Leaving late: Understanding the extent and predictors of college late departure

Zachary Mabel*
Harvard Graduate School of Education

Tolani A. Britton
Harvard Graduate School of Education

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Research on college dropout has largely addressed early exit from school, even though a large share of students who do not earn degrees leave after their second year. In this paper, we offer new evidence on the scope of college late departure. Using administrative data from Florida and Ohio, we conduct an event history analysis of the dropout process as a function of credit attainment. Our results indicate that late departure is widespread, particularly at two- and open-admission four-year institutions. We estimate that 14 percent of all entrants to college and one-third of all dropouts completed at least three-quarters of the credits that are typically required to graduate before leaving without a degree. Our results also indicate that the probability of departure spikes as students near the finish line. Amidst considerable policy attention towards improving student outcomes in college, our findings point to promising new avenues for intervention to increase postsecondary attainment.

Keywords: Postsecondary completion; college dropout; late departure; human capital

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* Please address all correspondence to Zachary Mabel. Address: 11 Danforth Street #2, Boston, MA 02130. Phone: (202) 306-7278. Email: zam340@mail.harvard.edu.

1. INTRODUCTION

Over the last two decades, improvements in data quality have shown that college dropout is widespread and raised concern over low completion rates at U.S. colleges and universities. Approximately two-thirds of degree-seeking students at community colleges withdraw before earning an associate or bachelor's degree within six years of initial enrollment, while nearly 40 percent of undergraduates at four-year institutions exit before earning a degree in this timeframe.[1] Data sources also suggest that more than 40 percent of college students who do not earn degrees leave after their second year of school (Bowen, Chingos, & McPherson, 2009; Shapiro et al., 2014).

In an era in which the returns to college completion are large for most students but public funding for higher education is limited, targeting students who are near graduation but remain at risk of dropout may offer a cost-effective strategy for increasing degree attainment. However, because much of the research and policy attention on the dropout issue has focused on early departure (Adelman, 2006; Chemers, Hu & Garcia, 2001; Kuh, Cruce, Shoup, Kinzie & Gonyea, 2008; Stinebrickner & Stinebrickner, 2012; Zajacova, Lynch, & Espenshade, 2005), less is known about how close to degree attainment non-completers are at the time of dropout and which students are at risk of leaving late.

In this paper, we offer new evidence on the scope and predictors of college late departure. Building on previous research, which has traditionally modeled dropout as a function of time enrolled and demonstrated that the likelihood and predictors of withdrawal are dynamic (Desjardins, Ahlburg, & McCall, 1999; Ishitani, 2006; Stratton, O'Toole, & Wetzel, 2008), we examine dropout instead as a function of credit progress towards degree completion. As we

[1] Author's calculations using the National Center for Education Statistics, 2004/2009 Beginning Postsecondary Students Longitudinal Study.

describe in more detail in the following section, enrollment duration can obscure progress to completion because many students accumulate college credits slowly, which prolongs time to degree completion (Bound, Lovenheim, & Turner, 2012). Investigating dropout as a function of credit accumulation therefore provides a more precise approach to estimating the scope of late departure, which in this study we define to be non-degree completion among students who earned at least three-quarters of the credits typically required for graduation.

To preview our results, we find that many students withdraw after completing most of the credits that are typically required for graduation. We estimate that 14 percent of all degree-seeking students who enrolled in college and 33 percent of all dropouts completed at least three-quarters of the credits typically required to graduate before withdrawing. Moreover, we find that the probability of withdrawal spikes near the finish line. For example, the probability of dropout among students who reach the three-quarter credit threshold is nearly 1.5 times greater than the probability of dropout among students who completed at least half, but fewer than three-quarters of their credit requirements.

Although unpacking the causes of late departure is beyond the scope of this study, we descriptively examine which students are in jeopardy of leaving just shy of degree attainment and investigate how dropout predictors vary with proximity to completion. The results suggest that well-established predictors of early dropout, including poor academic preparation and non-sequential enrollment histories (Adelman, 2006; Attewell, Heil, & Reisel, 2012), also predict late departure. However, we also document relationships that have received less attention in the research literature. In particular, the spike in late departure signals that the relationship between credit accumulation and dropout is not constant through college. We also find suggestive evidence that the transition to more rigorous, upper division coursework may present a crucial

barrier to completion for many students who are capable of passing introductory coursework. Students who dropout late appear to maintain their effort in terms before exiting, yet experience increasing rates of course failure as they progress in school. These findings, coupled with the fact that the magnitude of many dropout predictors varies with credit progress, suggests the student dropout profile is dynamic along the pathway to degree completion.

We structure the remainder of this paper into three sections. In Section 2, we discuss the barriers to completing college and what is currently known about college dropout from the research literature. In Section 3, we describe our data, study sample, key measures, and methods for empirical analysis. We present our results in Section 4 and conclude in Section 5 by discussing the implications of our findings for research and policy.

2. BACKGROUND

2.1 Theoretical and Empirical Models of College Attrition

Scholars have theorized about the process of college persistence for decades, with two models motivating much of the early research on the topic. The Student Integration Model developed by Tinto (1987) posits that retention is primarily a function of the robustness of the social and intellectual life of a college. According to this framework, students are presumed to dropout when they are not academically or socially integrated into their school community. Bean's Student Attrition Model (1980), on the other hand, suggests that institutional factors play a smaller role in the decision to leave than do individual and environmental factors, such as whether a student perceives her college experience is providing practical value and will lead to better employment outcomes. Cabrera, Nora, and Castaneda (1993) later integrated these two models to demonstrate the connectedness of individual, institutional, and environmental factors

associated with departure. While providing conceptual frameworks for the causes of dropout, these theories do not account for the temporal dimension of the dropout process.

To account for the dynamic nature of investments in human capital and how the risk of dropout varies with time, Willett and Singer (1991) suggested the use of discrete time survival analysis. Following this convention, Desjardins, Ahlburg, and McCall (1999) use event history modeling to shed light on when students are at greatest risk of dropping out of school, as measured by time since initial enrollment. Employing variables from the structural model of Cabrera, Nora, and Castaneda (1993), such as high school records, demographic information, and current student achievement and financial aid, the authors find that predictors often treated as static are actually time-varying. Several studies over the last two decades have followed this same methodological approach to study predictors of dropout and when it occurs (Calcagno, Crosta, Bailey & Jenkins, 2006; Desjardins, Ahlburg, & McCall, 2002; Ishitani, 2006; Stratton, O'Toole, & Wetzel, 2008).

2.2 Student Progress to Completion: Enrollment Duration versus Credit Attainment

Because most studies have focused on the temporal dimension of dropout, less empirical work has explored how much academic progress students actually make before withdrawing. Of the work that has examined credit completion as a metric of progress, most look at how credits earned in the first year predict subsequent persistence and graduation (Adelman, 2006; Kuh, Cruce, Shoup, Kinzie, Gonyea, 2008; Zajacova, Lynch, & Espenshade, 2005). Furthermore, longitudinal studies that include credit attainment as a predictor typically follow the conventional approach to modeling progress as a function of time (Calcagno, Crosta, Bailey & Jenkins, 2006). Within this setup, it has been shown that credit accumulation increases the probability of graduation, but prior research has stopped short of examining how many students are dropping

out late.[2] Furthermore, research has not examined when dropout occurs conditional on surpassing intermediate progress milestones. Evaluating proximity to graduation may be difficult to parse out for this reason unless the dropout process is explicitly modeled as a function of academic progress.

This raises an important question: is time since initial enrollment a suitable proxy for degree progress? In Figure 1, we explore this empirically by plotting the distributions of credits earned one, three, and five years into college among undergraduates of public institutions in Florida and Ohio. The results show that while average credit attainment increases with enrollment duration, the variation in accumulated credits is large and increasing over time. By year 3, the standard deviation of completed credits (22.6) is equal to almost one full-time-equivalent year of credit attainment. For students who make it to a 5th year of college, the standard deviation is comparable to approximately 1.3 years of academic progress. The wide variation in credit completion indicates that time is a noisy measure of degree progress, especially as enrollment duration increases.

Several facets of the college student experience help to explain why credit attainment is a better proxy for academic progress than enrollment duration. First, roughly one-third of students are required to take developmental or remedial courses, which do not count towards a degree, but must be completed prior to taking credit-bearing courses (Attewell, Lavin, Domina, & Levey, 2006). Discontinuous enrollment, whereby students take time off from college but later return, is also widespread (O'Toole, Stratton, & Wetzel, 2003), as is working while in college (Scott-Clayton, 2012), which hinders full-time enrollment and has been shown to cause full-time enrollees to complete fewer credits per term (Darolia, 2014). In light of this evidence, and as we

[2] Furthermore, because credit accumulation is a necessary requirement for graduation, the positive correlation documented previously is also a function of enrollment duration.

discuss in greater detail in section *3.4*, in this study we model dropout as a function of credit progress to examine the scope of the late departure phenomenon.

It is important to note that many of the aforementioned characteristics of the student experience are common to students throughout their time in school. However, the influence of these characteristics on the likelihood of dropout is likely to vary with proximity to graduation. For example, as students age they are likely to take on additional work and family commitments that may make completing college more challenging. Furthermore, because perceptions of belonging in college influence the likelihood of stop out but typically stabilize over time (Walton and Cohen, 2007; Robbins et al., 2004), the relationship between prior enrollment behavior and the likelihood of degree completion may diminish as students progress in college. We thus hypothesize that the influence of student characteristics will vary with the number of credits completed and examine evidence for this in our empirical work.

2.3 Leaving College in the Ninth Hour

Although proximity to graduation is an understudied topic in the dropout literature, aspects of the traditional college experience suggest that many students may be susceptible to leaving late. At large, open access colleges and universities students are often required to navigate complex bureaucracies and receive minimal advising to chart their course. Student-to-counselor ratios at those institutions, which frequently exceed 1,000:1, create environments in which many students are unaware of whom to contact if they need support (Gallagher, 2010; Center for Community College Student Engagement, 2009). As a result, research finds that nearly half of community college students do not understand their graduation requirements, and choosing courses at random is commonplace (Rosenbaum, Deil-Amen, and Person, 2006; Grubb, 2006; Schneider and Yin, 2011). Thus, students who have spent more years in college may

accumulate numerous credits that do not contribute to graduation (Scott-Clayton & Rodriguez, 2014), thereby increasing their chances of exhausting eligibility for time-limited sources of financial aid. Furthermore, because students typically have an abundance of choice when deciding which courses to take, they may delay progress to completion by avoiding required classes that are demanding and unpleasant (Bailey, Jeong, & Cho, 2010).

The road to completion also becomes increasingly self-directed because colleges frequently assume that students can navigate through school independently after the first year. Support programs primarily target first-year students for this reason, even though initial impacts of first-year interventions, such as learning communities and student success courses, typically fade out in subsequent semesters when students lose access to structured supports (Rutschow, Cullinan & Welbeck, 2012; Visher, Weiss, Weissman, Rudd, & Wathington, 2012). In this isolated environment, the risk of departure may loom large for students who have made substantial academic progress. Unanticipated obstacles, including changes in financial aid, experiencing hardship such as a family member's job loss, or even failing a required course, may derail advanced undergraduates who are committed to graduating and capable of doing so.

These features of the college landscape may explain why a large portion of dropout during the first two years of college is attributed to what students learn about the expectations of college and their own academic performance, whereas these factors play a much smaller role in later dropout decisions (Stinebricker & Stinebricker, 2014). Furthermore, because per-student resources are most limited at broad-access institutions where student needs are greatest, the challenges to finishing college after making substantial progress are likely to vary across institutions and be most acute at two- and non-selective four-year institutions where graduation rates are lowest.

In spite of the documented challenges encountered by college-goers, the number of students leaving college after making considerable academic progress is not well known. Dated estimates suggest that nearly 25 percent of traditional-age students from the high school graduating class of 1992 entered college and completed at least 75 percent of their academic degree requirements before leaving without a degree (IHEP, 2011). However, this two-decade old estimate may no longer reflect the current postsecondary landscape. For example, the growing shift of financial aid from grants to loans in recent decades has increased both the percentage of students that take-on debt to pay for college and average loan amounts (Baum, Elliot and Ma, 2014). If students are less willing to invest in additional schooling as debt accumulates, then the rate of late departure may be increasing over time. Alternatively, the problem may be less severe today now that technology innovations offer students more ways to balance school with other responsibilities. In short, more analysis is needed to understand if many students are withdrawing near graduation because much has changed in higher education over the last two decades.

This paper contributes to the literature on college persistence and attainment by examining three research questions: 1) how many of the credits typically required for graduation do non-completers earn, 2) which students are at risk of dropping out after completing most of their credit requirements, and 3) do the predictors of late departure differ from the predictors of withdrawal at earlier points along the path to degree completion? By focusing on proximity to degree completion as a function of academic progress instead of enrollment duration, which we measure by the percentage of credits typically required for graduation which students have completed, we provide a more detailed picture of when students are dropping out and which students are at risk of leaving late. As we discuss in our concluding remarks, our findings offer

policymakers and institutional leaders new avenues for increasing degree attainment by targeting supports to this oft-overlooked population of students.

3. DATA, SAMPLES, AND METHODS

3.1 Data

The data in this study are from the Florida Department of Education K-20 Data Warehouse (KDW) and the Ohio Board of Regents (OBR), which maintain longitudinal student-level records at public colleges and universities in Florida and Ohio, respectively. From these systems we have high school and college application records, including demographic and transcript data on students. These data are then linked to term-by-term college enrollment, course transcript, and degree award records at all public two- and four-year institutions in both states. We are therefore able to observe students' credit accumulation in remedial and college-level courses and can track progress to degree completion by the number of credits completed over time.

This rich dataset captures enrollment and completion records for the census of students at Ohio public colleges and for the majority of college-bound, Florida high school graduates.[3] However, a limitation of our data is that we cannot differentiate between students who dropped out and those who transferred to private or out-of-state institutions. Our results overstate the extent of dropout for this reason, although the magnitude of upward bias is likely small given that only 6 percent of students first attending public institutions in Florida and Ohio subsequently transfer to private or out-of-state colleges (Shapiro, Dundar, Wakhungu, Yuan, & Harrell, 2015), whereas 44 percent of the students in our data withdrew before earning a degree.

[3] KDW records capture the census of Florida public high school graduates, not the census of college-bound students as in Ohio. In the 2000-01 academic year, 85 percent of all first-time freshmen at public institutions in Florida were in-state residents (authors' calculations using IPEDS). We therefore observe most, though not all students who first attended public colleges and universities in Florida.

3.2 Samples

We explore the scope and determinants of college late departure among a sample of first-time, degree-seeking undergraduates who enrolled at public institutions in Florida and Ohio between the fall 2000 and fall 2001 academic terms. We condition our sample on traditional college entrants, which comprise approximately 80 percent of all first-time college-goers, in order to observe both pre-entry characteristics and the complete enrollment trajectories of students in the data. Specifically, we restrict our sample to include students who: a) were between the ages of 17-19 at the time of high school graduation, and b) enrolled at least half-time (attempted 6 or more credits) as a degree-seeking student within 16 months of high school completion. We also condition the sample on students with complete demographic, prior achievement and college experience data, given that one objective of this study is to examine the predictors of late departure. These restrictions yield a sample of 54,012 unique students, of which 22,499 first attended two-year college, 12,318 first attended an open-admission four-year institution, and 19,195 first attended a selective four-year university.[4] We separately examine our research questions by the type of institution students first attended to allow the magnitude and risk factors of late departure to vary by college sector.[5]

To examine dropout as a function of credit progress, we follow the convention in the discrete event history modeling literature and construct a student-period dataset. However, whereas most event history analyses construct a student-by-time dataset to examine *when* dropout occurs, we construct a student-by-credit category dataset to examine *how many* credits

[4] We classified four-year universities as selective if Barron's Profiles of American Colleges categorized the institution as "very", "highly" or "most competitive" in the 2000-01 school year. Nine of the 24 public universities in Florida and Ohio met this criterion.

[5] As a robustness check, we also conducted analyses on a sample in which we assigned students to their last institution attended. The results we present throughout the paper are robust to whether students are assigned to the first or last school that they attended.

students complete upon exiting school for the last time. This dataset contains one observation per credit category for each student, with each student contributing as many observations to the sample as the number of credit thresholds they surpassed.[6] The student-period sample is comprised of the same 54,012 unique students but yields 177,331 student-by-credit category observations.

In Table 1, we present descriptive statistics for three samples of students: all first-time, degree-seeking undergraduates who attended public postsecondary institutions in the United States in fall 2003 (column 1), the sample of public college entrants in Florida and Ohio ages 17-19 at high school graduation who enrolled in college within 16 months of high school completion (column 2), and the subset of those students in our analytic sample (column 3).[7] There are some important differences between all first-time public undergraduates nationwide and those in our analytic sample as a result of the sample restrictions we impose. Because of our age restriction, the students in our analytic sample are younger at entry (18.5 versus 21.3 years old) and a significantly larger share entered college immediately following high school graduation (91 percent versus 65 percent). Students who first attended four-year institutions are also overrepresented in our sample (58 percent in our sample versus 43 percent nationally). However, on gender, race, and high school GPA, the students in our analytic sample closely mirror the profile of all incoming undergraduates nationwide.

The students in our analytic sample also closely mirror the full population of traditional public college entrants in Florida and Ohio on observable demographic characteristics. In terms

[6] For example, a student who earned 20 of the 120 credits typically required to earn a bachelor's degree would contribute a single observation to the student-period dataset, corresponding to the interval when fewer than one-quarter of the requisite credits to graduate had been earned. Another student who earned 90 credits would contribute four observations to the dataset, given that they completed three-quarters of the credits typically required for a bachelor's degree.

[7] The statistics in column 1 draw on data from the National Center for Education Statistics, 2003-04 Beginning Postsecondary Students Longitudinal Study.

of college performance, the students in our analytic sample are slightly higher performing than the statewide sample. Average credit attainment is 8 units (9 percent) higher and the dropout rate is 3.6 points (7.6 percent) lower in our analytic sample compared to the statewide population. However, these differences largely reflect the overrepresentation of students who first attended four-year colleges in the analytic sample (58 percent versus 52 percent statewide). Differences within sector are considerably smaller, which is notable because we stratify by institution type in all of our analyses. Furthermore, the late departure rate (i.e. the dropout rate among students who completed three-quarters of the credits typically required for graduation) is nearly equivalent in both the statewide and analytic samples. We take this as evidence, in addition to the size and diversity of the Florida and Ohio postsecondary systems, that our findings likely generalize to traditional students in other large public college systems across the country.

3.3 Dependent and Independent Measures

In our empirical work, we examine the probability of withdrawal by the proportion of college-level credits cumulatively earned. This allows us not only to examine whether a student left college without earning their degree, but also how much academic progress they made towards degree completion at the time of departure. For this investigation, we constructed the categorical variable *CRED_CAT*, which captures the share of credits completed, in quarter increments, typically required for degree completion (i.e. $X < 0.25$; $0.25 \leq X < 0.5$; $0.5 \leq X < 0.75$; and $0.75 \leq X$).[8]

To investigate predictors of dropout by credit progress, we leverage a rich set of pre- and post-entry measures that capture many of the demographic, incoming preparation, enrollment

[8] Because we do not observe programs of study for most students in the data, we assume associate and bachelor's degree-seeking students must earn 60 and 120 college-level credits to graduate, respectively. These thresholds are consistent with the graduation requirements for most majors published on institutional websites in Florida and Ohio. We assigned students to either the 60 or 120 credit threshold according to the degree type they first pursued.

momentum, and college performance factors shown to correlate strongly with degree progress in the research literature (Adelman, 2006; Attewell, Heil, & Reisel, 2011; Nora, Barlow, & Crisp, 2005). These include indicators for gender and race, whether the student entered college immediately following high school graduation, whether the student took remedial coursework, and a continuous measure of high school GPA. We also examine time-varying enrollment and academic performance factors, including indicators for having previously stopped out from college and transferred institutions, age in years, and the student's average term GPA, number of credits attempted, and proportion of credits earned in each credit period.[9]

Our outcome measure is an indicator equal to "1" if a student did not earn an associate or bachelor's degree within six years of initial enrollment in college, or was not enrolled in college at the start of their seventh year.[10] By construction, all students assigned a value of "0" had therefore either graduated within six years or were still enrolled in their seventh year and presumed to be working towards their degree. We count all students who completed an associate or bachelor's degree, regardless of which credential they initially pursued, as degree earners. This ensures that the departure rates we estimate are not inflated by changes to degree intentions over time.

[9] A clear omission from this list is financial aid, which a large body of research has shown can increase the probability of enrollment, persistence, and degree completion (see Dynarski & Scott-Clayton, 2013 for a summary of this literature). Unfortunately, we do not observe complete aid packages for students in our data and therefore cannot examine the relationship between financial aid and credit progress to graduation.

[10] Because our data is right-censored at year 7, some students coded as dropouts will have stopped out but later re-enrolled and graduated beyond the time horizon we observe. This will also lead to overestimation of late dropout rates, although the definition of dropout we employ likely results in a minimal amount of upward bias due to censoring. To examine this issue, we turned to an administrative dataset from the University System of Georgia, which maintains longitudinal student-level records at public, four-year colleges and universities in the State of Georgia and allows us to track students over a longer time horizon (i.e., through 10 years following initial enrollment). We find that only 14 percent of USG students who completed 90 or more credits (i.e., 75 percent of the credits typically required for bachelor's degree completion) and who were not still enrolled in year 7 completed a bachelor's degree within 10 years. This suggests that the vast majority of students coded as dropouts in our study sample did not return to college and subsequently graduate after year 7.

3.4 Empirical Strategy

We begin our empirical work by calculating sample departure rates within each credit category and institution type. We then examine dropout rates by pre- and post-entry characteristics for students who reach the three-quarter credit threshold to shed light on which students are at risk of dropping out after completing most of their credit requirements. Next, to allow for population inferences that extend beyond our study sample, we turn to event history modeling using the student-period dataset. For this analysis, we estimate a single risk discrete-time hazard model using a logistic regression specification of the following form:[11]

(1) $$\Pr(Y_{idc} \mid X_{idc}) = P(\theta_{idc} + Z_{idc} + \omega_s), \text{ where } P(j) = \frac{1}{1+e^{-(j)}}.$$

Because the student-period dataset contains one observation for each credit category a student surpasses, in this specification we are modeling the conditional risk of dropout, also called the "hazard" in event history analysis, for student i who first pursued degree d in credit interval c. To test whether the probability of dropout varies both by the proportion of credits completed and the type of degree sought, we include indicator variables for twelve (4 credit categories x 3 institution types) credit-by-institution type categories (θ_{icd}). By including this set of dummy variables, an attractive feature of this regression model is that we make no assumption as to the functional form of the underlying relationship between credit attainment and dropout. To account for factors which may influence the progress students make towards degree completion and their risk of dropout, in some models we also include the full set of pre- and post-entry student characteristics (Z_{idc}) and an indicator of whether the student attended college in Florida or Ohio (ω_s). In those models, the vector Z_{idc} also includes a measure of time between

[11] In addition to estimating logistic hazard models, we also fit random intercept logistic and complementary log-log hazard models and estimated models that account for parametric and non-parametric representations of unobservable factors affecting student dropout behavior (i.e. "unobserved heterogeneity" or "frailty" in event history modeling nomenclature). Our substantive conclusions are unaltered by these modeling decisions, and we therefore present results from the logistic models for simplicity and computational efficiency.

the term students reached each credit period and initial enrollment, which partials out the correlation between credit attainment and enrollment duration so that our results do not conflate dropout as a function of academic progress and time.

To formally test whether the risk of departure differs by progress to degree completion and institution type, we carry out post-estimation General Linear Hypothesis (GLH) tests of whether the coefficients on the credit-by-institution type indicators are equivalent. Likewise, to examine heterogeneity in dropout risk factors by proximity to degree completion, we augment equation (1) with interactions of θ_{idc} and Z_{idc} and then conduct GLH tests of whether the coefficients on the interaction terms are equal in magnitude. In all analyses, we report inference statistics that account for both the correlation of outcomes among students attending the same schools and for multiple testing by controlling the False Discovery Rate.[12]

4. RESULTS

4.1 The Probability of Departure by Proximity to Degree Completion

We begin our results section with a graphical presentation of enrollment outcomes through six years following college entry. Figure 2 shows the share of entrants that dropped out and completed a degree or remained enrolled by institution type. To highlight the scope of late departure, we define two groups of dropouts in the figure: those who withdrew prior to earning three-quarters of the credits typically required to graduate ("early" dropouts) and those who surpassed the three-quarter credit threshold ("late" dropouts). Across all institutions, late dropouts represent 14 percent of all students who ever enrolled in college and one-third of all dropouts. Figure 2 also shows that late departure is especially prevalent at two- and open-

[12] The FDR controls the proportion of rejections that are Type I errors, i.e. false discoveries. It reduces the penalty to multiple hypothesis testing when some Type I error is acceptable, as is the case for exploratory analyses like this one.

admission four-year institutions, representing 20 percent and 14 percent of all students who respectively began their college careers in those sectors.

In Figure 3, we disaggregate rates of late departure at two-year institutions by race, which shows that the phenomenon is widespread among students of different backgrounds. Approximately 20 percent of White, Black, and Hispanic/Latino students left college without a degree after accumulating three-quarters of their college-level credits. Analogous results in Figure A1 of the appendix also reveal small differences by race at four-year institutions. In Table A1 of the appendix, we present more detailed departure rates by credit category and show that late dropouts represent the largest share of withdrawals in each sector.

The fact that late dropouts represent a large share of all college entrants implies that the probability of departure spikes late into college. To show that this is the case, we turn to the results of our event history analysis. In Figure 4, we present graphical results of conditional dropout probabilities estimated from a logit hazard model that includes the twelve credit-by-institution type categories. Across all institution types, the probability of withdrawal is constant or declines in each of the first three credit categories. For students who first attended two- and open-admission four-year colleges, the probability of departure respectively declines from 0.19 to 0.10 and from 0.13 to 0.11 between the first and third credit intervals. For students who first attended four-year selective institutions, the probability of dropout is approximately .06 in each of the first three credit intervals.

In contrast, the probability of departure increases substantially for all students after they have completed three-quarters of their college-level credits. This spike is largest at non-selective institutions, with conditional dropout probabilities of 0.34 and 0.21 among students first attending two- and open-admission four-year students, respectively. However, students attending

four-year selective admissions institutions also experience a large increase in the probability of late departure in relative terms, rising from 0.6 to 0.10 between the third and fourth credit interval.

To examine if the spike in late departure is explained by the changing composition of students along the pathway to degree completion or the cumulative amount of time students enrolled in college, in Table A2 we re-estimate the hazard model with the inclusion of pre- and post-entry student characteristics. Notably, most of the departure estimates in the first three credit periods attenuate slightly after the inclusion of covariates, whereas the probability of departure in the fourth period spikes even higher. This suggests that enrollment duration and dynamic selection are unlikely to explain the increase in dropout risk late into college. In fact, because unobserved dropout factors will lead to monotonically decreasing departure rates (Singer and Willett, 2003), which we do not observe, the spike in late departure is not attributable to omitted variable bias. As shown in the bottom of Table A1, we also reject that the risk of departure is equal across credit categories and institution types. The p-values from all GLH tests are less than .01, indicating that both the spike in late departure and the differences in its pervasiveness by sector are substantively and statistically significant.

4.2 Predictors of Late Departure

To explore which students are at risk of late departure, we begin by reporting dropout rates in the fourth credit interval by student demographic, prior achievement, and college enrollment characteristics.[13] For ease of interpretation, we present results separately by incoming

[13] Given that the relationships we document in this section are purely correlational, the findings should not be mistaken by the reader for determinants of dropout. Indeed, much as a student's race or ethnicity is not the direct cause of their departure, it is likely that some of the enrollment factors we examine are not the underlying reason for a student's decision to leave school (although they may signal warning of a student's decision to drop out). For this reason, we use the terms predictor and risk factor interchangeably, but only in reference to documenting observable

attributes and enrollment experiences during college in Tables 2 and 3, respectively. Unlike the unconditional dropout rates in Figure 3, the results in Table 2 point to large differences in the conditional probability of late departure on several dimensions, including by race and high school GPA.[14] For example, the probability of dropout is approximately 1.5 times greater for Black and Latino students relative to Whites, while students with high school GPAs in the bottom quartile are 3 times more likely than top-quartile students to dropout late.

We also find large differences in dropout risk by the experiences of students in college. Consistent with previous work that has linked early academic momentum to increases in the likelihood of graduating (Adelman, 2006; Attewell, Heil, & Reisel, 2012), the largest contrasts in Table 3 emerge when we compare rates by whether or not students previously stopped out and by the proportion of attempted credits students earned once they reached the three-quarter credit mark. Students who withdrew from college and later returned are three times more likely than continuously enrolled students to dropout late, and students who failed to earn 20 percent or more of their attempted credits each semester, on average, are more than five times as likely to withdraw without earning a degree relative to students who failed no more than 10 percent of their course load each term. Taken together, these results suggest that enrollment momentum and early performance in upper division courses may play important roles in diagnosing which students are at greatest risk of late departure.

In Table 4, we examine the role of academic momentum in more detail by comparing how credit loads, credit attainment, and grade performance evolve over time. For this analysis,

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characteristics that can help diagnose the types of students at risk of leaving late. Neither term, nor any of our findings in this section, are intended to imply causality.

[14] The divergent findings between Figure 2 and Table 2 can be explained by differences in the size of the initial enrollment cohort across student subgroups. For example, for every Black student that first attended a two-year institution in our sample, nearly 4 white students enrolled. Because the share of late dropouts among all college entrants is similar for Blacks and Whites, it must therefore be the case that the probability of dropout is higher for the subset of Black students that reached the three-quarter credit mark.

we again restrict the sample to students who completed three-quarters of their credits and compare the academic progression of late dropouts to college graduates and late persisters (i.e. students who persisted to their seventh year of college). The results in panel A indicate that many students attempted fewer credits later in their college careers than at the outset, although the decline is larger on average for students who dropped out. For example, in column 7, we find that graduates and late persisters attempted 13.9 credits per semester before completing one-quarter of their credits versus 12.3 credits per semester once they exceeded the three-quarter credit mark, an 11.6 percent decline in relative terms. By comparison, in column 8 we find that late departers experienced an average credit load decline of 18.1 percent between the first and fourth credit interval.

We observe an even larger discrepancy between late dropouts and graduates/late persisters in panel B of Table 4, which examines the average share of attempted credits that students earned per term in each credit period. Graduates and late persisters not only passed a greater fraction of their early courses compared to late dropouts (0.93 versus 0.87 in column 7), but they also continued to earn nearly all of their attempted credits in the fourth interval as well. On the other hand, late dropouts earned just 76 percent of their attempted credits each semester, on average, once they reached the three-quarter credit threshold. Between the first and fourth credit interval, the proportion of credits completed per semester by late dropouts thus declined 11.9 percent, while among graduates and late persisters the proportion increased 0.4 percent. The evolution of college grades between late dropouts and their peers is less informative, as the results in panel C suggest. Both groups improved their GPAs over time, with late dropouts who first attended four-year institutions gaining nearly as much in relative terms as their peers who

graduated or re-enrolled. However, late dropouts earned lower grades compared to non-dropouts each semester at both the beginning and the end of college.

The divergent patterns of academic performance between graduates and late dropouts in Table 4 could be the result of many factors. For instance, it is possible that late dropouts experience increasing academic difficulty as course rigor intensifies in later years. Alternatively, late dropouts might reduce their academic effort preemptively as they begin to consider the decision to withdraw. Although we are unable to identify the root cause(s) of their academic declines in the data, the evidence suggests that late dropouts reduced their effort little before their final term. In Table A3, we show how academic performance evolved for late dropouts in their last three terms. In their final semester, late dropouts decreased their enrollment intensity by 1.2 credits compared to only 0.3 fewer credits in the previous term. The number of credits late dropouts completed also declined considerably more in their final term (-1.7 credits) compared to the previous one (-0.5), and we find no evidence that late dropouts earned lower grades in their courses until their final semester. Flagging effort preceding the decision to withdraw is therefore an unlikely explanation for the academic performance declines we document among late dropouts.

To explore the potential sources of late dropout further, we also examined the extent to which the phenomenon is associated with credit accumulation in required coursework.[15] Although neither the Florida nor Ohio data allow us to track completion of major-specific requirements precisely, we constructed a proxy measure of major requirements in the three most popular majors in Florida (i.e., Business, Psychology, and Education) by identifying common

[15] As indicated in footnote 8, this analysis is limited to students at four-year colleges and universities in Florida for whom we observe majors of study. To make this analysis tractable, we also restricted the sample to students in the top three majors in Florida where sample sizes were sufficiently large to identify course-taking patterns by program of study.

courses completed by bachelor's degree recipients in those programs. We then compared the number and share of credits completed in those courses between graduates and late dropouts. The results of this analysis indicate that graduates completed just under half (49 percent) of their credits in major, while late dropouts completed only a slightly smaller share (41 percent) of their credits in those courses. On average, late dropouts completed 13.5 fewer credits in those courses than graduates, indicating that many late dropouts may have only needed to pass 3-4 additional courses to fulfill their major requirements to graduate. These results provide additional indication that academic challenges in major-specific courses may explain much of the late dropout phenomenon.

Because many observable characteristics of students are correlated, the simple mean differences reported in Tables 2-4 may mask which factors predict dropout over and above others. To obtain a more nuanced portrait of the late departure risk profile and to examine how the dropout profile varies along the pathway to degree completion, we turn once again to our event history modeling framework. Specifically, we interact the credit-by-institution type indicators with the pre- and post-entry characteristics to examine whether dropout risk factors vary by proximity to degree completion. To simplify this analysis, we collapse the student-period dataset into two periods: before and after students earned three-quarters of the credits typically required to graduate.

In columns 1, 3 and 5 of Table 5, we report differences in the probability of late departure (in percentage points) for each predictor, which we evaluate at the average values of all other covariates in the model. Whereas the unadjusted differences in Table 2 revealed that minority students faced greater risk of late departure, in Table 5 we see that those gaps are fully explained by other observable characteristics of students. Across all sectors, the point estimates on the race

dummies are generally negative or near zero when they are positive. We also find that the relationship between the timing of initial college enrollment and late departure flips signs after we account for student attributes and other enrollment experiences. In column 8 of Table 3, we see that students who delayed attendance following high school graduation were 10 percentage points more likely than seamless enrollees to dropout late; yet after controlling for other observables, students who took time off between high school and college were 3 – 8 points *less* likely to dropout late into college.

In column 7 of Table 5, we also report the results of GLH tests that examine whether the conditional risk factors of late departure are equal across sectors. On most dimensions we reject that the risk profile is the same across institution type. In general, where we find differences by sector, the associations are strongest for students who first attended two-year institutions. Whether students transferred institutions is one notable exception to this pattern, however. Students who attended multiple institutions are no more likely than non-transfer students to dropout late if they first attended a two-year college, whereas transfer students who first attended four-year institutions are more likely than their non-transferring peers to leave college without earing an associate or bachelor's degree after completing ninety college-level credits.

The results in Table 5 also reveal that incoming achievement and academic momentum in college remain strong predictors of late departure. All else equal, we find that students with high school GPAs one standard deviation above the mean are 1-5 percentage points less likely to drop out in the fourth credit interval relative to students with mean value high school GPAs. Students who enrolled in remedial coursework at two-year institutions are also 11 percentage points more likely than non-remedial students to drop out late. Students who withdrew from college and later returned are at particularly high risk of late departure, ranging from 5 points at selective four-

year universities to 19 points at two-year colleges, as are students who struggled to earn passing grades in their late-stage coursework.

On several dimensions we also find that the late departure risk profile is distinct from the predictors of dropout at earlier points along the credit continuum. In columns 2, 4 and 6 of Table 5, we compare the conditional risk of dropout in the fourth credit interval to the risk of withdrawal in the first three intervals. Three results stand out in particular from these comparisons, all of which hold across sectors. First, the relationship between initial enrollment timing and dropout changes direction as students accumulate three-quarters of their credits. For example, among students who first attended two-year colleges, those who matriculated immediately following high school graduation were 16 (7.8 – 23.5) percentage points *less* likely than delayed enrollees to dropout before completing three-quarters of their credits, but 8 percentage points *more* likely to exit without a degree relative to delayed matriculants once they surpassed the threshold.[16] Second, we find that while students who previously stopped out experienced high risk of late departure, non-sequential enrollment is a much stronger predictor of earlier dropout. Differences in the probability of dropout between continuous and discontinuous enrollees are approximately twice the magnitude before students complete three-quarter of their credits compared to afterwards. Lastly, high course failure rates more strongly predict late departures than earlier dropouts. A one-half standard deviation increase from the average proportion of credits earned per term is associated with 14 and 10 percentage point declines in the probability of dropout in the fourth interval at two- and open-admission four-year institutions, respectively, versus declines of less than 5 percentage points when students earned fewer than three-quarters of their credits to degree completion. Taken together, these results

[16] The relationship we document between enrollment timing and early departure is consistent with previous research. See, for example, Bozick and DeLuca (2005).

reveal that the risk profile for departure varies in meaningful ways with proximity to degree completion.

4.3 Policy Application: Using Predictive Modeling to Target Students for Intervention

Although the results in Table 5 identify characteristics that differentiate late dropouts from other students, they do not reveal how well prediction models distinguish between students who are and are not at risk of dropping out late. Yet the answer to this question is particularly policy-relevant because it can help policymakers and higher education leaders pinpoint which students on campus may stand to benefit from late-stage intervention. We therefore evaluate the performance of candidate prediction models and present the results in Table 6. For this analysis, we conditioned the sample on students who completed at least three-quarters of the credits typically required to graduate. After running logistic regression models separately by institution type and predicting the probability of late departure for each student, we derived probability cut-offs to categorize students as either at-risk or not at-risk of late dropout.[17] We then calculated the percentage of students correctly assigned to the risk group that matched their observed outcome. To evaluate how well the cut-offs generalize out-of-sample, we randomly split the sample into development and validation subsamples. We estimated all models on the development subsample and present results for both the development (columns 1-3) and validation (columns 4-6) subsamples in Table 6. We also report results from two prediction models. Because some institutions may not observe prior enrollment histories for transfer students, we test a parsimonious model in panel A that contains only predictors that most colleges are likely to

[17] We established the cut-offs as the probability (rounded to the nearest point) which equated the percentage of late dropouts classified as at-risk (i.e. model sensitivity) and the percentage of graduates/active enrollees classified as not at-risk (i.e. model specificity).

observe for all students.[18] In panel B, we present results from a model that includes the full set of student-level predictors for point of comparison.

The results in Table 6 show that the prediction models correctly classify the majority of students in the development and validation subsamples. Across both models and subsamples, the percent of students assigned to the risk group that matched their observed enrollment behavior ranges from 70 percent to 83 percent. In addition, no fewer than 68 percent of late dropouts are classified as at-risk and the same is true of graduates/active enrollees assigned to the non-risk group. Comparing the results in columns 1-3 to those in columns 4-6 also indicates that the predictive models perform well out-of-sample. For example, in columns 1 and 4 of panel A, the percent of students correctly classified is nearly identical across the two subsamples (67.6 percent versus 67.8 percent among late dropouts and 71.3 percent versus 70.8 percent among non-late dropouts).

We also find that institutions can identify most students at-risk of dropping out late using just a few basic demographic variables and their recent past performance in school. The model in panel B leads to only small improvements in correctly classifying students, ranging from 0.5 percent (column 1) to 2.4 percent (column 3). The concordance statistic, which reports the probability that a randomly selected late dropout has a higher predicted probability of withdrawal than a randomly selected graduate/active enrollee, is also near 0.8 or 0.9 in panel A and increases by no more than 5 percent in panel B. Both of the models we tested therefore exhibit strong predictive power.

[18] These predictors are indicators for gender and race; age at the time the student reached the three-quarter credit threshold; whether the student entered as a transfer student; and mean academic performance in the fourth credit period (i.e. the average term GPA, average number of credits attempted per term; and the average proportion of credits earned per term).

One caveat to these generally promising results is that a large share of students assigned to the at-risk group did not drop out. This largely reflects the fact that most students who reach the three-quarter credit threshold do not drop out, even though the conditional dropout rate spikes late in college. As a result, predictive models that generate a large number of "false positives" will lead to targeting many inframarginal students for intervention. However, in Figure A2 we show that the share of inframarginal students decreases considerably as the predicted probability of late departure rises. Among students who first attended two-year colleges, more than two-thirds of students with predicted probabilities greater than or equal to 0.5 actually dropped out late and nearly three-quarters of students with predicted probabilities of 0.6 or higher did so. Resource-constrained institutions can therefore ensure that investments reach students most in need by establishing more stringent cut-offs for intervention.

5. DISCUSSION

In this study, we provide a new perspective on college dropout by examining how many credits students have completed when leaving school without a degree. The results suggest that late departure is widespread, especially at two- and open-admission four-year institutions, where nearly 20 percent and 14 percent of students respectively began their college careers but dropped out after earning three-quarters of the credits typically required to graduate. At greatest risk of late departure are students poorly prepared for the academic rigor of college and those who struggle to maintain momentum. The strong relationship between momentum and late departure that we document reinforces that many students may stand to benefit from more robust guidance and support throughout their time in school, especially as the rigor of upper division coursework escalates. Importantly, because there is considerable variation in the returns to college degrees, it is possible that late departure is an optimal human capital investment decision for some

students. Nevertheless, given the extent of the phenomenon and the high returns to degree completion for most college-goers, we believe efforts to mitigate late departure are likely to benefit many who dropout late.

Initiatives undertaken in recent years to mitigate late departure have focused almost exclusively on re-engaging individuals after they have withdrawn from school. For instance, through Project Win-Win, a partnership between the Institute for Higher Education Policy and the State Higher Education Executive Officers, sixty postsecondary institutions attempted to contact individuals who needed 9 or fewer credits to earn an associate degree and provide them with templates for finishing their degree (IHEP, 2013). Unfortunately, efforts to retroactively support late departers have achieved only modest success because they require labor-intensive investments to identify and contact eligible individuals (Adelman, 2013).

Alternative strategies have also emerged to simplify the decision environment for students by changing the structure of degree programs. Some four-year institutions have begun to award associate degrees to students en route to a bachelor's degree, either by acquiring associate degree-granting authority or by establishing new partnerships with community colleges (Bragg, Cullen, Bennett, & Ruud, 2011). Other institutions are offering structured programs that constrain student choices in order to increase completion rates and accelerate time to degree receipt (Weinbaum, Rodriguez, & Bauer-Maglin, 2013). Early evidence suggests these efforts can substantially increase credit and credential attainment (Zeidenberg, Cho, & Jenkins, 2010; Scrivener, Weiss, Ratledge, Rudd, Sommo & Fresques, 2015). However, all of these interventions are quite radical in the context of higher education, and as a result, the majority of students at risk of late departure are not receiving support during the most promising time to intervene: while they are still enrolled.

Our findings suggest that colleges may be able to substantially increase degree attainment by targeting interventions to students who have made considerable academic progress but remain at risk of dropping out. While it is too soon to know which interventions are most effective and the contexts in which they work best, one thing is clear. Helping more students complete their final steps to a degree requires paying more attention to the late departure phenomenon and further investigating its origins and consequences.

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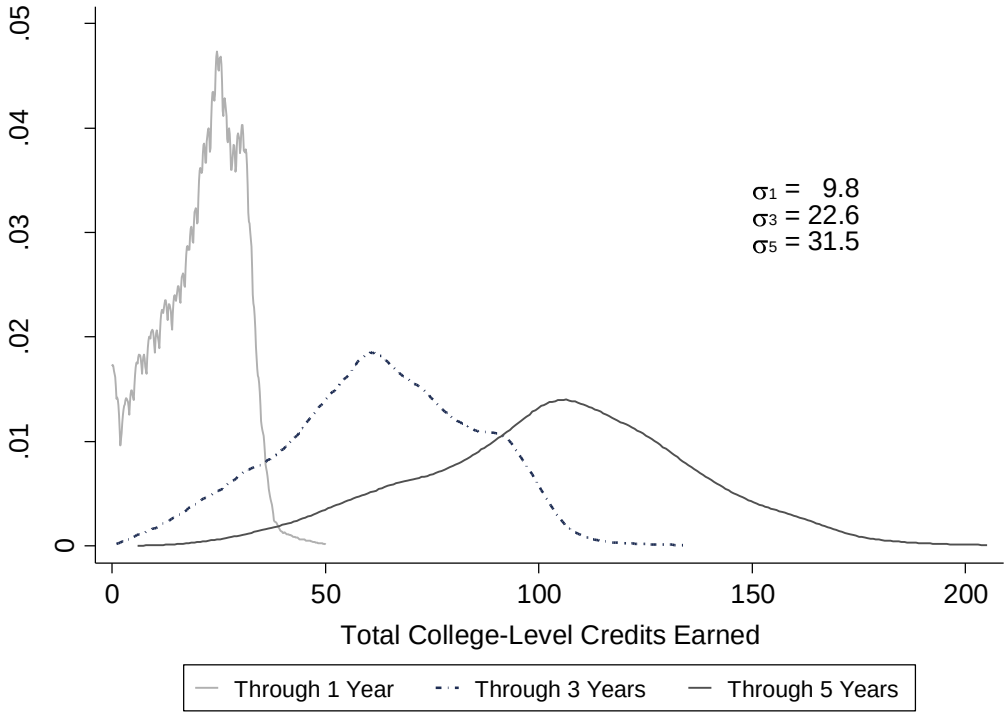
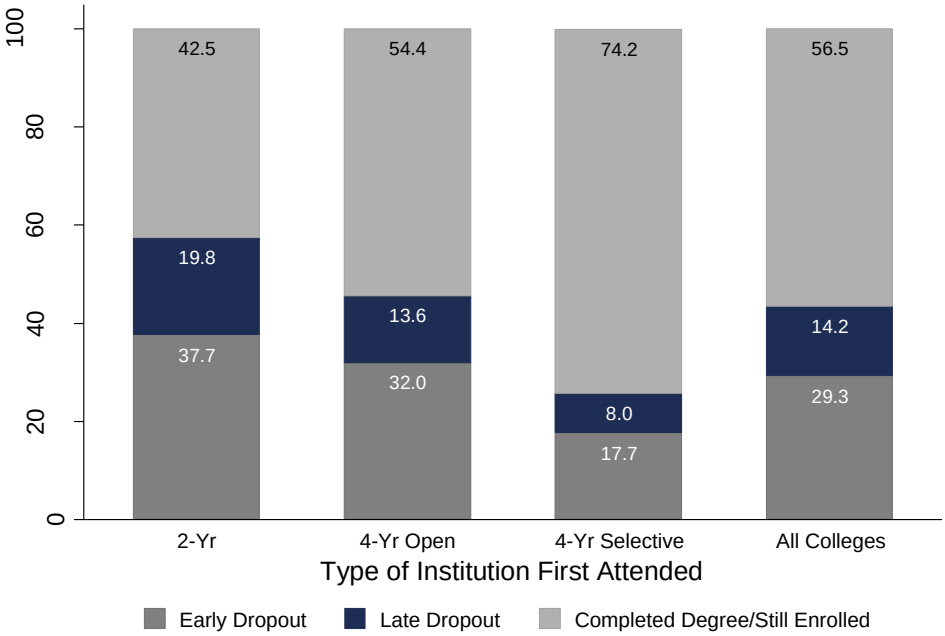
Figure 1. Distributions of total college-level credits earned by year of attendance



Notes: The sample is comprised of all degree-seeking undergraduates ages 17-19 at high school graduation who enrolled at least half-time at public postsecondary institutions in Florida and Ohio within 16 months of high school completion. See column 2 of Table 1 for descriptive statistics of the sample.
Sources: Florida Department of Education and Ohio Board of Regents.

Figure 2. The share of college entrants that are late dropouts, by institution type



Notes: Outcomes are reported through six years following initial college enrollment. Early dropouts capture students who withdrew prior to earning three-quarters of the college-level credits typically required to graduate. Students who surpassed the three-quarter credit threshold before dropping out are captured as late dropouts. Students who graduated within six years of entry or who were actively enrolled in year 7 are captured in the completed degree/still enrolled category.

Figure 3. The share of college entrants that are late dropouts at two-year institutions, by race/ethnicity

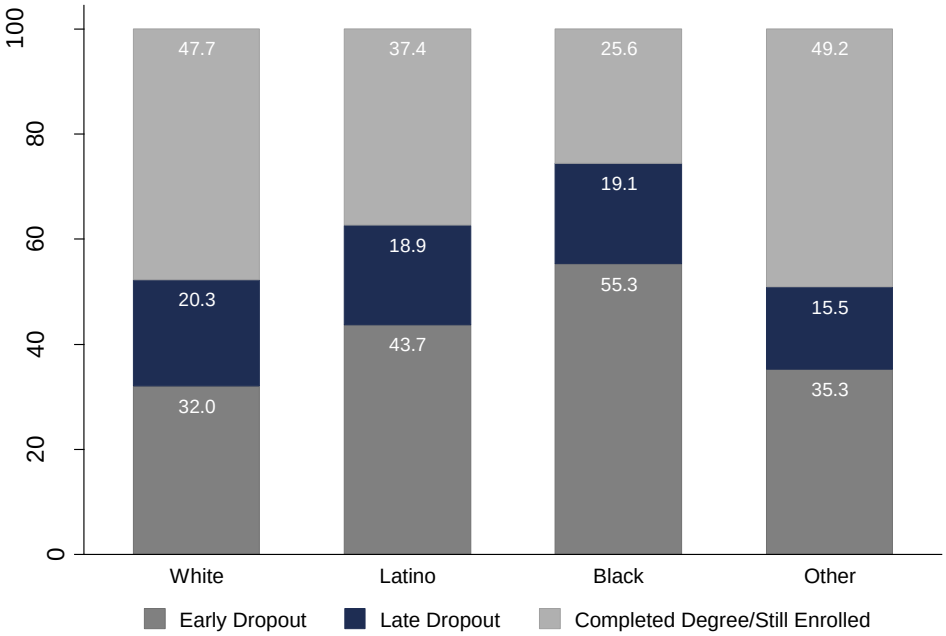
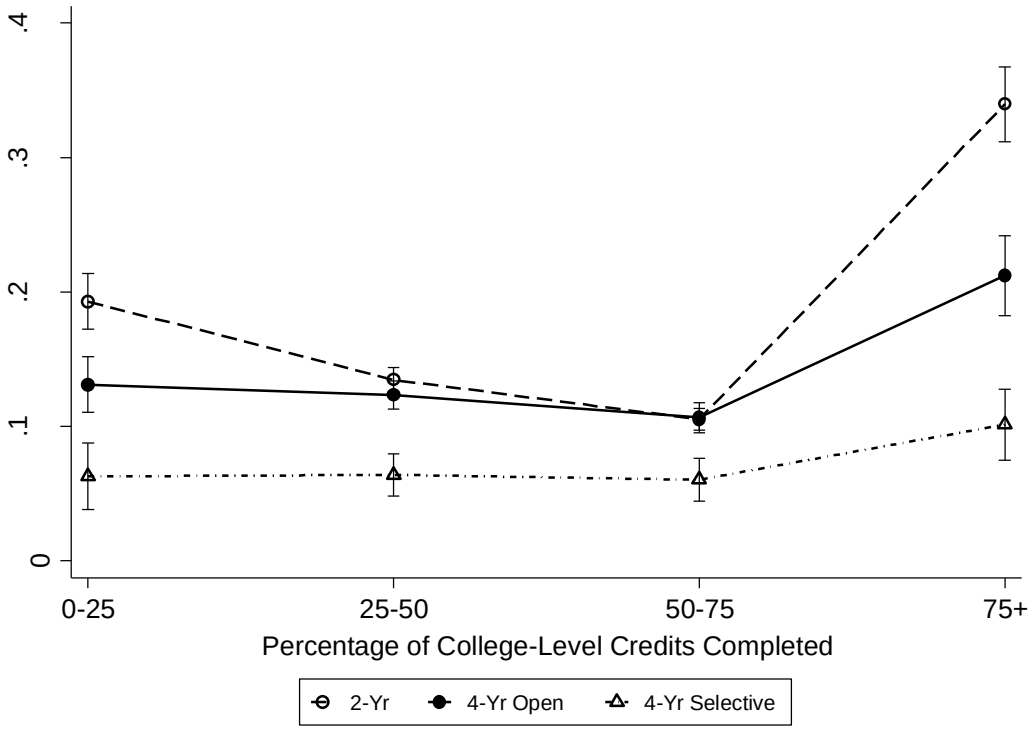


Figure 4. Fitted probabilities of dropout, by credits completed and college sector



Note: Fitted probabilities are estimated from a logit regression that includes twelve credit-by- degree categories and a constant. Ninety-five percent confidence intervals are shown around each point estimate.

Table 1. Descriptive statistics for national, state, and analytic samples

	(1) National Sample	(2) State Sample	(3) Analytic Sample
	First-time degree-seeking undergraduates	*Enrolled in college w/in 16 months of hs graduation*	*Subset of students from column 2 with complete data*
Female	0.562	0.563	0.595
White	0.651	0.760	0.718
Black	0.124	0.125	0.157
Latino	0.126	0.084	0.094
Other Race	0.099	0.031	0.030
		[99,648]	
Age at college entry	21.300	18.508	18.481
	(0.140)	(0.489)	(0.480)
HS GPA	3.105	3.019	3.016
	(0.786)	(0.613)	(0.617)
		[60,868]	
Seamless enrollee	0.654	0.887	0.909
First attended:			
2-Yr college	0.572	0.481	0.417
4-Yr open admissions college		0.191	0.228
4-Yr selective admissions college		0.328	0.355
Cumulative college-level credits earned		87.948	96.436
		(61.379)	(61.777)
Dropout and completed > 0.75 of credits		0.136	0.142
Ever dropout	0.522	0.471	0.435
Number of students	16,100†	101,103	54,012

† Sample size is estimated

Notes: Column 1 reports sample-weighted statistics computed with NCES PowerStats for undergraduates attending public colleges in fall 2003. The samples in columns 2 and 3 are comprised of degree-seeking undergraduates ages 17-19 at high school graduation who enrolled at least half-time at public postsecondary institutions in Florida and Ohio within 16 months of high school completion. Unweighted means are reported in columns 2 and 3 with standard deviations in parentheses and the number of observations in brackets if less than the full sample. HS GPA is on a 4.0 scale. Seamless enrollees first entered college in the same year as their graduation from high school.

Sources: U.S. DOE, NCES, 2003-04 Beginning Postsecondary Students Longitudinal Study (col 1); Florida Department of Education and Ohio Board of Regents (cols 2 and 3).

Table 2. Sample departure rates conditional on completing 75% or more of college-level credits, by college sector and student attributes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College sector first attended	2-Yr		4-Yr Open Admissions		4-Yr Selective		All	
A. Gender	%	N	%	N	%	N	%	N
Female	0.316	8,223	0.200	4,648	0.088	9,349	0.196	22,220
Male	0.371	5,005	0.231	3,252	0.123	5,801	0.236	14,058
B. Race								
White	0.315	9,707	0.191	5,678	0.094	12,229	0.192	27,614
Black	0.463	1,628	0.295	1,342	0.142	1,552	0.303	4,522
Latino	0.364	1,584	0.244	634	0.136	740	0.281	2,958
Other	0.249	309	0.187	246	0.107	629	0.160	1,184
C. High School GPA (cumulative)								
Top Quartile	0.185	1,416	0.169	734	0.068	2,720	0.117	4,870
3rd Quartile	0.250	2,567	0.146	2,646	0.075	6,333	0.130	11,546
2nd Quartile	0.330	4,296	0.217	2,506	0.130	4,286	0.227	11,088
Bottom Quartile	0.432	4,949	0.311	2,014	0.176	1,811	0.351	8,774

Notes: Upper bound points for GPA quartiles (on 4.0 scale) are: Q1 =2.5; Q2 = 3.0; Q3 = 3.44.

Sources: Florida Department of Education; Ohio Board of Regents.

Table 3. Sample departure rates conditional on completing 75% or more of college-level credits, by college sector and experiences in college

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
College sector first attended	2-Yr		4-Yr Open Admissions		4-Yr Selective		All	
A. Initial Enrollment Timing	%	N	%	N	%	N	%	N
Immediately after high school	0.339	11,691	0.211	7,687	0.102	14,960	0.207	34,338
Delayed 1 or more semesters	0.326	1,537	0.254	213	0.111	190	0.297	1,940
B. Remediation Status								
Enrolled in remedial coursework	0.416	6,775	0.276	2,237	0.190	1,629	0.352	10,641
Did not enroll	0.254	6,453	0.188	5,663	0.091	13,521	0.154	25,637
C. Number of Schools Attended								
One	0.380	6,096	0.166	5,387	0.065	10,784	0.175	22,267
Two or more	0.300	7,132	0.313	2,513	0.194	4,366	0.269	14,011
D. Number of Stopouts								
None	0.251	8,681	0.152	6,371	0.074	13,196	0.146	28,248
One or more	0.501	4,547	0.466	1,529	0.292	1,954	0.443	8,030
E. Age at Time of Completing 75% of credits								
Less than 23	0.297	6,991	0.136	2,922	0.048	8,486	0.157	18,399
23 and older	0.382	6,237	0.258	4,978	0.171	6,664	0.268	17,879
F. Average Credits Attempted per Term								
Less than 12 credits	0.360	8,268	0.272	3,206	0.126	6,311	0.261	17,785
12 or more credits	0.299	4,960	0.172	4,694	0.084	8,839	0.164	18,493
G. Proportion of Credits Completed per Term								
Less than 0.80	0.614	3,549	0.579	1,165	0.466	1,470	0.572	6,184
0.80 to 0.90	0.350	2,471	0.293	1,097	0.150	1,826	0.270	5,394
0.90 to 1.0	0.196	7,208	0.121	5,638	0.049	11,854	0.109	24,700
H. Term GPA in College								
Top Quartile	0.262	2,814	0.170	1,885	0.069	4,370	0.150	9,069
3rd Quartile	0.213	3,318	0.171	1,795	0.066	3,957	0.141	9,070
2nd Quartile	0.295	3,246	0.184	2,048	0.090	3,775	0.184	9,069
Bottom Quartile	0.534	3,850	0.311	2,172	0.210	3,048	0.372	9,070

Notes: The number of schools, stopouts, and age at enrollment are calculated through the term in which students reached the 75 percent credit completion threshold. College academic measures are calculated as per-term averages over all terms following the completion of 75 percent of credits. Upper bound points for college GPA quartiles (on 4.0 scale) are: Q1 =2.06; Q2 = 2.61; Q3 = 3.28.

Sources: Florida Department of Education; Ohio Board of Regents.

Table 4. The evolution of academic performance among students completing 75% or more of college-level credits, by college sector and late departure status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2-Yr		4-Yr Open Admissions		4-Yr Selective Admissions		All	
Outcome	Graduated or Still Enrolled	Dropped Out	Graduated or Still Enrolled	Dropped Out	Graduated or Still Enrolled	Dropped Out	Graduated or Still Enrolled	Dropped Out
A. Average credits attempted per term								
Credit interval 1 (0-25%)	13.228	12.805	14.643	14.261	14.058	13.774	13.931	13.318
Credit interval 4 (75% or more)	11.389	10.321	13.162	11.797	12.524	11.618	12.314	10.904
Percent change from interval 1 to interval 4	-13.9%	-19.4%	-10.1%	-17.3%	-10.9%	-15.7%	-11.6%	-18.1%
B. Proportion of credits completed per term								
Credit interval 1	0.916	0.865	0.930	0.866	0.940	0.874	0.930	0.867
Credit interval 4	0.905	0.752	0.939	0.788	0.951	0.773	0.934	0.764
Percent change from interval 1 to interval 4	-1.3%	-13.1%	0.9%	-9.0%	1.2%	-11.6%	0.4%	-11.9%
C. Term GPA in college								
Credit interval 1	2.428	2.130	2.273	2.040	2.410	2.041	2.386	2.092
Credit interval 4	2.705	2.250	2.677	2.367	2.813	2.364	2.750	2.299
Percent change from interval 1 to interval 4	11.4%	5.7%	17.7%	16.0%	16.7%	15.8%	15.3%	9.9%
Observations	8,769	4,459	6,221	1,679	13,608	1,542	28,598	7,680

Notes: Academic performance measures are constructed as per-term averages over all terms following completion of 75 percent of credits.

Sources: Florida Department of Education; Ohio Board of Regents.

Table 5. Conditional risk factors for departure by credit completion status and college sector (N = 89,942)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
College sector first attended	2-Yr		4-Yr Open Admissions		4-Yr Selective Admissions		
	Completed 75% or more credits	Difference (75+ minus 0-75)	Completed 75% or more credits	Difference (75+ minus 0-75)	Completed 75% or more credits	Difference (75+ minus 0-75)	χ^2 test: Risk of late departure equal across sectors?
Female	**-0.036**	-0.021	-0.006	0.027	**-0.010**	0.002	**4.526**
	(0.007)	(0.153)	(0.358)	(0.139)	(0.056)	(0.448)	(0.100)
Latino	**-0.052**	**-0.088**	-0.003	-0.018	0.003	0.001	**8.201**
	(0.003)	(0.008)	(0.463)	(0.365)	(0.447)	(0.481)	(0.027)
Black	-0.001	**-0.083**	0.017	0.028	-0.003	0.003	0.624
	(0.481)	(0.001)	(0.318)	(0.264)	(0.424)	(0.444)	(0.410)
Other race	**-0.103**	**-0.134**	-0.033	0.010	-0.002	0.012	**14.31**
	(0.001)	(0.003)	(0.134)	(0.432)	(0.463)	(0.365)	(0.003)
HS GPA (cumulative)	**-0.047**	**-0.025**	**-0.045**	-0.017	**-0.014**	-0.007	**7.555**
	(0.001)	(0.024)	(0.031)	(0.264)	(0.089)	(0.308)	(0.035)
Seamless enrollee	**0.078**	**0.235**	**0.032**	**0.158**	**0.026**	**0.077**	**22.83**
	(0.001)	(0.001)	(0.038)	(0.001)	(0.001)	(0.008)	(0.001)
Took remedial coursework	**0.107**	-0.007	0.020	0.004	**0.017**	0.013	**39.19**
	(0.001)	(0.410)	(0.178)	(0.448)	(0.038)	(0.226)	(0.001)
Attended 2 or more schools	-0.025	**0.047**	**0.067**	-0.001	**0.050**	-0.005	**14.84**
	(0.190)	(0.060)	(0.001)	(0.481)	(0.001)	(0.409)	(0.003)
Stopped out at least once	**0.190**	**-0.155**	**0.164**	**-0.136**	**0.046**	**-0.088**	**37.94**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.038)	(0.001)
Age	-0.045	-0.067	-0.007	0.001	0.013	0.016	2.585
	(0.112)	(0.041)	(0.463)	(0.483)	(0.357)	(0.318)	(0.216)
Credits attempted	-0.0230	0.003	**-0.049**	-0.024	-0.008	0.004	3.462

	(0.252)	(0.477)	(0.025)	(0.247)	(0.264)	(0.382)	(0.147)
Share of credits completed	**-0.138**	**-0.096**	**-0.103**	**-0.064**	**-0.026**	-0.017	**25.88**
	(0.001)	(0.001)	(0.001)	(0.035)	(0.039)	(0.142)	(0.001)
College GPA (term)	**-0.032**	**-0.030**	**-0.031**	**-0.044**	**-0.011**	-0.009	3.613
	(0.064)	(0.089)	(0.010)	(0.001)	(0.035)	(0.120)	(0.139)

Notes: The number of schools, stopouts, and age measures are calculated up to the term in which students reached each credit interval. College academic variables are calculated as the per semester average within each credit interval. All models also control for the number of terms between the time each credit period was reached and initial college entry. Conditional risk factors are reported in percentage points and estimated from a fully interacted logit regression model evaluated at the average values of all covariates in the model. See text for model details. Estimates for high school and college GPA, age, and credits attempted are percentage point differences associated with a standard deviation increase from the mean. Estimates for the proportion of credits completed are percentage point differences associated with a one-half standard deviation increase from the mean. Adjusted p-values that account for multiple hypothesis testing and the clustering of students within schools are reported in parentheses. Point estimates in bold are statistically significant at the .10 level.

Sources: Florida Department of Education; Ohio Board of Regents.

Table 6. Student risk classifications from prediction models of college late departure

	(1)	(2)	(3)	(4)	(5)	(6)
	Development Sample			Validation Sample		
	2-Yr	4-Yr Open Admissions	4-Yr Selective Admissions	2-Yr	4-Yr Open Admissions	4-Yr Selective Admissions
A. Model 1: In absence of cross-institutional tracking						
Percent at-risk | late dropout	67.6	72.3	75.1	67.8	68.0	75.9
Percent not at-risk | not late dropout	71.3	76.6	81.3	70.8	77.5	81.7
Percent late dropout | at-risk	54.5	45.5	31.1	54.2	44.9	32.2
Percent not late dropout | not at-risk	81.3	91.1	96.7	81.2	90.0	96.7
Percent of students correctly classified	70.1	75.7	80.7	69.8	75.5	81.1
Concordance statistic	0.77	0.81	0.85	0.76	0.79	0.86
B. Model 2: In presence of cross-institutional tracking						
Percent at-risk | late dropout	74.9	77.0	81.1	75.0	77.3	76.4
Percent not at-risk | not late dropout	68.1	77.3	82.8	68.9	75.9	83.1
Percent late dropout | at-risk	54.8	48.9	35.7	53.9	44.3	32.6
Percent not late dropout | not at-risk	84.0	92.3	97.4	85.0	93.1	97.1
Percent of students correctly classified	70.4	77.3	82.6	70.9	76.2	82.5
Concordance statistic	0.79	0.84	0.89	0.80	0.84	0.88
Probability cut-off used to assign risk status	0.3	0.2	0.1	0.3	0.2	0.1
Observations	6,614	3,950	7,575	6,614	3,950	7,575

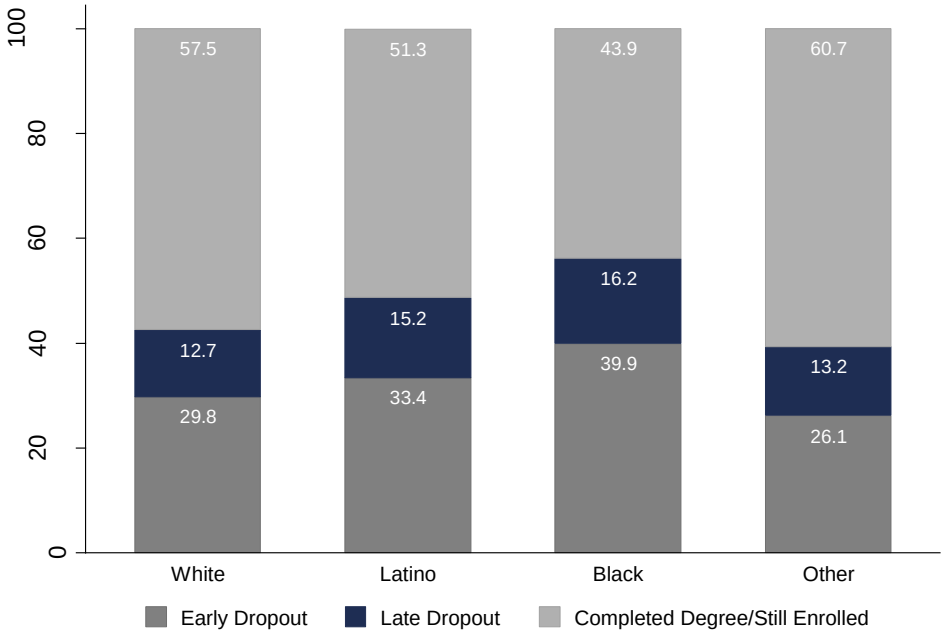
Notes: Risk classifications are derived from logit regression models used to predict the probability of late departure. The predictors in Model 1 include: indicators for gender, race and Pell Grant eligibility status; age at the time the student exceeded the three-quarter credit threshold and the square of this term; whether the student transferred schools prior to exceeding the three-quarter credit threshold; and the average term GPA, average number of credits attempted per term; and the average proportion of credits earned per term after reaching the three-quarter credit threshold. Model 2 includes all predictors from Model 1 as well as the full set of prior achievement and college experience predictors specified in Table 5.

Sources: Florida Department of Education; Ohio Board of Regents.

APPENDIX

Figure A1. The share of college entrants that are late dropouts at four-year institutions, by race/ethnicity

A. Four-Year Open Admissions Institutions



B. Four-Year Selective Admissions Institutions

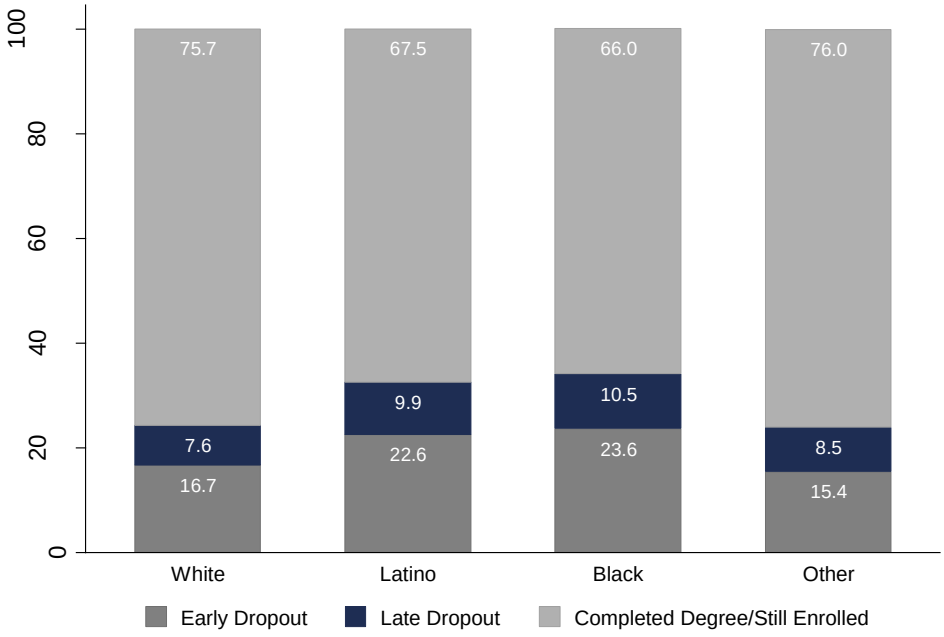
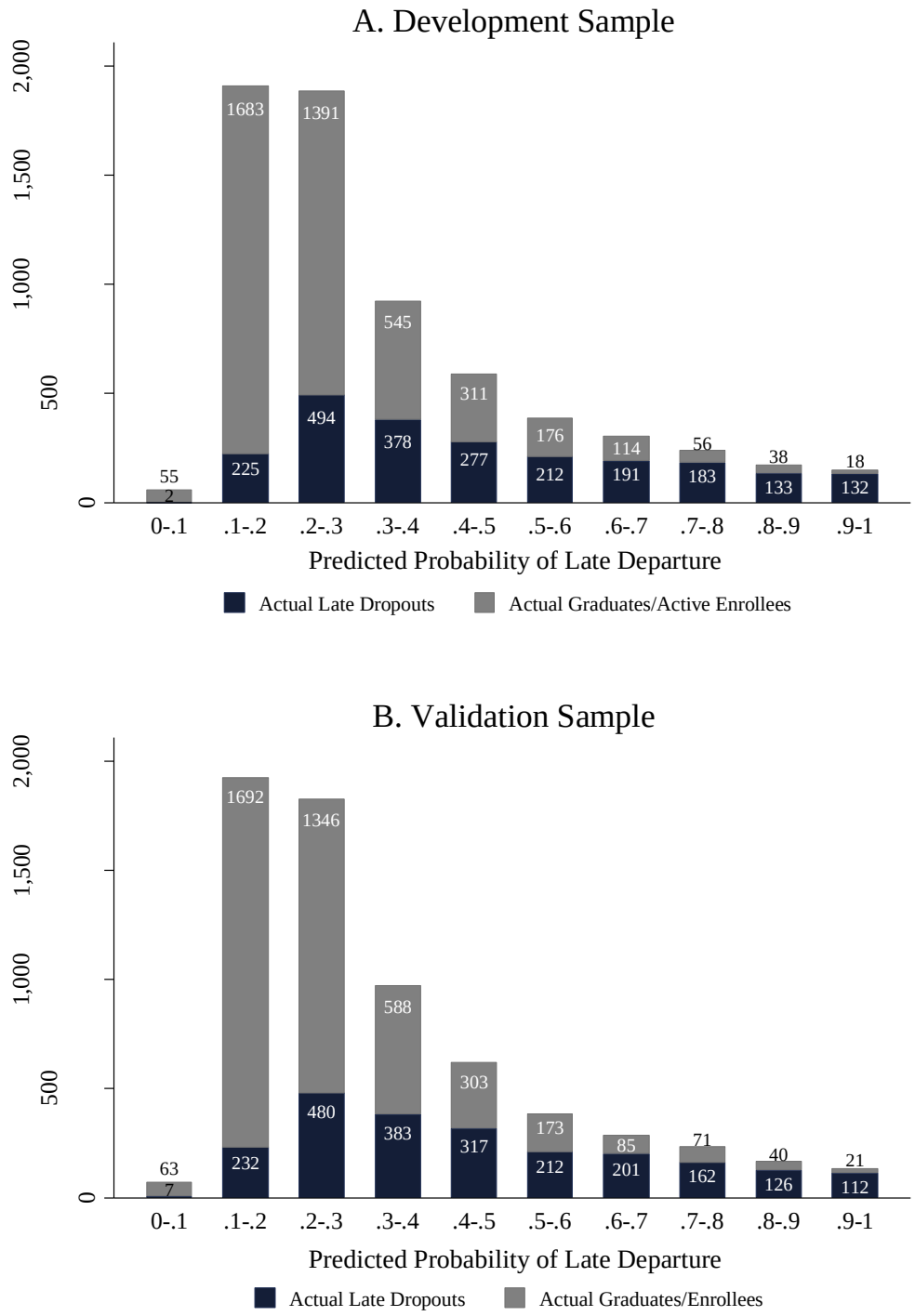


Figure A2. Observed enrollment outcomes by the predicted probability of late departure, among students who first attended two-year colleges



Notes: The sample is conditioned on students who completed at least three-quarters of the credits typically required to earn a degree. Predicted probabilities are derived from logit regression models that include the predictors in Model 1 of Table 6. See Table 6 for details.

Table A1. Sample departure rates by credit completion status and college sector

	(1)	(2)	(3)	(4)
	2-Yr	4-Yr Open Admissions	4-Yr Selective	All
Share of departures among students that…	Panel A. Before 25% of credits completed			
Ever enrolled in college	0.197	0.133	0.064	0.135
Reached the credit threshold	0.197	0.133	0.064	0.135
	[22,499]	[12,318]	[19,195]	[54,012]
Ever dropped out	0.343	0.291	0.248	0.310
	Panel B. 25-50% of credits completed			
Ever enrolled in college	0.108	0.108	0.061	0.091
Reached the credit threshold	0.136	0.125	0.065	0.106
	[17,915]	[10,614]	[17,881]	[46,410]
Ever dropped out	0.188	0.236	0.235	0.209
	Panel C. 50-75% of credits completed			
Ever enrolled in college	0.072	0.080	0.053	0.067
Reached the credit threshold	0.106	0.108	0.061	0.088
	[15,259]	[9,120]	[16,603]	[40,982]
Ever dropped out	0.124	0.175	0.205	0.153
	Panel D. 75% or more of credits completed			
Ever enrolled in college	0.198	0.136	0.080	0.142
Reached the credit threshold	0.337	0.213	0.102	0.212
	[13,228]	[7,900]	[15,150]	[36,278]
Ever dropped out	0.345	0.299	0.312	0.327

Notes: The number of students that ever enrolled at 2-, 4-year open admission, and 4-year selective institutions are 22,499, 12,318, and 19,195, respectively. The numbers of students that ever dropped out are 12,943, 5,618, and 4,947, respectively. The numbers of students that reached each credit threshold are reported in brackets.

Sources: Florida Department of Education; Ohio Board of Regents.

Table A2. Conditional probabilities of departure by credit completion status and college sector (N = 177,331)

	(1)	(2)	(3)	(4)	(5)	(6)
		Model 1			Model 2	
Proportion of college-level credits completed	2-Yr	4-Yr Open Admissions	4-Yr Selective Admissions	2-Yr	4-Yr Open Admissions	4-Yr Selective Admissions
0-25%	0.193	0.131	0.063	0.174	0.114	0.056
	(0.172 - 0.213)	(0.110 - 0.152)	(0.038 - 0.087)	(0.162 - 0.186)	(0.102 - 0.126)	(0.047 - 0.065)
25-50%	0.134	0.123	0.063	0.113	0.115	0.061
	(0.125 - 0.142)	(0.113 - 0.133)	(0.048 - 0.079)	(0.104 - 0.121)	(0.106 - 0.124)	(0.055 - 0.067)
50-75%	0.104	0.105	0.060	0.098	0.112	0.058
	(0.095 - 0.112)	(0.094 - 0.116)	(0.044 - 0.076)	(0.086 - 0.109)	(0.101 - 0.123)	(0.049 - 0.067)
75% or more	0.336	0.209	0.100	0.377	0.242	0.116
	(0.308 - 0.364)	(0.179 - 0.239)	(0.074 - 0.127)	(0.336 - 0.418)	(0.207 - 0.277)	(0.091 - 0.141)
χ^2 test: Is the probability of departure equal across credit intervals?	**771.8** (0.001)	**36.96** (0.001)	**14.27** (0.007)	**226.4** (0.001)	**44.55** (0.001)	**29.47** (0.001)
χ^2 test: Is the probability of late departure equal across college sectors?		**144.7** (0.001)			**220.5** (0.001)	
Demographic + college experience controls					✓	

Notes: Conditional probabilities are estimated from logistic regression models using the student-by-credit category dataset. See text for details. The covariates in Model 2 include: indicators for gender and race; high school GPA and GPA squared; whether the student entered college immediately following high school graduation; whether the student took one or more remedial education courses; whether the student stopped out at least once prior to exceeding credit threshold c; whether the student ever transferred schools prior to exceeding credit threshold c; age at the time the student reached credit threshold c and the square of this term; number of terms between the time each credit period was reached and initial college entry; average term GPA in each credit period; average number of credits attempted per semester in each credit period; and the average proportion of credits earned per semester in each credit period. Lower and upper bounds of the 95% confidence interval around fitted probabilities are reported in parentheses and account for the clustering of students within schools. Adjusted p-values that account for multiple hypothesis testing are shown in parentheses below chi-square statistics. Point estimates in bold are statistically significant at the .10 level.
Sources: Florida Department of Education; Ohio Board of Regents.

Table A3. The evolution of academic performance in the last three terms of enrollment among students who withdrew from college after completing 75% or more of their college-level credits (N = 22,401)

	(1)	(2)	(3)
	Term credits attempted	Term credits completed	Term GPA
Penultimate term (t-1)	-0.288***	-0.493***	-0.015
	(0.067)	(0.088)	(0.013)
Final term (t)	-1.476***	-2.161***	-0.120***
	(0.085)	(0.127)	(0.020)
Constant	12.036***	9.481***	2.388***
	(0.300)	(0.263)	(0.039)
R^2	0.018	0.029	0.003

*** p<0.01, ** p<0.05, * p<0.1

Notes: The sample is restricted to student-by-term observations in late dropouts' last three terms of enrollment. All results are estimated from ordinary least squares models. The omitted category is students' third-to-final term. Standard errors, clustered by institution, are reported in parentheses.