

Examining the Feasibility of Empirically Predicting College Closures

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Abstract: Higher education is facing demographic and financial challenges that threaten the existence of many small nonprofit and for-profit colleges. Yet there have been few rigorous empirical efforts to identify colleges at risk of closing before students can complete their studies. In this paper, I use publicly-available data from the federal government to determine factors that are associated with closures and then predict the likelihood of a college closing. I find that the majority of college closures come from the top decile of predicted closure probabilities, but that most colleges with high closure probabilities remain open for several years.

There are growing concerns about the financial stability of much of the American higher education system. The number of high school graduates is expected to decline nationally over the next decade. These declines are forecast to be particularly large in the Northeast and Midwest, two areas that are home to a large share of private nonprofit colleges (Grawe, 2018). There is also skepticism about the value of higher education from many individuals amid rising student loan debt and pressures to hold colleges more accountable for their students' outcomes (Kelchen, 2018b). The growing partisan divide in public perceptions of higher education (Parker, 2019) could also threaten the viability of some struggling colleges. Finally, massive losses to the higher education industry as a result of the coronavirus pandemic of 2020 threaten to deplete the resources of colleges that were in reasonable shape prior to the pandemic and ensuing recession.

All of the above factors have led to greater attention being paid to college closures. Although college closures have existed throughout the history of American higher education (e.g., Tewksbury, 1932), the issue gained national prominence in the 2010s. Credit ratings agency Moody's prominently predicted in 2015 that the number of private nonprofit colleges closing each year would double within the next three years (Woodhouse, 2015), while Harvard professor Clayton Christensen has repeatedly forecasted that half of all colleges will close within the next ten to fifteen years (Hess, 2018).

While the rate of college closures is currently falling short of Christensen's well-publicized predictions, there have been a number of prominent closures and near-closures over the last few years. These closures have been limited to private for-profit and nonprofit colleges, as public colleges typically are involved in mergers instead of closures. In the for-profit sector, several large chains such as Argosy University, Corinthian Colleges, ITT Tech, and Vatterott College have collapsed since 2012. None of the nonprofit colleges that have closed during this time are of the size of the large for-profit chains, but closures (such as the College of New Rochelle and multiple colleges in Vermont) and near-closures (such as Hampshire College and Sweet Briar College) have garnered substantial attention.

In an ideal world, a college would announce its closure with enough time for current students to finish their studies at that institution or at another college that has agreed in advance to accept those students and help them complete in a timely manner (something that is known as a teach-out agreement). Closures of private nonprofit colleges occasionally occur in this manner, but many closures happen with much less notice. If a college collapses overnight without a teach-out agreement in place, as often happens in the for-profit sector, students are left scrambling without guidance from their institution.

Abrupt college closures have negative impacts on both students and taxpayers. Students who attend a college that closes abruptly have two potential options. They can try to complete their studies at another college, which may require them to repeat a number of courses if a teach-out agreement is not in place. Alternatively, they can apply for a closed school discharge from the U.S. Department of Education (Office of Federal Student Aid, n.d.a.), which forgives the loans of all students who were enrolled within 120 days of the college closing without completing a credential but also forces them to restart their studies from scratch at another institution.¹ When students apply for closed school discharges, the bill effectively gets passed to taxpayers. In the last several years, the federal government has forgiven at least half a billion dollars in loans after several large for-profit college closures (Kreighbaum, 2019).

To reduce the risk to taxpayers and to protect students, the federal government requires colleges to be financially sound in order to receive federal financial aid dollars. Private colleges (both for-profit and nonprofit) must receive a passing score on a financial responsibility metric to receive federal aid, with low-performing colleges being required to post a letter of credit with the U.S. Department of Education in

¹ New regulations promulgated by the Trump administration will extend the 120-day window to 180 days, but also end automatic forgiveness after three years (Kreighbaum, 2019).

order to keep aid eligibility. A poor financial responsibility score is one of the factors that can place a college under Heightened Cash Monitoring (HCM), which in its most severe form may require institutions to be reimbursed by the federal government after disbursing aid to students (Office of Federal Student Aid, 2019a). However, this current system has both failed to identify a number of colleges that closed and contributed to the collapse of other colleges by restricting their access to credit (Blumenstyk, 2014).

These concerns have led to efforts by a number of different agencies and organizations to better identify colleges at risk of closure and intervene in ways to protect students and taxpayers. Private colleges are overseen by a regulatory triad of state authorizing agencies, accrediting bodies, and the federal government (Tandberg, Bruecker, & Weeden, 2019), and each of these groups is taking actions. For example, the Massachusetts Board of Higher Education (2019) has proposed regulations that would oversee the financial health of private nonprofit colleges and identify institutions it sees at risk of closure within the next 18 months, and the state's House unanimously passed legislation requiring the board or the college's accreditor to do annual financial reviews (Schoenberg, 2019). Both the U.S. Department of Education and members of Congress are working to update financial requirements for colleges and place additional responsibilities on accrediting agencies (Busta, 2019). Finally, there are a growing number of efforts by private organizations and researchers to judge colleges' financial viability (Carlson, 2020).

While it is important to both students and taxpayers to identify colleges at risk of closure to either begin an orderly ending of operations or to help avoid closure, one challenge of these efforts is the fear of a self-fulfilling prophecy if students no longer consider attending a college that is financially unstable, hastening the institution's demise. This concern has led some private colleges and advocacy organizations to push back against the proposed Massachusetts regulations (Seltzer, 2018; Sullivan & Stergios, 2019) and was one reason why the U.S. Department of Education historically did not release the names of colleges under additional financial oversight (Stratford, 2015). This means that any efforts to identify colleges at risk of closure must be as accurate as possible to avoid false positives, especially as a large percentage of colleges that were identified as being at risk of closure decades ago have remained open today (Tarrant, Bray, & Katsinas, 2018).

In this paper, I used publicly-available data on institutional finances and other characteristics to predict the probability of closure two and four years later among private nonprofit and for-profit colleges. To briefly preview my results, I found a number of characteristics that are associated with college closures for both sectors of higher education. However, while I was able to identify colleges at relatively high risk of closure, only a small fraction of these high-risk colleges ended up closing. This suggests that the predictive power of data elements that are widely available across colleges is relatively weak. This highlights the need for the federal government, accrediting bodies, and state authorizing agencies to collect better data on factors that may better predict closure.

Efforts to Measure Financial Viability

There are a number of existing efforts by a range of stakeholders and researchers to measure a college's financial viability. In this section, I summarize some of the key initiatives and discuss the research on whether any of these metrics can accurately forecast college closures.

Federal government

The federal government's primary mechanism to evaluate a college's financial viability is through its financial responsibility score for all private nonprofit and for-profit colleges. This score, which ranges from -1 to 3 and is designed to be a measure of financial health, is the primary determinant of whether a

private college has to post a letter of credit with the Office of Federal Student Aid (FSA) in order to participate in federal financial aid programs. There are three components to the score: a primary reserve ratio (liquidity), equity ratio (ability to borrow money), and a net income ratio (Office of Federal Student Aid, n.d.b.).

While the score is associated with other important measures such as enrollment levels and donations (Hunter, 2012), there are concerns about the calculations not meeting current accounting standards (National Association of Independent Colleges and Universities, 2012). Additionally, prior research shows that the scores do not affect how colleges allocate their resources (Kelchen, 2018a). A somewhat related mechanism is heightened cash monitoring (HCM). There are two levels of HCM: level 1, which includes additional oversight but allows colleges to receive federal aid dollars in advance of students requesting the funds, and level 2, which requires colleges to be reimbursed after giving out aid dollars. Most colleges are placed under HCM are on level 1 because of low financial responsibility scores, the smaller number of colleges operating under HCM2 face the more severe restrictions due to governance or oversight issues (Office of Federal Student Aid, 2019b).

State governments

Massachusetts commissioned the consulting firm EY-Parthenon (2018) to develop a teach-out viability metric (TVM) that focused on whether four-year private colleges had the financial resources to continue operating for the next two to four years. This metric is based on revenue from undergraduate students, donations, graduate students, and investments; expenses on instruction, student support, benefits, and general operations; and available assets. These components are generally more nuanced than the financial responsibility score, but no details are publicly available about how each measure is used in the overall TVM. While details on the predictive power of TVM are not provided, the consultants claim to successfully flag ten colleges that are either at risk of closure or have already closed. The proposed regulations in Massachusetts would also use credit ratings from private agencies such as Moody's and Standard & Poor's along with information from accreditors and other regulatory agencies to determine which colleges are at risk of closure (Massachusetts Board of Higher Education, 2019).

Many states use the Composite Financial Index (CFI) to examine colleges' financial health (Tandberg, 2018). The CFI has four primary metrics, three of which are broadly similar to the financial responsibility metrics from the Department of Education. The fourth metric is a return on net assets ratio, which is the increase in net assets from the previous year. The authors of the CFI (Prager, Sealy, & Co., KPMG, & Attain, 2016) also recommend using a liquidity measure that compares the sources and uses of available resources.

Accrediting agencies

Financial stability is one of the key factors that accreditors use when evaluating colleges. A review of accreditation actions by the United States Government Accountability Office (2014) found that both regional and national accreditors were more likely to sanction colleges with low financial responsibility scores or Department of Education program reviews related to financial concerns. Regional accreditors also factored student outcomes such as graduation and retention rates into their decisions, while national accreditors did not.

For example, the Higher Learning Commission (a regional accreditor) uses the CFI to identify colleges to receive additional scrutiny. Colleges below a certain score on the CFI must provide annual reports with additional financial data until their performance approves. The accreditor also considers large changes in enrollment or degrees awarded, declines in the number of full-time faculty, few few-time faculty or high student/faculty ratios, and being in the bottom 5% of completion rates in making decisions

(Higher Learning Commission, 2019). Many other accreditors do not publicly list which financial criteria they use to evaluate colleges, but they do require colleges to submit audited financial statements.

Other researchers

Researchers have conducted two main types of analyses to identify factors associated with private nonprofit college closures, with no quality research to this point exploring the issue among for-profit colleges. The first method is to suggest factors based on expert opinions or simple t-tests between colleges that stayed open or colleges that closed. Lyken-Segosebe (2017), Parthenon-EY (2017), Sherman (2016), and Stowe and Komarsara (2016) identified factors such as per-student tuition revenue, tuition dependency, the share of part-time students, interest expenses, and low donation levels in their examinations of private college closures. Two other notable efforts by consultants identified similar risk factors, often getting into specificity about the exact levels of values such as tuition dependency without providing support for their assertions (Denneen & Dretler, 2012; Martin, Samels, & Associates, 2009).

A smaller body of research has identified relationships between various institutional characteristics and private nonprofit college closures using a regression framework. Porter and Ramirez (2009) examined the survival through 2005 of private colleges listed in the 1973 Carnegie classification. Using a survival model, they found that higher levels of selectivity, endowment values, and enrollment along with not having a religious affiliation were related to closing or merging. Bates and Santerre (2000) examined factors associated with closures and mergers separately using cases between 1960 and 1994. They showed that lower faculty salaries and tuition levels and not being religiously affiliated were associated with an increased likelihood of closure.

Two recent efforts to identify a college's risk of closure have garnered a significant amount of media attention. The educational consulting firm Edmit commissioned an analysis that predicted exact closure dates for private colleges using an unknown set of publicly available data points.² However, the report was never released after Utica College threatened to sue if the projections were released (Ducoff, 2019; Fain, 2019), even though an effort by *Forbes* to grade colleges' financial health proceeded unaffected (Coudriet & Schifrin, 2019). A new book titled *The College Stress Test* identified four metrics from IPEDS data (new student enrollment, net tuition revenue, retention rates, and external funding received) that are associated with a college's risk of closing or merging. They did not publish a list of colleges' risk scores in the book, instead preferring that readers do their own calculations using the metrics (Zemsky, Shaman, & Baldrige, 2020).

Data, Sample, and Methods

In this paper, I used data from 2002 through 2019 to examine the extent to which various institutional and local economic characteristics are associated with colleges closing. Details on my sample, data, and methods are included in the following sections.

Sample

I began with all private nonprofit and for-profit colleges that were in the Integrated Postsecondary Education Data System (IPEDS) universe and received federal Title IV financial aid. Public colleges were eliminated because they tend to merge with other institutions instead of close and these mergers do not have an adverse financial impact on the federal government. Colleges outside of the 50

² As a disclosure, I have provided feedback to Edmit on several of their endeavors on a volunteer basis.

states and Washington, DC were also eliminated because these institutions may face different economic conditions and oversight policies that could affect the likelihood of closure.

I also removed all branch campuses, as determined by the Office of Federal Student Aid (FSA)'s OPEID number, from my analyses to focus on whether the entire institution closed instead of just one location. This matches how FSA treats institutions for Title IV accountability purposes and also captures the risk to the federal government. Branch campuses typically have teach-out agreements with the main campus or are wound down orderly, while the entire institution closing can lead to taxpayers bearing the risk. If a college had an OPEID ending in "00," it remained in the sample as the main or parent institution, while other branch or child campuses were eliminated. For example, Strayer University has one parent campus (OPEID: 145900) and 47 child campuses with OPEIDs between 145901 and 145999. This resulted in an initial sample size of 4,806 unique institutions.

The next sample restriction was to eliminate 369 private nonprofit colleges that are listed in any of the 2000-2018 Carnegie basic classifications as being divinity schools, yeshivas, or theological seminaries, as the reasons for these institutions closing could be due to their religious order instead of financial concerns. An additional 49 colleges were eliminated for having records in IPEDS between 2001 and 2017, but never being listed as being open during that period. Finally, I eliminated 546 private nonprofit colleges that ever had endowments of at least \$50 million (in inflation-adjusted colleges). I chose this threshold because only two specialized private nonprofit colleges with endowments above this threshold were listed as being closed in PEPS, and both (Atlanta College of Art and Episcopal School of Nursing) were acquired by larger universities. At lower thresholds, two additional closed nonprofit colleges had endowments between \$25 million and \$50 million, 13 had endowments between \$10 million and \$25 million, and 16 had endowments between \$1 million and \$10 million.

This resulted in a final analytic sample of 3,834 colleges and universities, including 2,660 colleges that were for-profit institutions when they were last observed in the dataset and 1,174 nonprofit institutions. For the 91 colleges that held both nonprofit and for-profit status during the period of analysis (such as Grand Canyon University and Heald College), they are analyzed based on their status in each given year and thus can end up contributing to both the nonprofit and for-profit analyses.

Data

The outcome of interest for this analysis is whether a college stopped operating based on Federal Student Aid's Postsecondary Education Participants System (PEPS), which includes a dataset of closed schools which is updated weekly (Office of Federal Student Aid, 2020). Because PEPS includes information on every branch campus closure as well as main campus closures, my definition of closure is based on the main campus (Federal Student Aid OPEID code ending in 00) closing. A small number of colleges closed, reopened, and then closed again during the period of analysis; they are counted as multiple closures as appropriate.

Table 1 highlights the number of colleges that closed in each year between 2002 and 2019, broken down by institutional type and level based on the predominant degree offered (from the College Scorecard). About 25% of colleges were missing information on the level variable, so I used Carnegie classifications where available and counted the rest as two-year colleges after looking through the list of colleges with missing data.

[Insert Table 1 here]

A total of 754 colleges (622 for-profit and 132 nonprofit) closed during the period of analysis, with the vast majority of these closures (544) occurring among two-year for-profit colleges. The number of

closures was generally steady during much of the 2000s, with between 29 and 36 colleges closing in every year except 2002 (61) and 2007 (59). There was then a lull in closures following the Great Recession, with only one closure observed between 2012 and 2014. Closures then jumped to 108 in 2016, 97 in 2017, 123 in 2018, and 68 in 2019. 2018 also saw the highest number of closures in both the nonprofit (20) and for-profit (103) sectors. Among the two-thirds of colleges that reported to IPEDS one full academic year prior to closure (for example, 2017-18 enrollment for a 2019 closure), mean FTE enrollment was 337 students at nonprofit colleges and 262 students at for-profit colleges.

I then compiled data on a number of publicly-available measures that could be used to predict potential future closures. For each of the measures, I used data from one full academic year prior to the calendar year in which the institution closed. FSA publishes four different accountability measures that were available for most of the period of study. The College Scorecard includes data on colleges placed on Heightened Cash Monitoring (HCM) level 2, the most serious level of federal monitoring that requires a college to be reimbursed for any federal student aid disbursed instead of receiving funds in advance (Office of Federal Student Aid, 2019). Data on colleges on the lower level of monitoring (HCM 1) are not available until 2015, so I could not include them in my analysis.

For colleges that participated in the federal student loan system (the vast majority of the sample), FSA calculates cohort default rates (CDRs) that are compiled in the College Scorecard. For the cohorts of students entering repayment prior to or during Fiscal Year 2012, two-year CDRs were used for accountability purposes. FSA then switched to a three-year CDR for accountability purposes in Fiscal Year 2013, so my CDR measure is a composite of two-year and three-year rates during the panel. Few colleges failed the CDR test in any given year, so I did not include an indicator for whether a college failed.

Two other measures are only available for part of the panel. The first is financial responsibility scores, which were described in the previous section. Although financial responsibility scores have been calculated since at least 1996, only scores from the 2006-07 academic year forward have been released due to alleged data quality concerns in previous years and my FOIA request for earlier data was unsuccessful (Kelchen, 2018a). I also created a measure of failing the financial responsibility score metric in that year or the prior year to highlight this adverse outcome. The second measure comes from the 90/10 rule that limits for-profit colleges to receiving 90% of their total revenue from federal Title IV aid. Although this measure has been calculated in its current form since 1998 (Lee & Looney, 2019), data are only publicly available since the 2007-08 academic year. I used the measure of the percentage of revenue coming from Title IV in my analyses.

A number of institutional characteristics that could be associated with the likelihood of closure are available from IPEDS. For both for-profit and nonprofit colleges, full-time equivalent (FTE) enrollment, the tuition discount rate, tuition revenue as a share of total revenue, and total revenue were all available. For private nonprofit colleges, I used endowment values new first-time, full-time enrollment, the admit rate, and the yield rate. I also included measures of whether there were substantial negative changes in a college's financial situation in that year or the prior year. For tuition discount rates, tuition reliance, and the admit rate, I created indicators for whether there was a five percentage point increase. Similarly, I created indicators for whether FTE enrollment, total revenue, or endowment values decreased by at least ten percent.

For both sectors, I used information on the percentage of students who ever had a Pell Grant or student loan from the College Scorecard. The final two metrics capture a college's local economic situation, since most small private nonprofit and for-profit colleges draw most of their students from a local area. These metrics are the county-level unemployment rate (from the Bureau of Labor Statistics)

and the percent of county residents in poverty (from the Census Bureau).. These factors reflect potential demand for the college and students' ability to afford attending.

[Insert Table 2 here]

Table 2 contains summary statistics of the analytic sample among colleges that were open in the 2016-17 academic year. Most colleges in the sample were small, with mean enrollment among nonprofit colleges being 1,202 students and just 557 students at for-profit colleges. Just over one-fifth of nonprofit colleges and one-third of for-profit colleges saw a decline in FTE enrollment of at least 10% in that year, with slightly lower rates of large declines in total revenue. Large endowment declines were less common in 2016-17, which was a stronger year for endowments in general. About 10% of nonprofit colleges and 16% of for-profit colleges saw an increase in tuition reliance of at least five percentage points, while 16% of for-profit colleges had a sizable increase in the share of revenue coming from federal funds. Finally, about one in four nonprofit colleges had their admit rate increase by five percentage points or more—another key marker of financial stress.

Methods

I ran a series of linear probability models to examine the extent to which institutional and local economic conditions in a given year were associated with a college closing both two years and four years later. I used linear probability models instead of probit models due to some variables and years of data being dropped from probit models for being perfect predictors of closing or not closing since college closures are a low-probability outcome. I chose these time periods to align with the typical length of certificate and degree programs, as regulators may choose to act if a two-year college does not have the resources to operate for the next two years and if a four-year college cannot demonstrate its viability for the next four years. For each sector and lag period, I ran four models. All of these models included institution-clustered standard errors and year fixed effects.

Model (1) covered the full period of study and included variables that were available for nearly all colleges that had IPEDS data in a given year: logged FTE enrollment (and whether there was a drop of at least ten percent in that year or the prior year), tuition discount rate (and whether there was an increase of at least five percentage points in that year or the prior year), HCM 2, CDR, county poverty and unemployment rates, and whether the institution was a four-year college. For analyses examining closure later in the panel (beginning in 2009-10), Model (3) adds financial responsibility scores (and whether the college failed in that year or the prior year) for both sectors and the percentage of revenue from federal sources (and whether there was an increase of at least five percentage points in that year or the prior year) for for-profit colleges only.

The other two models included variables that were only available for a subset of institutions. Model (2), which was for the full panel, added logged total revenue (and whether there was a drop of at least percent in that year or the prior year), tuition reliance (and whether there was an increase of at least five percentage points in that year or the prior year), and the percentage of students who ever received Pell Grants or student loans for both sectors. For private nonprofit colleges, Model (2) also added logged endowment (and whether there was a drop of at least percent in that year or the prior year), new first-time, full-time enrollment, the admit rate (and whether there was an increase of at least five percentage points in that year or the prior year), and the yield rate. Finally, Model (4) adds the same variables from Model (2) onto the existing variables from Model (3) for the period beginning in 2009-10.

Limitations

The most substantial limitation of my analyses is that some measures that could potentially be related to a college closing were not available for all colleges in my sample or for all cohorts. For example, FSA requires colleges with low financial responsibility scores, facing HCM, or with other potential concerns to submit letters of credit in order to continue receiving federal financial aid. Because FSA has the ability to determine the percentage of Title IV funds among its staff (Office of Inspector General, 2017), this data element could be an important predictor of college closures. However, this information was first made available to the public for the 2013 award year, which does not allow for analyses. Similarly, I could not use HCM level 1 status because that was first made public in 2015.

I initially intended to use IPEDS data on assets and equity for for-profit colleges, as declines in assets or taking out owner's equity could be a possible indication of an impending closure. But I was not able to include these data elements for a majority of for-profit colleges, since many small colleges only have to submit core revenue and expense information to IPEDS. Since these are the colleges that were likely at highest risk of closure, I had to exclude these measures.

I did use financial responsibility scores as a variable in the models, but FSA has historically not made these scores public for all colleges for which scores are calculated. In response to a Government Accountability Office (2017a) report, FSA began publishing scores for all colleges with multiple OPEIDs but a common owner instead of just choosing one OPEID to publish. This means that data on for-profit college chains are incomplete in my data prior to the 2015-16 academic year due to an inability to fully track ownership in previous years. Additionally, FSA historically has not published financial responsibility scores for all institutions that failed, instead placing the college on HCM (Kelchen, 2018a). Since some of these colleges are placed on HCM 1 instead of HCM 2, the HCM 2 flag in the College Scorecard does not capture all of these institutions.

Results

I first examined factors associated with the likelihood of closure two years later among private nonprofit colleges (Table 3). The results from Model (1), which included the full panel period and only the variables available for most colleges, showed a negative and statistically significant relationship between the likelihood of closure and changes in FTE enrollment. The magnitudes of the coefficients are meaningful; for example, a decrease in enrollment of 10% or more in the current year was associated with a 1.16% increase in the likelihood of closure two years later and a large decline in the prior year was associated with a 0.65% increase in the likelihood of closing. Decreases in FTE enrollment also influenced the probability of closing separate from large changes. Large increases in the tuition discount rate were associated with increases in the likelihood of closure of between 0.5% and 1%.

Federal accountability metrics also affected the chances of a college closing two years later. Being placed on HCM 2 status was associated with a 2.42% increase in the likelihood of closure, which is substantial given the low rate of college closures. A one percentage point increase in the cohort default rate was associated with a 0.09% increase in closures. The other measures in the model (county-level poverty and unemployment rates and whether the institution was a four-year college) were not significant at $p < .05$.

[Insert Table 3 here]

For Model (2), I added a number of other variables that could potentially influence whether a college is forced to close. The general pattern of results from Model (1) held for enrollment (with the exception of the level of FTE enrollment turning positive and marginally significant), tuition discount rates, and cohort default rates. However, HCM 2 status was no longer statistically significant and being a four-year college was associated with a 1.16% higher likelihood of closure in Model (2). Among the newly-

added variables to the model, large declines in total revenue and endowment values in that year increase the likelihood of closure by 0.5% to 0.6%, while declines in the endowment value and new student enrollment also increase the likelihood of closure. Finally, increases in the yield rate among admitted students increase the probability of closure, which could be a function of the increased tuition discounting needed to induce more admitted students to attend.

Models (3) and (4) are similar to Models (1) and (2), but focused on closures from 2009-10 forward and added financial responsibility scores as a covariate. The general pattern of results is broadly similar when considering the more limited timeframe, although large declines in total revenue are not significant in Model (4). A decrease in the financial responsibility score is associated with a higher risk of closure in Model (3), but failing the test in that year or the previous year is not significant in either model at $p < .05$.

Table 4 contains the same four models for private nonprofit colleges as Table 3, using a four-year lag between the covariates and closure instead of a two-year lag. In general, most of the same covariates predicting closure within two years also predict closure within four years, with larger coefficients (in absolute terms). Total revenue does become a stronger predictor of closure four years later, with a 10% decline in the current year being associated with a 0.9% to 1.6% increase in the probability of closure four years later. Failing the financial responsibility score test becomes significant at $p < .10$ in Model (3) and $p < .05$ in Model (4), with coefficients ranging between 1.5% and 2.0%. A surprising difference is that the coefficient on HCM 2 is positive and significant in Models (1) and (3) while being negative and significant in Models (2) and (4).

[Insert Table 4 here]

Turning next to for-profit colleges using a two-year lag (Table 5), FTE enrollment was a stronger predictor of closure than in the private nonprofit sector. A 10% decline in enrollment in the current year was associated with an increase in the likelihood of closure of approximately 1% across all four models, with similar coefficients for large declines in the prior year. Since FTE enrollment changes likely portend declines in future revenue, it makes sense for this to be a stronger predictor of closure in a sector of higher education in which earning profits is expected. Being on HCM 2 status is the single strongest predictor of closure, with coefficients ranging from 10% to 13% across the models. This differs from private nonprofit colleges, where HCM 2 status was a weaker and not consistently significant predictor of closure.

[Insert Table 5 here]

Cohort default rates were a strong predictor of closure in the first three models, similar to in the nonprofit sector. This was a somewhat surprising finding given that CDRs rarely result in colleges losing Title IV eligibility and are a weak proxy for student outcomes such as longer-term default rates and student loan repayment rates due to the ability of colleges to push students into deferment or forbearance on their loans (Kelchen & Li, 2017; Miller, 2018). But while default management techniques can reduce the CDR (Blumenstyk, 2010), they may be too expensive for for-profit colleges to continue subsidizing while remaining profitable.

A one-point decline in the financial responsibility score was associated with a 1% increase in the likelihood of closure, although a current failing score yielded a 2.6% lower likelihood of closure in Model (4). The percentage of total revenue coming from federal Title IV funds was associated with future closures in Model (3), but not model (4). While few colleges hit the 90% limit on federal funding to lose Title IV access (Kelchen, 2017), a heavy reliance on federal dollars may suggest a lack of interest in these programs by employers—a key source of non-federal funds. Increased tuition reliance and declines in total

revenue were also associated with closure, but these relationships were weaker following the Great Recession.

The final set of models (in Table 6) repeats the four models using a four-year lag among for-profit colleges. The patterns of coefficients are broadly similar across two-year and four-year lags, with point estimates generally being larger in absolute terms for the four-year lag. Notably, the coefficients for cohort default rates and four-year colleges increase substantially using a four-year lag, as do the coefficients for total revenue. These relationships are expected because owners of for-profit colleges may be willing to tolerate losses in the short term while not doing so in the longer term if the business fails to turn around.

[Insert Table 6 here]

Finally, I used the regression coefficients to predict the probability of closure for each college based on their characteristics. I then divided these predicted probabilities into deciles to examine the number of colleges in each decile that closed within the two-year or four-year period. As illustrated in Table 7, the number of colleges that closed typically increased by decile. The majority of private nonprofit colleges that closed had a predicted probability in the top decile of the distribution, although less than ten percent of colleges in the top decile closed four years later. The distribution of closures was more spread out in the models with fewer covariates (1 and 3) than the models with more covariates, although Models (2) and (4) also had fewer closures due to many closed colleges missing some covariates of interest and being excluded from the model.

[Insert Table 7 here]

My predictive models also performed reasonably well for for-profit colleges, many more of which closed during the period of study. While a few colleges in the lower half of the probability distribution closed within two years, a majority of closed colleges were in the top decile. This distribution spread out much further after four years, with the top decile containing the largest number of closures but not a majority of closures in three of the four models. This dispersion, which was also present to a smaller extent in the private nonprofit sector, could be because colleges faced shocks in later years that could have also contributed to closures. Nevertheless, the models did generally identify the majority of colleges at risk of closure across sectors and time periods.

Discussion

The issue of sudden college closures has received a great deal of attention in recent years due to challenging demographic and economic headwinds that many small private nonprofit and for-profit colleges face, and these issues have been compounded by the effects of the coronavirus pandemic. When a college closes with little or no notice, students often face a difficult choice. They can choose to try to resume their studies elsewhere, often with no guarantee that all of their credits will transfer, and adjust to a new educational environment. The alternative is for students to receive a closed school discharge from the U.S. Department of Education, which forgives borrowers' federal student loans but requires students to start over while also shifting the loan burden to taxpayers.

In this paper, I used publicly-available data compiled by the federal government to examine factors associated with college closures within the following two to four years. I found several factors, such as sharp declines in enrollment and total revenue, that were reasonably strong predictors of closure. Poor performances on federal accountability measures, such as the cohort default rate, financial responsibility

metric, and being placed on the most stringent level of Heightened Cash Monitoring, were frequently associated with a higher likelihood of closure. My resulting models were generally able to place a majority of colleges that closed into a high-risk category, but only a small percentage of these high-risk colleges closed within the next several years.

Since a majority of colleges identified of being at the highest risk of closure remained open even four years later, there are practical and ethical concerns with using these results in the policy process. The greatest concern is that these results become a self-fulfilling prophecy—being identified as at risk of closure could hasten a struggling college’s demise. Of the three components of the regulatory triad, accrediting agencies probably have the easiest ability to use this assessment of financial risk to better target their reviewing resources because the accreditation process tends to be more collegial and confidential. State regulators may be able to keep the results confidential (as Massachusetts is seeking to do through the TVM process), but the federal government is unlikely to do so. The U.S. Department of Education kept the HCM list secret until 2015 due to concerns that publishing the list would lead colleges to close (Stratford, 2015), and it is unclear at this point whether publicizing the list has accelerated the closure process.

Incorporating additional data elements into the analysis could also help to better identify colleges at the highest risk of closing. In my analysis, I was limited to data collected by the federal government that has been published for at least a decade. There have been some improvements to available data in recent years that would be helpful to forward-looking analysts. The list of colleges on HCM 1 status has been published since 2015, and information on letters of credit with the Department of Education goes back to the early 2010s. Student loan repayment rates and earnings of former students (both from the College Scorecard) have some promise, although coverage is low at smaller colleges due to privacy suppression restrictions.

The U.S. Department of Education could improve IPEDS by collecting additional measures of a college’s financial health, as many stakeholders in the higher education community have requested (Kolbe & Kelchen, 2017). Some of these measures include the underlying metrics used to calculate financial responsibility scores, information on the equity position of small for-profit colleges that do not currently have to report all details to IPEDS, deferred maintenance backlogs, and spending on marketing and recruitment activities.

Three other types of measures could be particularly helpful in identifying which colleges are at risk of closure. One measure is whether a college faces any significant legal actions that could imperil its survival. This information should be available in court filings and may also be reflected on a college’s financial statement, but it is difficult to compile this information across a large number of colleges. The second measure is whether a college’s accreditor is pursuing any actions that could lead to sanctions or revocation of accreditation. Currently, accreditors often describe similar actions against colleges using different terms, making comparability difficult (United States Government Accountability Office, 2017b). Additionally, many accreditors do not publish complete lists of their actions, with the Western Association of Schools and Colleges being a notable exception (WASC Senior College and University Commission, n.d.). The third measure is whether states have taken actions against colleges. Given that state agencies vary considerably in their capacity (Tandberg et al., 2019), this information is not currently available for all states.

Finally, even an improved college closure identification process is unlikely to successfully capture every college that is risk of imminent closure. To protect students and taxpayers in these situations, it is crucial for every college to have a teach-out plan that is agreed to by the receiving college on file with their accreditor and the U.S. Department of Education before accessing federal financial aid dollars. Requiring

a plan from every college eliminates concerns that submitting a plan means that a college is at high risk of closure and also guards against random shocks (such as a natural disaster or a financial scandal) that could lead to a college's temporary or permanent closure. This requirement would be especially beneficial in the for-profit sector, where teach-out plans upon closure tend to be less common than among nonprofit colleges.

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Table 1: Number of college closures by year and institutional type.

Calendar year	Private nonprofit		Private for-profit		Total
	Two-year	Four-year	Two-year	Four-year	
2002	7	3	42	9	61
2003	4	3	20	9	36
2004	7	1	19	9	36
2005	4	2	21	9	36
2006	11	3	17	1	32
2007	8	4	38	9	59
2008	3	0	32	1	36
2009	3	2	24	0	29
2010	3	3	12	0	18
2011	1	1	6	0	8
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	1	0	0	0	1
2015	0	1	5	0	6
2016	10	5	91	2	108
2017	8	3	76	10	97
2018	13	7	91	12	123
2019	2	9	50	7	68
Total	85	47	544	78	754

Source: Author's calculations using PEPS data on closures.

Notes:

- (1) Colleges are classified based on their status in their final year of operation.
- (2) Institutions are classified as four-year colleges based on a combination of the predominant degree awarded (from the College Scorecard) and an institution's Carnegie classification. If data on both are missing, the college is classified as a two-year institution.
- (3) A small number of colleges closed, reopened, and then closed again during the length of the panel. They are counted as multiple closures.

Table 2: Summary statistics of the dataset (2016-17 academic year).

	Private nonprofit colleges		For-profit colleges	
	Mean	St. Dev.	Mean	St. Dev.
FTE enrollment	1,202	3,403	557	3,414
[10% drop in that year]	20.3	40.3	35.5	47.8
[10% drop in prior year]	20.7	40.6	37.6	48.4
Discount rate (pct)	23.5	20.2	--	--
[5ppt rise in that year]	6.6	24.8	--	--
[5ppt rise in prior year]	7.2	25.8	--	--
On HCM 2	1.2	11.1	2.0	13.54
Cohort default rate (pct)	8.1	6.6	13.0	8.1
County pct poverty	14.5	5.0	14.4	4.6
County unemployment	4.8	1.4	4.8	1.2
Four-year college	69.9	45.9	6.4	24.5
Financial responsibility score	2.4	0.8	2.0	1.0
[Failed that year]	6.6	24.9	9.9	29.8
[Failed prior year]	7.3	26.0	9.1	28.8
Pct of revenue from Title IV	--	--	66.3	17.3
[5ppt rise in that year]	--	--	15.7	36.4
[5ppt rise in prior year]	--	--	13.0	33.7
Total revenue (\$mil)	33.5	46.6	8.3	46.5
[10% drop in that year]	11.3	31.7	30.7	46.1
[10% drop in prior year]	17.3	37.9	32.4	46.8
Endowment (\$mil)	13.1	13.3	--	--
[10% drop in that year]	8.0	27.2	--	--
[10% drop in prior year]	7.8	26.8	--	--
Tuition reliance (pct)	62.3	21.4	84.7	16.6
[5ppt rise in that year]	10.1	30.1	15.0	35.7
[5ppt rise in prior year]	19.9	40.0	15.7	36.4
New FTFT enrollment	223	196	--	--
Admit rate (pct)	67.6	19.8	--	--
[5ppt rise in that year]	23.4	42.4	--	--
[5ppt rise in prior year]	24.6	43.1	--	--
Yield rate (pct)	35.6	21.9	--	--
Ever had loan (pct)	87.7	12.6	84.4	12.6
Ever had Pell (pct)	62.8	15.4	78.1	12.0
Number of colleges	840		1,886	

Sources: College Scorecard (HCM 2, CDR, ever loan or Pell), Federal Student Aid (financial responsibility score, percent of revenue from Title IV), Census Bureau (poverty rate), Bureau of Labor Statistics (unemployment rate), Integrated Postsecondary Education Data System (all others).

Notes:

(1) Private nonprofit colleges that ever had an endowment of over \$50 million (in current dollars) are

excluded from the sample.

(2) 2-year cohort default rates were used through 2012-13, with 3-year rates used in following years.

Table 3: Results of linear probability models predicting private nonprofit college closures two years later.

	Full sample				2009-10 forward			
	Model (1)		Model (2)		Model (3)		Model (4)	
	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)
Log FTE enrollment	0.0027***	(0.0009)	0.0078*	(0.0040)	-0.0028*	(0.0017)	0.0086*	(0.0045)
[10% drop in that year]	0.0116***	(0.0021)	0.0067***	(0.0022)	0.0063***	(0.0022)	0.0045*	(0.0024)
[10% drop in prior year]	0.0065***	(0.0021)	0.0030	(0.0021)	0.0022	(0.0022)	0.0017	(0.0024)
Discount rate (pct)	0.0039	(0.0055)	0.0116	(0.0091)	-0.0002	(0.0086)	0.0087	(0.0097)
[5ppt rise in that year]	0.0052*	(0.0029)	0.0059**	(0.0026)	0.0049	(0.0031)	0.0084***	(0.0029)
[5ppt rise in prior year]	0.0100***	(0.0028)	0.0044*	(0.0025)	0.0062**	(0.0030)	0.0043	(0.0028)
On HCM 2	0.0242***	(0.0078)	0.0036	(0.0160)	0.0395***	(0.0126)	0.0010	(0.0157)
Cohort default rate (pct)	0.0899***	(0.0164)	0.0528**	(0.0261)	0.0856***	(0.0214)	0.0159	(0.0275)
County pct poverty	-0.0004*	(0.0002)	0.0003	(0.0003)	-0.0012**	(0.0005)	-0.0002	(0.0003)
County unemployment	0.0279	(0.0632)	0.0472	(0.0636)	0.0793	(0.0835)	0.0437	(0.0648)
Four-year college Financial responsibility score	0.0011	(0.0024)	0.0116**	(0.0049)	-0.0086*	(0.0048)	0.0086*	(0.0049)
[Failed that year]	--	--	--	--	-0.0042**	(0.0019)	-0.0014	(0.0017)
[Failed prior year]	--	--	--	--	0.0059	(0.0050)	0.0086*	(0.0045)
Log total revenue	--	--	-0.0063	(0.0041)	--	--	-0.0042	(0.0045)
[10% drop in that year]	--	--	0.0050**	(0.0020)	--	--	0.0021	(0.0022)
[10% drop in prior year]	--	--	0.0030	(0.0020)	--	--	0.0008	(0.0022)
Log endowment	--	--	0.0021***	(0.0005)	--	--	-0.0022***	(0.0005)
[10% drop in that year]	--	--	0.0063***	(0.0023)	--	--	0.0085***	(0.0024)
[10% drop in prior year]	--	--	-0.0030	(0.0022)	--	--	-0.0030	(0.0024)
Tuition reliance (pct)	--	--	-0.0030	(0.0096)	--	--	-0.0029	(0.0100)
[5ppt rise in that year]	--	--	-0.0001	(0.0019)	--	--	0.0012	(0.0021)
[5ppt rise in prior year]	--	--	0.0021	(0.0018)	--	--	0.0036*	(0.0020)
(Log) new FTFT enrollment	--	--	0.0055***	(0.0020)	--	--	-0.0053**	(0.0021)
Admit rate (pct)	--	--	0.0020	(0.0050)	--	--	0.0033	(0.0054)
[5ppt rise in that year]	--	--	-0.0005	(0.0016)	--	--	0.0001	(0.0017)
[5ppt rise in prior year]	--	--	-0.0015	(0.0015)	--	--	-0.0006	(0.0016)
Yield rate (pct)	--	--	0.0127**	(0.0054)	--	--	0.0117*	(0.0060)
Ever had loan (pct)	--	--	-0.0052	(0.0197)	--	--	0.0085	(0.0202)
Ever had Pell (pct)	--	--	0.0012	(0.0127)	--	--	-0.0040	(0.0131)
Number of colleges	794		408		778		399	
Adjusted R-squared	0.027		0.024		0.0025		0.028	

Sources: See Table 2.

Notes:

- (1) Private nonprofit colleges that ever had an endowment of over \$50 million (in current dollars) are excluded from the sample.
- (2) The regression models also include clustered standard errors and year fixed effects.
- (3) 2-year cohort default rates were used through 2012-13, with 3-year rates used in following years.
- (4) * indicates $p < .10$, ** indicates $p < .05$, and *** indicates $p < .01$.

Table 4: Results of linear probability models predicting private nonprofit college closure four years later.

	Full sample				2009-10 forward			
	Model (1)		Model (2)		Model (3)		Model (4)	
	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)
Log FTE enrollment	-0.0061***	(0.0018)	0.0116**	(0.0059)	-0.0067***	(0.0024)	0.0193**	(0.0094)
[10% drop in that year]	0.0204***	(0.0033)	0.0046	(0.0038)	0.0100***	(0.0038)	-0.0008	(0.0043)
[10% drop in prior year]	0.0118***	(0.0033)	0.0129***	(0.0038)	0.0048	(0.0038)	0.0099**	(0.0042)
Discount rate (pct)	0.0205*	(0.0111)	0.0368**	(0.0145)	0.0178	(0.0135)	0.0274	(0.0194)
[5ppt rise in that year]	0.0060	(0.0047)	-0.0096**	(0.0046)	-0.0066	(0.0053)	-0.0074	(0.0051)
[5ppt rise in prior year]	0.0018	(0.0045)	-0.0048	(0.0044)	0.0024	(0.0050)	-0.0001	(0.0050)
On HCM 2	0.0506***	(0.0187)	0.1303***	(0.0276)	0.0901***	(0.0217)	-0.2788***	(0.0350)
Cohort default rate (pct)	0.1639***	(0.0305)	0.0547	(0.0449)	0.1092***	(0.0352)	0.0341	(0.0518)
County pct poverty	-0.0011**	(0.0005)	-0.0008*	(0.0004)	-0.0018***	(0.0006)	-0.0015**	(0.0006)
County unemployment	0.0019	(0.1233)	0.0854	(0.1068)	0.1702	(0.1342)	0.2198*	(0.1233)
Four-year college Financial responsibility score	-0.0095*	(0.0057)	0.0138*	(0.0075)	-0.0155**	(0.0069)	0.0220**	(0.0104)
[Failed that year]	--	--	--	--	-0.0136***	(0.0031)	-0.0027	(0.0030)
[Failed prior year]	--	--	--	--	0.0150*	(0.0085)	0.0200**	(0.0080)
[Failed prior year]	--	--	--	--	0.0041	(0.0076)	0.0109	(0.0073)
Log total revenue	--	--	-0.0083	(0.0054)	--	--	-0.0285***	(0.0093)
[10% drop in that year]	--	--	0.0156***	(0.0036)	--	--	0.0092**	(0.0038)
[10% drop in prior year]	--	--	0.0105***	(0.0034)	--	--	0.0061	(0.0038)
Log endowment	--	--	-0.0013	(0.0008)	--	--	-0.0013	(0.0009)
[10% drop in that year]	--	--	0.0013	(0.0040)	--	--	-0.0019	(0.0041)
[10% drop in prior year]	--	--	-0.0011	(0.0039)	--	--	-0.0056	(0.0041)
Tuition reliance (pct)	--	--	0.0100	(0.0152)	--	--	0.0052	(0.0204)
[5ppt rise in that year]	--	--	-0.0041	(0.0033)	--	--	-0.0039	(0.0035)
[5ppt rise in prior year]	--	--	0.0004	(0.0031)	--	--	0.0056	(0.0035)
(Log) new FTFT enrollment	--	--	-0.0050	(0.0031)	--	--	-0.0024	(0.0042)
Admit rate (pct)	--	--	-0.0046	(0.0083)	--	--	0.0032	(0.1026)
[5ppt rise in that year]	--	--	0.0053*	(0.0027)	--	--	0.0011	(0.0031)
[5ppt rise in prior year]	--	--	0.0032	(0.0026)	--	--	0.0006	(0.0029)
Yield rate (pct)	--	--	0.0235***	(0.0089)	--	--	0.0307***	(0.0110)
Ever had loan (pct)	--	--	-0.0260	(0.0288)	--	--	-0.0293	(0.0440)
Ever had Pell (pct)	--	--	-0.0202	(0.0189)	--	--	-0.0050	(0.0274)
Number of colleges	951		650		743		398	
Adjusted R-squared	0.048		0.024		0.054		0.022	

Sources: See Table 2.

Notes:

- (1) Private nonprofit colleges that ever had an endowment of over \$50 million (in current dollars) are excluded from the sample.
- (2) The regression models also include clustered standard errors and year fixed effects.
- (3) 2-year cohort default rates were used through 2012-13, with 3-year rates used in following years.
- (4) * indicates $p < .10$, ** indicates $p < .05$, and *** indicates $p < .01$.

Table 5: Results of linear probability models predicting private for-profit college closure two years later.

	Full sample				2009-10 forward			
	Model (1)		Model (2)		Model (3)		Model (4)	
	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)
Log FTE enrollment	-0.0095***	(0.0014)	-0.0078***	(0.0028)	-0.0045	(0.0027)	-0.0088*	(0.0049)
[10% drop in that year]	0.0147***	(0.0023)	0.0111***	(0.0027)	0.0104***	(0.0029)	0.0066**	(0.0030)
[10% drop in prior year]	0.0105***	(0.0023)	0.0084***	(0.0027)	0.0087***	(0.0030)	0.0081***	(0.0029)
On HCM 2	0.0998***	(0.0114)	0.1256***	(0.0158)	0.1092***	(0.0160)	0.1131***	(0.0221)
Cohort default rate (pct)	0.1077***	(0.0165)	0.0438**	(0.0208)	0.1023***	(0.0213)	0.0336	(0.0230)
County pct poverty	-0.0004	(0.0004)	-0.0002	(0.0004)	-0.0003	(0.0007)	0.0001	(0.0008)
County unemployment	0.0307	(0.0937)	-0.0861	(0.1041)	0.0225	(0.1383)	0.0245	(0.1402)
Four-year college	0.0224***	(0.0070)	0.0085	(0.0078)	0.0190	(0.0141)	-0.0062	(0.0147)
Financial responsibility score	--	--	--	--	-0.0099***	(0.0029)	0.0099***	(0.0028)
[Failed that year]	--	--	--	--	-0.0061	(0.0094)	0.0261***	(0.0092)
[Failed prior year]	--	--	--	--	-0.0028	(0.0074)	-0.0016	(0.0074)
Pct of revenue from Title IV	--	--	--	--	0.0455***	(0.0163)	0.0307	(0.0196)
[5ppt rise in that year]	--	--	--	--	0.0019	(0.0035)	0.0049	(0.0034)
[5ppt rise in prior year]	--	--	--	--	0.0047	(0.0032)	0.0037	(0.0031)
Log total revenue	--	--	0.0040	(0.0026)	--	--	0.0156***	(0.0048)
[10% drop in that year]	--	--	0.0097***	(0.0030)	--	--	0.0061*	(0.0032)
[10% drop in prior year]	--	--	0.0169***	(0.0030)	--	--	0.0049	(0.0032)
Tuition reliance (pct)	--	--	0.0202***	(0.0072)	--	--	0.0235**	(0.0114)
[5ppt rise in that year]	--	--	-0.0013	(0.0033)	--	--	-0.0014	(0.0036)
[5ppt rise in prior year]	--	--	-0.0060*	(0.0032)	--	--	-0.0053	(0.0034)
Ever had loan (pct)	--	--	0.0013	(0.0170)	--	--	-0.0247	(0.0285)
Ever had Pell (pct)	--	--	0.0538***	(0.0159)	--	--	0.0482	(0.0316)
Number of colleges	1,770		1,367		1,563		1,133	
Adjusted R-squared	0.054		0.048		0.044		0.0037	

Sources: See Table 2.

Notes:

- (1) The regression models also include clustered standard errors and year fixed effects.
- (2) 2-year cohort default rates were used through 2012-13, with 3-year rates used in following years.
- (3) * indicates $p < .10$, ** indicates $p < .05$, and *** indicates $p < .01$.

Table 6: Results of linear probability models predicting private for-profit college closure four years later.

	Full sample				2009-10 forward			
	Model (1)		Model (2)		Model (3)		Model (4)	
	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)	Coeff.	(SE)
Log FTE enrollment	-0.0159***	(0.0022)	-0.0105**	(0.0046)	-0.0235***	(0.0035)	-0.0267***	(0.0075)
[10% drop in that year]	0.0196***	(0.0033)	0.0178***	(0.0043)	0.0133***	(0.0047)	0.0127**	(0.0056)
[10% drop in prior year]	0.0139***	(0.0032)	0.0027	(0.0042)	0.0090*	(0.0047)	0.0048	(0.0056)
On HCM 2	0.0972***	(0.0019)	0.0435	(0.0280)	0.1454***	(0.0250)	0.0397	(0.0370)
Cohort default rate (pct)	0.1268***	(0.0247)	0.1288***	(0.0338)	0.1612***	(0.0331)	0.1129***	(0.0412)
County pct poverty	0.0002	(0.0007)	0.0003	(0.0008)	-0.0008	(0.0009)	-0.0012	(0.009)
County unemployment	-0.0154	(0.1512)	-0.1571	(0.1834)	0.1842	(0.1931)	-0.0413	(0.2013)
Four-year college	0.0417***	(0.0113)	0.0498***	(0.0135)	0.0735***	(0.0183)	0.0664***	(0.0192)
Financial responsibility score	--	--	--	--	-0.0106**	(0.0045)	-0.0094*	(0.0051)
[Failed that year]	--	--	--	--	0.0167	(0.0149)	0.0086	(0.0172)
[Failed prior year]	--	--	--	--	-0.0155	(0.0117)	0.0122	(0.0138)
Pct of revenue from Title IV	--	--	--	--	0.0829***	(0.0231)	0.0461	(0.0304)
[5ppt rise in that year]	--	--	--	--	-0.0011	(0.0054)	0.0052	(0.0064)
[5ppt rise in prior year]	--	--	--	--	0.0063	(0.0049)	0.0066	(0.0057)
Log total revenue	--	--	-0.0005	(0.0042)	--	--	0.0211***	(0.0069)
[10% drop in that year]	--	--	0.0371***	(0.0046)	--	--	0.0225***	(0.0061)
[10% drop in prior year]	--	--	0.0394***	(0.0046)	--	--	0.0178***	(0.0062)
Tuition reliance (pct)			0.0547***	(0.0120)	--	--	0.0021	(0.0170)
[5ppt rise in that year]			-0.0191***	(0.0051)	--	--	-0.0031	(0.0067)
[5ppt rise in prior year]			-0.0250***	(0.0050)	--	--	-0.0013	(0.0065)
Ever had loan (pct)	--	--	-0.0303	(0.0291)	--	--	-0.1087***	(0.0411)
Ever had Pell (pct)	--	--	0.1141***	(0.0279)	--	--	0.0577	(0.0457)
Number of colleges	2,026		1,598		1,361		952	
Adjusted R-squared	0.078		0.088		0.066		0.052	

Sources: See Table 2.

Notes:

- (1) The regression models also include clustered standard errors and year fixed effects.
- (2) 2-year cohort default rates were used through 2012-13, with 3-year rates used in following years.
- (3) * indicates $p < .10$, ** indicates $p < .05$, and *** indicates $p < .01$.

Table 7: Examining the accuracy of college closure predictions.

Decile	Number closed two years later				Number closed four years later			
	Model (1)	Model (2)	Model (3)	Model (4)	Model (1)	Model (2)	Model (3)	Model (4)
<u>Nonprofit colleges</u>								
Bottom	0	0	0	0	1	0	5	2
Second	0	0	0	0	1	0	2	0
Third	0	0	0	0	4	0	0	0
Fourth	1	0	0	0	1	0	0	0
Fifth	0	0	0	0	6	1	1	0
Sixth	2	0	0	0	5	0	0	0
Seventh	1	0	0	0	10	1	3	0
Eighth	3	0	3	0	12	1	2	1
Ninth	8	0	6	0	20	4	15	0
Top	31	7	21	5	87	18	59	16
Max observations/decile	919	426	668	331	920	440	676	345
<u>For-profit colleges</u>								
Bottom	0	0	0	0	8	1	2	0
Second	3	0	0	1	18	7	5	1
Third	1	1	1	1	13	5	4	3
Fourth	8	4	0	0	25	10	7	6
Fifth	6	2	3	0	24	16	16	6
Sixth	10	2	2	0	32	25	19	8
Seventh	16	11	7	3	67	27	37	14
Eighth	41	15	23	2	135	55	50	22
Ninth	78	30	41	14	195	90	82	29
Top	192	96	87	39	350	238	160	55
Max observations/decile	1,695	1,062	895	519	1,693	1,062	863	519

Note: Deciles are based on the predicted probabilities from the models in Tables 3-6.