVID period. As shown in Column (1) of Table 3, the coefficient on the *POST* indicator is -0.0054 and statistically significant, indicating that retention rates were, on average, 0.54 percentage points lower in the post-COVID period compared to the pre-COVID period. This finding provides support for H1. Given that the average retention rate is 75.5%, this represents a relative drop of about 0.72%. For an average institution with an enrollment size of 5,305 students (see Table 1), a 0.54% drop is approximately 29 fewer students returned for their sophomore year due to the pandemic effect.

Column (1) of Table 3 also shows that first-year retention rates in private institutions, on average, have retention rates that are 9.79 percent lower compared to their public counterparts, equivalent to 519 fewer returning students.

Main campuses exhibit retention rates that are 4.5 percentage points higher than those of satellite or branch campuses, corresponding to roughly 239 additional retained students.

The coefficient on *Total Cost* is -0.0011. For a \$10,000 increase in total cost of attendance, retention drops by 1.1 percent, which translates to 58 fewer returning students. This suggests that financial burden is part of the reason for students quitting college early.

The coefficient on institution *Size* is -0.0313. As *Size* is log-transformed, a 10% larger student enrollment is linked to a 0.0031 drop in retention ($0.0313 \cdot \log(1.10)$), that is, a 0.31 percent point drop. For an institution with 10,000 students, being 10% larger (of 11,000 students) is translated to 31 fewer retained students. The results suggest that larger institutions—characterized by more diverse student populations—may face a higher likelihood of mismatches between

students and institutional environments. In contrast, smaller institutions, often offering more specialized or closely aligned academic programs, may achieve stronger student-institution fit and consequently higher first-year retention rates.

For the baseline results in Column (1) of Table 3, we find that the following institutional characteristics are statistically insignificant: Admission rate, instructional expenditures, percent of full-time faculty, average faculty salary, and tuition revenues.

Next, we examine Hypothesis 2, which predicts the impact of the COVID-19 pandemic on retention rates varies with institutional characteristics. Following Equation (2), we include institutional characteristics, the *POST* indicator, and interaction terms between *POST* with institutional characteristics. The results are reported in Table 4 and provide support for H2, indicating systematic variation in retention rates across institutional characteristics. The estimated effects of institutional characteristics are qualitatively similar to those reported in Column (1) of Table 3. For brevity, these coefficients are omitted from Tables 4, 5, 7, and 8.

As shown in Column (4) in Table 4, the coefficients on the interaction between *POST* and total cost of attendance is -0.0002, and is statistically significantly at the 5 percent level. This means that for every \$10,000 additional cost of attendance, the negative impact of the COVID-19 period on retention was magnified by an additional 0.2 percent point, equivalent to about 11 fewer retained students in more expensive institutions, given an average institutional size of 5,305 students. This suggests that higher education expenses during COVID-period exacerbated financial strains and affordability concerns faced by students, particularly as the pandemic disrupted campus life, intern and employment opportunities, and the perceived value of in-

person education. In addition, the hot labor market during the time increased the opportunity cost of attending college.

We find that several institutional resource measures are negatively associated with student retention rates in the post-COVID period. As shown in Column (5) of Table 4, the coefficients on the interaction between *POST* and instructional expenditure is -0.0003, and statistically significant at 1 percent level. This suggests approximately 16 fewer retained students for every \$1,000 increase in instruction expenditure per student during post-COVID period. Column (7) and (8) of Table 4 report -0.0021 and -0.005 coefficients for the interaction between *POST* and average faculty salary, and the interaction between *POST* and tuition revenue, respectively. For an increase of \$1,000 in tuition revenue per student, and an increase of \$1,000 average monthly faculty salary in the post-COVID period, there would be an additional 0.5 and 2.1 percentage points drop in student retention. Prior to the pandemic, many of these institutions had invested heavily in personalized, face-to-face learning environments and robust in-person support systems—such as dedicated academic advising centers, peer mentoring programs, and wellness services embedded in campus life—which had proven effective in enhancing student persistence. However, when the pandemic forced a rapid shift to remote and online learning, these high-touch, in-person capabilities became largely irrelevant or inaccessible. As a result, the retention advantage once held by resource-rich institutions diminished, leading to a deeper drop from their previously higher baseline. This phenomenon reflects a leveling of the playing field in higher education, where traditional strengths no longer guarantee resilience in a disrupted learning landscape.

As shown in Column (6) of Table 4, the composition of faculty, including the

proportion of full-time instructors, has no statistically significant effect on retention rates in the post-pandemic period. This finding aligns with the broader observation that the challenges introduced by the pandemic—such as the abrupt shift to remote instruction, diminished student engagement, and reduced access to campus-based support—affected both full-time faculty and part-time lecturers alike. Regardless of employment status, instructors faced similar constraints in adapting their teaching methods and maintaining meaningful connections with students in a virtual environment. As a result, the traditional advantage of institutions with a higher share of full-time faculty was neutralized, further contributing to the leveling of the playing field across higher education.

In addition, as seen in Column (1), (2), and (3) in Table 4, factors such as main campus status, institution size, and public versus private designation did not show significant effects on retention rates in the post-COVID period compared to pre-pandemic levels. While these variables typically contribute to student outcomes in broader regression models, their influence appears to have diminished during the pandemic. Institutions that once benefited from centralized resources, larger infrastructures, or distinct public/private advantages were equally challenged by the sudden shift to remote learning and the breakdown of traditional support systems. This further reinforces the notion that the pandemic leveled the playing field in higher education, neutralizing structural advantages and exposing a shared vulnerability across diverse institutional types.

In contrast to pre-pandemic evidence, our results reveal a shift in how institutional characteristics relate to student persistence. Consistent with prior studies, financial burden remains negatively associated with retention (Ryan, 2004; Chen, 2012).

However, unlike earlier findings that link higher selectivity and greater resource intensity to improved retention outcomes (Titus, 2004; Gansemer-Topf & Schuh, 2006), we find that these advantages weakened during the COVID-19 disruption. Resource-intensive and highly selective institutions experienced larger declines in retention, indicating that their traditionally high-touch, in-person operational models were less adaptable to remote environments. This pattern highlights that institutional performance depends not only on resource levels but also on the flexibility and scalability of underlying operational processes, particularly under conditions of system-wide disruption.

Next, we reexamine the baseline COVID effect and additional impact of institutional characteristics on student retention using a four-year subsample, which includes three years prior to the COVID-19, and one year (AY2020-21) immediately following its onset. If the impact of COVID was transitory, it may have diminished quickly over the subsequent three-year post-pandemic period. This subsample therefore captures the immediate effects of the COVID-19 that are not evident over a longer post-COVID horizon. The baseline estimates of the COVID-19 impact on retention rates for this subsample are reported in Column (2) of Table 3 and are highly similar to those obtained from the entire six-year sample reported in Column (1) of Table 3. The main campus indicator was dropped due to a lack of variation in four-year subsample. The *POST* indicator has a t-value of 1.59.

The results of the impact of additional institutional characteristics and post-COVID indicator variable for four-year subsample are presented in Table 5. As seen in Column (3), (4), (6), and (7), the interaction terms between the *POST* indicator and cost attendance, instructional resource variables such as instructional expenditure, average

faculty salary, and tuition revenue are qualitatively similar to those reported in Table 4. In addition, Table 5 reports additional impact from institutional selectivity, institution control type, and institution size on student retention, which shows up during the first academic year after COVID, but not found in the longer post-COVID sample period (Table 4).

As shown in Column (8) of Table 5, the coefficient on the interaction between institution size and the *POST* interaction is 0.0038. A one-standard deviation increase in institution size—for example, an increase from an enrollment of 2,180 students to 7,379 students—is associated with approximately 34 additional retained students during the initial pandemic period relative to a smaller peer institution. This pattern may reflect the greater capacity of large institutions to provide academic, financial, and psychological support, as well as technological infrastructure and flexible instructional delivery, helping students better cope with the disruptions caused by the pandemic.

As reported in Column (2) of Table 5, the coefficient on the interaction between private and the *POST* indicator is -0.0152. For an average institution with an enrollment size of 5,305, private institutions experienced about 81 fewer students in the AY2020-21, compared to public counterparts. This finding suggests that the organizational structures and financial models of private universities may have limited their ability to provide adequate support for first-year students during the disruptions caused by the COVID-19 pandemic. Public universities generally benefited from greater access to state and federal emergency funding and could rely on larger administrative and technological infrastructures to support remote learning and student services. In contrast, private institutions, which are typically more tuition-dependent and operate

with less public financial support, may have faced stronger budget constraints and staffing limitations that hindered their ability to assist first-year students effectively during the crisis.

Also in Column (1) of Table 5, the coefficient on the interaction between admission rate and the *POST* indicator is 0.0394. For a 10-percentage drop in admission rate, this suggests about 21 fewer retained students in a more rigorous institution in the initial period of the pandemic. These institutions, which traditionally benefit from strong academic reputations and high-achieving student populations, were not immune to the disruptive effects of the pandemic. The academic and psychological challenges introduced by remote learning, social isolation, and uncertainty compounded the already demanding nature of these environments, making it more difficult for new students to adapt and persist. As a result, the retention advantage typically associated with selectivity eroded, reinforcing the broader trend of a leveled playing field across higher education during this period of upheaval.

5.3. Regression Results: Graduation Rates

In this section, we assess the impact of COVID-19 pandemic on another important performance measure: six-year graduation rates. We first examine Hypothesis 3 (H3), which predicts that six-year graduation rates did not decline and may increase following the pandemic. Table 6 reports the baseline effect of COVID in the entire six-year sample (Column 1) and four-year sample (Column 2), respectively. As shown in Column (1) of Table 6, the coefficient on the *POST* indicator is 0.0084 and statistically significant at the 1 percent level. This increase translates to an improvement of about 1.47% in the average

six-year graduation rate (57.3%) during the post-COVID period. The positive and significant *POST* coefficient provides strong support for H3, suggesting that longer-term degree completion was not adversely affected and may have benefited from institutional flexibility and policy adjustments, such as expanded pass–fail grading options adopted by more than 80% of institutions (AACRAO, 2020).

We then turn to Hypothesis 4 (H4), which predicts that the impact of COVID-19 on graduation rates varies systematically across institutional characteristics. Table 7 presents the interaction effects of COVID with institutional features, including selectivity, control type, size, cost of attendance, and institutional resources. The results provide strong support for H4, indicating substantial heterogeneity in post-COVID graduation outcomes across institutions.

Specifically, in Column (9) of Table 7, the coefficient on the interaction between size and *POST* indicator is 0.006, implying a 0.73 percentage points (1.3 percent) increase in graduation rate for one standard deviation increase in institution size. Column (2) in Table 7 shows the six-year graduation rate is about 1.43 percentage points (2.5 percent reduction) lower at private institutions compared with the public counterparts. This suggests that resources in larger, public institutions provide an additional boost in facilitating degree completion after the pandemic, compared to their counterparts.

Just as higher costs of attendance were linked to sharper declines in first-year retention during the post-COVID period, six-year graduation rates also declined more steeply at higher-cost institutions following the onset of the pandemic. As shown in Column (4) of Table 7, the coefficient on the interaction between cost and *POST* is -0.005, implying a reduction of 0.5 drop (0.87 percent reduction) in six-year graduation

rates for an increase of \$10,000 in total cost of attendance.

As shown in Column (1) in Table 7, the coefficient on the interaction between admission rate and *POST* is 0.0149, suggesting universities with more selective admission policies—typically associated with rigorous academic standards—experienced greater setbacks in graduation outcomes compared to their less selective counterparts. A 10% reduction in admission rate (more selective) links to about 1.49 percent reduction in graduation rates.

Column (5) and (8) in Table 7 reports similar impacts of instructional expenditure, tuition revenue in six-year graduation rates during the pandemic period, mirroring findings on retention rates reported in Tables 4 and 5, where institutions with greater instructional resources, such as higher instructional expenditures and larger net revenues, faced more pronounced declines. These results suggest that the substantial investments made by resource-rich institutions prior to the pandemic were not effectively reconfigured to address the evolving academic, social, and emotional needs of students in a remote or hybrid environment. Consequently, the traditional advantages conferred by wealth and selectivity diminished, further contributing to the leveling of the playing field across the higher education landscape.

Extending prior research on institutional determinants of student outcomes, our results show that the relationship between institutional characteristics and graduation performance changed during the pandemic period. While earlier studies generally associate higher resource levels and institutional selectivity with improved graduation outcomes (Ryan, 2004; Gansemer-Topf & Schuh, 2006), we

find that these advantages weakened under COVID-19 conditions. In particular, the negative interaction effects for cost, selectivity, and resource intensity indicate that institutions with traditionally stronger performance experienced greater disruption in long-term outcomes. At the same time, the positive effect of institutional size is consistent with prior evidence that larger institutions benefit from greater operational capacity and resource diversification (Titus, 2004). Overall, these findings indicate that the effectiveness of institutional resources is contingent on how they are deployed and adapted in response to disruption.

Table 8 reports qualitatively similar findings on COVID-19 and institutional characteristics for graduation results in the four-year subsample, with three pre-COVID years and one immediate post-COVID data.

The modest R-squared values in Tables 3-8 are common in fixed-effects panel models using institutional-level data. Because institutional fixed effects absorb most cross-sectional variation in student outcomes attributable to time-invariant institutional characteristics, the reported R-squared reflects only the explanatory power of within-institution variation over time, which is inherently more limited than cross-sectional variation. In addition, retention and graduation rates are influenced by many idiosyncratic student-level factors—such as individual academic preparation, financial shocks, family circumstances, and health outcomes—that are not observable at the institutional level and therefore cannot be directly controlled for in the model. In this context, the magnitude and statistical significance of the estimated coefficients—rather than R-squared—are the primary indicators of explanatory power.

This study examines the impact of the COVID-19 pandemic on college student

VI. CONCLUSION

retention and graduation rates across four-year institutions in the United States, using institution-level data from the U.S. Department of Education's College Scorecard (U.S. Department of Education, 2023) for academic years 2017–2022. The pandemic constituted a major systemic shock to higher education, disrupting instructional delivery, campus operations, and student support mechanisms. Despite these disruptions, aggregate student outcomes proved relatively resilient. Panel regression analyses with institutional fixed effects indicate that first-year retention declined modestly—by approximately 0.5 percentage points—during the post-pandemic period, while six-year graduation rates increased by about 0.8 percentage points. These patterns suggest that short-term persistence was more vulnerable to pandemic-related disruptions than long-term degree completion, which may have benefited from institutional flexibility and temporary policy accommodations such as grading leniency and expanded academic support.

Beyond these average effects, the results reveal substantial heterogeneity in how institutional characteristics shaped student outcomes during and after the crisis. Institutions with higher tuition levels, greater instructional expenditures, and larger tuition revenues experienced more pronounced post-COVID declines in both first-year retention and six-year graduation rates, indicating that resource intensity alone did not protect student outcomes under crisis conditions. Private and highly selective institutions similarly faced larger short-term disruptions, particularly in the immediate post-pandemic period. In contrast, institutional size consistently mitigated pandemic effects, with larger institutions retaining and graduating more students, reflecting advantages associated with scale, infrastructure, and administrative capacity. Notably, faculty composition did not significantly moderate

either retention or graduation outcomes, suggesting that the rapid shift to remote instruction diminished the traditional benefits of full-time instructional staffing.

Building on these results, these findings offer a broader perspective on the role of institutional characteristics in shaping student outcomes. While prior research generally associates higher institutional resources and selectivity with improved retention and graduation rates (Ryan, 2004; Gansemer-Topf & Schuh, 2006), our results show that these advantages weakened during the COVID-19 disruption. In particular, resource-intensive and highly selective institutions experienced larger declines in performance, indicating that models optimized for in-person delivery may be less resilient under systemic shocks. These results underscore that institutional performance depends not only on resource availability but also on operational adaptability, extending prior work by highlighting the importance of flexibility and system design in sustaining outcomes under disruption.

More broadly, the pandemic appears to have compressed long-standing institutional differences in higher education. Advantages traditionally associated with wealth, selectivity, and high-touch, in-person support systems diminished when instruction and advising moved online. As a result, student outcomes depended less on institutional prestige and more on adaptability, scale, and operational flexibility. In this sense, the pandemic produced a temporary leveling of the playing field across institutions, exposing shared vulnerabilities while highlighting the importance of resilient system design in higher education.

At the same time, the analysis highlights the role of cost as a critical constraint during periods of crisis. Institutions with higher costs of attendance experienced sharper post-COVID declines in both retention and graduation rates, reflecting

heightened financial strain and increased perceived risk of educational investment amid economic uncertainty. Importantly, this effect appears to have been transitory. As campuses reopened and federal and state support stabilized the sector, cost differentials moderated, and by AY2022-23 most institutions had restored retention rates to near pre-pandemic levels, underscoring the system's capacity for adaptive recovery.

From an operations and supply chain perspective, these results offer broader insights into resilience in complex service systems. Institutions that had historically invested heavily in high-touch, in-person support structures resembled operational models optimized for efficiency under stable conditions but vulnerable to systemic shocks. When key operational nodes—such as physical classrooms, advising centers, and campus-based employment—became inaccessible, these resource-intensive models were slow to reconfigure. In contrast, institutions with more standardized, scalable, or flexible operating structures exhibited comparable or, in some cases, superior performance during the disruption, contributing to a temporary convergence in outcomes across institutional types. This study thus contributes to the operations and supply chain literature by demonstrating how system design and resource configuration influence performance resilience in complex service systems under large-scale disruption.

These patterns align with core insights from operations management: redundancy, adaptability, and modularity often matter more than resource intensity during crises. The pandemic revealed that resilience in higher education is not solely a function of financial capacity or prestige but of operational design and institutional agility. Policies and investments that enhance process flexibility, cross-functional coordination, and digital service delivery may therefore provide more durable

protection against future disruptions than traditional expenditures focused primarily on expanding in-person infrastructure.

Looking ahead, higher education faces another inflection point shaped not by a global pandemic, but by the rapid emergence of transformative technologies such as artificial intelligence. AI is redefining how knowledge is produced, transmitted, and evaluated, challenging the traditional role of universities as gatekeepers of expertise. Just as the COVID-19 pandemic disrupted established hierarchies and temporarily leveled the playing field across institutions, the rise of AI presents both risks and opportunities. Institutions that integrate technology thoughtfully—leveraging it to enhance teaching, personalize learning, and expand access—may sustain the more equitable landscape that emerged during the pandemic. Conversely, those that fail to adapt risk reintroducing or amplifying institutional disparities. Future research should therefore examine how colleges and universities can design resilient, inclusive, and technologically adaptive systems that promote student success in an increasingly uncertain and dynamic environment.

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TABLE 3. THE IMPACT OF COVID-19 ON RETENTION RATE: BASELINE RESULTS

Variables	(1) (AY2017-18 to AY2022-23)	(2) (AY2017-18 to AY2020-21)
<i>POST</i>	-0.0054 [0.0022]**	0.0035 [0.0022]
<i>Admission Rate</i>	-0.0151 [0.0149]	0.0002 [0.0169]
<i>Private</i>	-0.0979 [0.0033]***	-0.0546 [0.0026]***
<i>Main</i>	0.045 [0.0025]***	
<i>Total Cost</i>	-0.0011 [0.0003]***	-0.0025 [0.0006]***
<i>Instructional Exp</i>	0.0003 [0.0007]	0.0000 [0.0016]
<i>Pct. FT Faculty</i>	0.0223 [0.0140]	0.0283 [0.0235]
<i>Faculty Salary</i>	-0.0001 [0.0028]	0.0011 [0.0042]
<i>Tuition Rev</i>	0.0007 [0.0014]	0.0002 [0.0021]
<i>Size</i>	-0.0313 [0.0136]**	-0.0529 [0.0180]***
<i>Constant</i>	1.0492 [0.1152]***	1.2702 [0.1463]***
<i>Instt. FE</i>	Y	Y
<i>N</i>	8,945	5,994
<i>R-squared</i>	0.01	0.01

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 4. THE IMPACT OF COVID-19 AND INSTITUTIONAL CHARACTERISTICS ON RETENTION RATE (AY2017 – 18 TO AY2022 – 23)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<i>Retention Rate</i>								
<i>POST</i>	-0.0113 [0.0052]**	-0.0053 [0.0023]**	-0.0012 [0.0246]	0.0018 [0.0042]	-0.002 [0.0028]	-0.0084 [0.0059]	0.0113 [0.0063]*	0.0007 [0.0037]	-0.0092 [0.0142]
<i>Admission Rate *POST</i>	0.0084 [0.0074]								
<i>Private *POST</i>		-0.0002 [0.0028]							
<i>Main * POST</i>			-0.0043 [0.0247]						
<i>Total Cost *POST</i>				-0.0002 [0.0001]**					
<i>Instructional Exp *POST</i>					-0.0003 [0.0001]***				
<i>Pct_FT Faculty *POST</i>						0.0045 [0.0076]			
<i>Faculty Salary *POST</i>							-0.0021 [0.0007]***		
<i>Tuition Rev *POST</i>								-0.0005 [0.0002]**	
<i>Size *POST</i>									0.0005 [0.0017]
<i>Controls</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Instt. FE</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>N</i>	8,945	8,945	8,945	8,945	8,945	8,945	8,945	8,945	8,945
<i>R-squared</i>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 5. THE IMPACT OF COVID-19 AND INSTITUTIONAL CHARACTERISTICS ON RETENTION RATE (AY2017 – 18 TO AY2020 – 21)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Retention Rate</i>							
<i>POST</i>	-0.0236 [0.0072]***	0.0128 [0.0024]***	0.0351 [0.0048]***	0.0172 [0.0035]***	0.0016 [0.0067]	0.0342 [0.0074]***	0.0283 [0.0038]***	-0.0262 [0.0165]
<i>Admission Rate *POST</i>	0.0394 [0.0098]***							
<i>Private *POST</i>		-0.0152 [0.0033]***						
<i>Total Cost *POST</i>			-0.0009 [0.0001]***					
<i>Instructional Exp *POST</i>				-0.0013 [0.0003]***				
<i>Pct_FT Faculty *POST</i>					0.0028 [0.0087]			
<i>Faculty Salary *POST</i>						-0.0039 [0.0008]***		
<i>Tuition Rev *POST</i>							-0.0019 [0.0003]***	
<i>Size *POST</i>								0.0038 [0.0020]*
<i>Controls</i>	Y	Y	Y	Y	Y	Y	Y	Y
<i>Instt. FE</i>	Y	Y	Y	Y	Y	Y	Y	Y
<i>N</i>	5,994	5,994	5,994	5,994	5,994	5,994	5,994	5,994
<i>R-squared</i>	0.02	0.02	0.03	0.03	0.01	0.02	0.03	0.02

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 6. THE IMPACT OF COVID-19 ON GRADUATION RATE: BASELINE RESULTS

Variables	(1) (AY2017-18 to AY2022-23)	(2) (AY2017-18 to AY2020-21)
<i>POST</i>	0.0084 [0.0019]***	0.0048 [0.0021]**
<i>Admission Rate</i>	0.0339 [0.0103]***	0.0376 [0.0130]***
<i>Private</i>	0.0396 [0.0030]***	-0.0968 [0.0016]***
<i>Main</i>	-0.1359 [0.0022]***	
<i>Total Cost</i>	-0.0005 [0.0004]	0.0006 [0.0006]
<i>Instructional Exp</i>	0.0003 [0.0005]	0.0006 [0.0006]
<i>Pct_FT Faculty</i>	-0.0372 [0.0129]***	-0.0359 [0.0133]***
<i>Faculty Salary</i>	0.0049 [0.0023]**	0.0053 [0.0029]*
<i>Tuition Rev</i>	0.0021 [0.0008]***	0.0014 [0.0009]
<i>Size</i>	0.0111 [0.0109]	0.0126 [0.0148]
<i>Constant</i>	0.537 [0.0895]***	0.4412 [0.1221]***
<i>Instt. FE</i>	Y	Y
<i>N</i>	8,945	5,994
<i>R-squared</i>	0.02	0.02

Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 7. THE IMPACT OF COVID-19 AND INSTITUTIONAL CHATACTERISTICS ON GRADUATION RATE (AY2017 – 18 TO AY 2022 – 23)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	<i>Graduation Rate</i>								
<i>POST</i>	-0.0019 [0.0057]	0.0173 [0.0020]***	0.0027 [0.0158]	0.0262 [0.0034]***	0.0104 [0.0023]***	0.0148 [0.0047]***	0.0042 [0.0058]	0.014 [0.0029]***	-0.0387 [0.0140]***
<i>Admission Rate *POST</i>	0.0149 [0.0077]*								
<i>Private *POST</i>		-0.0143 [0.0028]***							
<i>Main * POST</i>			0.0059 [0.0161]						
<i>Total Cost *POST</i>				-0.0005 [0.0001]***					
<i>Instructional Exp *POST</i>					-0.0002 [0.0001]*				
<i>Pct_FT Faculty *POST</i>						-0.0094 [0.0062]			
<i>Faculty Salary *POST</i>							0.0005 [0.0006]		
<i>Tuition Rev *POST</i>								-0.0004 [0.0002]***	
<i>Size *POST</i>									0.006 [0.0017]***
<i>Controls</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Instt. FE</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>N</i>	8,945	8,945	8,945	8,945	8,945	8,945	8,945	8,945	8,945
<i>R-squared</i>	0.02	0.03	0.02	0.03	0.02	0.02	0.02	0.02	0.03

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 8. THE IMPACT OF COVID-19 AND INSTITUTIONAL CHATACTERISTICS ON GRADUATION RATE (AY2017 – 18 TO AY 2020 – 21)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	<i>Graduation Rate</i>								
<i>POST</i>	0.0048 [0.0021]**	-0.0035 [0.0076]	0.0147 [0.0019]***	0.0215 [0.0038]***	0.0073 [0.0026]***	0.0113 [0.0058]*	0.0007 [0.0063]	0.0116 [0.0031]***	-0.0493 [0.0153]***
<i>Admission Rate *POST</i>		0.012 [0.0101]							
<i>Private *POST</i>			-0.0161 [0.0029]***						
<i>Total Cost *POST</i>				-0.0005 [0.0001]***					
<i>Instructional Exp *POST</i>					-0.0002 [0.0001]**				
<i>Pct_FT Faculty *POST</i>						-0.0097 [0.0074]			
<i>Faculty Salary *POST</i>							0.0005 [0.0006]		
<i>Tuition Rev *POST</i>								-0.0005 [0.0002]***	
<i>Size *POST</i>									0.0069 [0.0018]***
<i>Controls</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Instt. FE</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>N</i>	5,994	5,994	5,994	5,994	5,994	5,994	5,994	5,994	5,994
<i>R-squared</i>	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.03

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%