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High School Economic Composition and College Persistence

Sunny X. Niu · Marta Tienda

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Abstract Using a longitudinal sample of Texas high school seniors of 2002 who enrolled in college within the calendar year of high school graduation, we examine variation in college persistence according to the economic composition of their high schools, which serves as a proxy for unmeasured high school attributes that are conductive to postsecondary success. Students who graduated from affluent high schools have the highest persistence rates and those who attended poor high schools have the lowest rates. Multivariate analyses indicate that the advantages in persistence and on-time graduation from 4-year colleges enjoyed by graduates of affluent high schools cannot be fully explained by high school college orientation and academic rigor, family background, pre-college academic preparedness or the institutional characteristics. High school college orientation, family background and pre-college academic preparation largely explain why graduates from affluent high schools who first enroll in 2-year colleges have higher transfer rates to 4-year institutions; however, these factors and college characteristics do not explain the lower transfer rates for students from poor high schools. The conclusion discusses the implications of the empirical findings in light of several recent studies that call attention to the policy importance of high schools as a lever to improve persistence and completion rates via better institutional matches.

Keywords College enrollment · College persistence · Institutional type · High school influences

Most students who enroll in college do so expecting to graduate in 4 years, but growing numbers are prolonging enrollment beyond eight semesters or leaving before completing a degree. Although 4-year college graduation rates remained stable at around 66 % until the

S. X. Niu
The College Board, 661 Penn Street, Suite B, Newtown, PA 18940, USA
e-mail: sniu@collegeboard.org

M. Tienda (✉)
Office of Population Research Princeton University, 184 Wallace Hall, Princeton, NJ 08544, USA
e-mail: tienda@princeton.edu

early 1990s, the norm of graduating in 4 years has eroded since the 1970s (Adelman 2004; Barton 2002). Even as college enrollment rates rise, large numbers of students who intend to complete a baccalaureate degree, particularly low-income and minority students, fall short of their goal. During the 1970s nearly 50 % of college enrollees graduated after 4 years of continuous enrollment, and 75 % did so within 6 years; however, by the mid-1990 s these shares dropped to 30 and 60 %, respectively (National Center for Education Statistics [NCES], 1996). About one-third of fall 2000 first-time enrollees at 4-year colleges completed a bachelor's degree within 4 years, and 58 % did so within 6 years (Carey 2004; NCES 2009). Among students who began their postsecondary education at 2-year colleges in 1992, nearly two in three sought a bachelor's degree or higher (Hoachlander et al. 2003), yet only 37 % had successfully transferred to a 4-year institution within 8 years (Adelman 2006).

The problem of persistence to degree is not new, it has received renewed attention because growing demand for college has outstripped the carrying capacity of the higher education system (Bowen et al. 2009; Hout 2009; Tienda and Sullivan 2009) and because tight fiscal budgets raise the social opportunity costs of non-completion (Bettinger 2004; Rosenbaum 1998). Inadequate family and teacher support in the college application process, poor academic preparation, and financial resources are the most common factors invoked to explain variation in college persistence (Bettinger 2004; Bettinger and Long 2009; Braxton et al. 1997; Dynarski 2003), but recent studies also call attention to the importance of the student-college match. Roderick et al. (2008, 2009) among others (e.g., Carey 2004; Dougherty et al. 2006; Hill 2008) show that success in college varies appreciably among high schools that serve students of similar backgrounds.

Relatively few studies consider whether high school attributes are associated with college achievement, persistence and completion (for exceptions, see for example, Fletcher and Tienda 2010; Summers and Wolf 1977). Early studies about high school influences on postsecondary outcomes focused on college intentions rather than actual experiences (e.g., Alwin and Otto 1977; Meyer 1970). An examination of possible links between high school attributes and college success is warranted for several reasons. First, there is extensive variation in college going traditions across seemingly similar high schools (Hill 2008), which may carry over to college persistence and completion. Second, high school test scores vary directly with the socioeconomic composition of students served (Rothstein 2004), which Jencks and Mayer (1990) claim is associated with college success. Third, students who graduate from high schools that serve large numbers of poor students often begin their postsecondary studies at 2-year institutions (Light and Strayer 2000; Schneider et al. 2006; Velez 1985), hence it is conceivable that high school influences on college persistence and completion may operate via institutional type.

Although Bowen et al. (2009) find only moderate associations between high school academic characteristics and college outcomes, they argue that high schools represent an important policy lever with potential to improve collegiate outcomes for students from low-income backgrounds. Our interest in the possible links between high school socio-economic composition and persistence behavior responds to their challenge and also addresses the importance of institutional fit in promoting collegiate success (see also Roderick et al. 2008, 2009). We discuss these implications in the conclusion.

If, as Jencks and Mayer (1990) claim, the economic composition of high schools is a proxy for school climate and college orientation, then we would expect postsecondary outcomes to differ among students who attend schools that largely serve well-off students compared to those that mainly serve poor students. Accordingly, we first examine the association between high school economic composition and postsecondary persistence and

subsequently identify the individual, high school and institutional factors responsible for the association. After a brief review of research about the determinants of college persistence, we describe the data and present descriptive tabulations. Next we outline the analytical strategy used to model the association between high school economic composition and college persistence and discuss empirical results. The final section summarizes the key findings and discusses their implications with reference to the emergent, if implicit, college-for-all norm (Rosenbaum 1998).

Individual and Institutional Determinants of Persistence

There is general consensus that that family background and pre-collegiate academic achievement are key determinants of college persistence and completion (Adelman 2004, 2006; Bowen and Bok 1998; Roderick et al. 2008); however, analysts disagree about the relative importance of specific attributes. For example, among high school seniors who began their college careers at 4-year colleges in 1980, Porter (1990) shows that those ranked in the top quartile of the SES and test score distributions were more likely to graduate than their lower-ranked classmates, but Kane (1994) finds no race/ethnic difference in college completion for this national cohort. Comparing the high school classes of 1972 and 1992, Bound et al. (2010) show that academic preparation (measured by math test percentiles) is associated with the likelihood of college completion for both cohorts, even when jointly considered with race/ethnicity, parental education, and income as well as institutional type and resources. Similar associations obtain for students who begin their postsecondary careers in 2-year institutions (Grubb 1991). Dougherty and Kienzl's (2006) study based on a cohort of students who enrolled in a community college in 1989 finds that high-SES students have significantly higher transfer rates than their low-income classmates, which they attribute both to better academic preparation and to higher educational aspirations.

High Schools and Student Outcomes

The question of whether schools exert independent influences on student achievement engages a longstanding controversy dating back to the Coleman (1968) report, which states that family background, not school attributes, is largely responsible for variation in student academic performance. Jencks et al. (1972) reinforced this conclusion by arguing that achievement gaps based on standardized test scores would narrow by 1 % or less if all high schools were of equal quality. Subsequent studies that attempted to discern school influences on scholastic outcomes produced mixed evidence, which Rutter (1983) attributes to inconsistencies in standards of evidence, in the outcomes analyzed, and, importantly, in the measurement of school attributes. Goldschmidt and Wang (1999), for instance, claim that school characteristics account for about two-thirds of the differences in secondary school persistence, but are not well suited to predicting specific student risk factors that contribute the likelihood of dropping out.

Hedges et al's (1994) meta-analysis of studies that assess K-12 school effects on student performance concludes that the magnitude of the median association is substantively important. None of the studies they included in their meta-analysis considers links between high school characteristics and college success, yet some analysts have explicitly acknowledged their relevance. Tinto's (1975, 1982, 1986) "interactionist" template outlines the individual and institutional circumstances that influence college persistence and

completion. For Tinto, who claims that high school influences operate by influencing students' aspirations, expectations and motivations for postsecondary education, the link is largely indirect; however, other studies posit direct influences on college persistence of secondary school attributes (Espenshade et al. 2009; Fletcher and Tienda 2010; Hill 2008; Manski and Wise 1983).

Manski and Wise (1983) claim that students who attended better high schools, which they define based on the share of the high school class that pursues postsecondary schooling, are considerably more likely to persist in college compared with students of comparable SES and scholastic achievement who attended high schools with weak college traditions. Espenshade et al. (2009) examine enrollees at seven selective institutions during the late 1990s and also assert an association between the quality of high school attended and both college persistence and graduation that is independent of student achievement and family background. Finally, Fletcher and Tienda (2010) use a fixed effects methodology that compares students who graduated from the same high school to argue that variation in the quality of high schools that black, Hispanic, Asian and white students attend is largely responsible for racial and ethnic differences in graduation rates from 4-year Texas public universities. Because their analysis lacks comprehensive family background data, Fletcher and Tienda (2010) cannot address what features of high schools carry over to postsecondary performance.[1]

None of the studies establishing links between high school characteristics and college persistence considers 2-year institutions—a gap our analysis addresses. Consideration of community colleges is important because low-income students are more likely than middle-class students to begin their college careers at 2-year institutions, to live at home, and to attend part-time—all circumstances that undermine persistence through a bachelor's degree (Dougherty and Kienzl 2006; Grubb 1991; Schneider et al. 2006; Velez 1985).

High School Inequality and College Persistence in Texas

In response to judicial and statutory bans on use of race-sensitive criteria in college admissions, several states implemented percentage plans to recruit top performing minority and low-income students. Among them, the Texas top 10 % law, which grants students who graduate in the top decile of their senior class automatic admission to any Texas public university, is the most generous. Because the Texas admission guarantee is extended to the top 10 % graduates from each high school in the state, it theoretically leveled the playing field by weakening the association between family background and college access. This is important because in Texas, like most states, there is vast socioeconomic and academic heterogeneity among its high schools and, consequently, in the college readiness of graduates from schools that serve affluent and low-income students.

The change in Texas's admission policy invites a reexamination of the link between high schools and college outcomes both because critics of the law allege that top-ranked students from low-performing schools lack adequate academic preparation to succeed in college (Tienda and Sullivan 2009) and because the law increased the economic heterogeneity of high schools that sent students to selective public institutions (Long et al. 2010).

[1] Economists also have attempted to show that high school quality matters not only for interim outcomes, such as receipt of a diploma, college enrollment, and degree completion, but also labor market outcomes (Betts 1995; Strayer 2002). Betts (1995) finds an association between high school attended and earnings, but notes that conventional measures of school quality, such as teacher salaries and average class size are not associated with variation in student performance.

The testable implication is that enrollees from high schools populated by large numbers of economically disadvantaged students will exhibit lower college persistence rates than equivalent students who graduated from high schools that serve few poor students. Alternatively, if student sorting by social class is largely responsible for observed differences in college persistence according to high school economic composition, then adjustments for family background and students' academic record should eliminate disparities in persistence by type of high school attended.

Persistence and the Student-Institution Match

The existence of an association between high school economic composition and college persistence may also reflect other circumstances that are associated with postsecondary success, notably the rigor of the school curriculum (Bowen et al. 2009; Roderick et al. 2008); the school's college orientation (Hill 2008); and the adequacy of the student-college match (Bowen et al. 2009; Carey 2004; Roderick et al. 2009). Furthermore, given the positive association between institutional selectivity and college graduation (Alon and Tienda 2005; Bowen and Bok 1998; Rothstein 2004), it is conceivable that college attributes account for the association between high schools' socioeconomic composition and college persistence. Therefore, we also consider institutional characteristics, such as size, distance, cost and type as well as the student-institution academic match when assessing variation in collegiate persistence (Cabrera et al. 1993; Carey 2004; DesJardins et al. 2002; Roderick et al. 2008, 2009).

Data and Operational Measures

This study uses the longitudinal survey data collected under the auspices of the Texas higher education opportunity project (THEOP). In spring 2002, a representative sample of Texas public high school seniors was surveyed (wave 1); a random sub-sample of the senior cohort was re-interviewed the following spring (wave 2) and again 4 years after high school graduation (wave 3). At the baseline survey, 13,803 seniors were interviewed using a paper and pencil in-class survey instrument. For cost reasons a random sub-sample of 8,345 seniors were selected for follow-up surveys. The response rate for wave 2 interviews was 70 %, generating 5,836 completed surveys; wave 2 weights were developed to recalibrate the first follow-up survey (wave 2 sample) to the original population.

Due to the difficulty of relocating respondents, wave 3 field operations lasted over a year (from January 2006 to March 2007), and 12 % (485 out of 4,114) of wave 3 respondents were interviewed after the conclusion of the 2006 academic year, which is 4 years after respondents' high school graduation. The wave 3 response rate of 50 % yielded 4,114 cases; wave 3 weights adjust the sample to the original population by taking into account both the sampling design and respondent non-response. In this analysis, we use wave 3 weights with Stata's svy command for the descriptive tabulations, but report raw counts in all tables by convention. We use Stata's cluster option with multinomial logit modeling to account for the fact that students are sampled within high schools.

Although the 50 % response rate for the wave 3 survey raises questions about the representativeness of the sample, comparisons between the 8,345 random sub-sample of 13,803 baseline respondents and the 4,114 wave 3 respondents reveal a high degree of

similarity based on ethno-racial composition and post-high school intentions. We are confident that wave 3 respondents are representative of 2002 Texas high school seniors in their college going behavior and their subsequent post-secondary attainment; however, to verify this premise we evaluate the robustness of our results by using different working samples. The robustness checks summarized in the methodological appendix affirm the core findings.

The baseline survey obtained basic demographic and socioeconomic characteristics as well as information about high school performance, experience and college plans. The first follow-up survey (wave 2) recorded whether and where respondents enrolled in college 1 year after high school graduation, and wave 3 interviews solicited information about students' academic status and college experiences.[2] Persistence, defined below, was determined using information from the third interview.

College Persistence

The operational definition of persistence is bound by the 4-year observation window and restricted to the sample of 2,752 students who matriculated at a postsecondary institution in the fall 2002 (commonly designated as "on-time" enrollees).[3] Based on the 1st post-secondary institution attended, we derive five mutually exclusive outcomes[4]:

- On-time graduation: students graduated from the 1st college attended (or expected to do so by August 2006) four years after first matriculating;
- Continuation: students remained enrolled at the 1st college attended;
- Transfer to a 4-year institution: students enrolled at a degree-granting institution when interviewed at the wave 3;
- Transfer to a 2-year/vocational institution: students transfer to a community college or vocational/technical school when interviewed at the wave 3;
- Dropout: students withdrew from the 1st college attended and did not enroll at another postsecondary institution during the observation period.

A handful of students who enrolled at a 4-year institution had graduated from the 1st attended institution at the last interview. For purposes of this study they are treated as on-time graduates. Two-year college students who graduated and then enrolled at another institution are classified as transfers.

[2] The sampling scheme for the baseline is described in detail in the "Methodology Report," http://theop.princeton.edu/surveys/baseline/baseline_methods_pu.pdf. For wave 2 surveys, the sampling scheme is described in 'Senior Wave 2 Survey Methodology Report,' http://theop.princeton.edu/surveys/senior_w2/senior_w2_methods_pu.pdf. Finally, the wave 3 sampling scheme is described in 'Senior Wave 3 Survey Methodology Report,' http://theop.princeton.edu/surveys/senior_w3/senior_w3_methods_pu.pdf. Tables comparing respondent attributes across waves are in the methods reports.

[3] About 66 % of the wave 3 sample enrolled in college within the same calendar year of high school graduation, 14 % delayed college enrollment until the following year or later, and the remaining 20 % had never enrolled anywhere at the wave 3 interview. We exclude 14 percent of the cohort that enrolled with delay to preserve a uniform window for observing completion and persistence and because students who delay enrollment differ in systematic ways from those who do not. In particular, students who delay are more likely to enter via 2-year institutions compared with on-time enrollees. These sensitivity analyses are available from authors on request.

[4] Students could have dropped out and re-enrolled, and also could have attended other institutions during the summers. Transfer students could have attended multiple institutions over the observation window, but nearly 70 % of transfer students attended only two institutions.

High School Economic Composition

To portray variation in economic composition of high schools, we use a typology that differentiates poor and affluent high schools from those that serve average shares of economically disadvantaged students. The Texas education agency (TEA) calculated the share of students who were ever economically disadvantaged (i.e. ever receive a free or reduced lunch), which we use to classify high schools into income poverty quartiles. Schools with the lowest quartile poor were designated affluent; those in the highest quartile poor were labeled poor; and the rest were classified as average. Thus, three mutually exclusive categories are used to portray high school economic composition:

- Affluent high schools: low shares of economically disadvantaged students;
- Average high schools: average shares of economically disadvantaged students;
- Poor high schools: high shares of economically disadvantaged students.

Additional Covariates

Several prior studies show that student demographic characteristics, family background and academic achievement may mediate the association between college persistence and high school economic composition (Adelman 2006; Bettinger 2004; Bettinger and Long 2009; Braxton et al. 1997; Dynarski 2003). We therefore include variables capturing demographic and family attributes (race/ethnicity; sex; parental education; home ownership and region of residence) and academic preparation (class rank, standardized test scores; college intentions, completion of AP and pre-calculus classes). Schools with similar economic composition may differ in their college-going traditions (Adelman 2006; Carey 2004; Dougherty et al 2006; Hill 2008); therefore, to control for variation in college-going traditions that is associated with both economic composition and collegiate persistence, we model the number of AP courses offered, as well as the school-specific shares of students with college plans, who pass algebra, and who pass AP exams.[5] Missing data is relatively modest, ranging 2–12 %, as reported in Tables 5 and 6 in Appendix. Although no single variable has a high proportion of missing, in order to prevent loss of cases using list-wise procedures, we use indicator variables to flag the missing cases in multivariate analyses.

College characteristics also influence students' persistence outcomes (Manski and Wise 1983; Stratton et al. 2008). Therefore, the statistical models include several institutional characteristics, including competitiveness of admissions, private/public status, whether located in Texas, average annual cost and total undergraduate enrollment. Furthermore, to assess the adequacy of the student-institution match (Long 2003; Roderick et al. 2008, 2009), we consider how a student's standardized test score compares to the average of a college's student body. The operational measure expresses a student's SAT score as a deviation from the institutional spread, reported by NCES and Barron's college profile for 2002.[6] Two-year colleges do not report SAT scores, and these data are also missing for some 4-year institutions. For institutions lacking information about SAT 25th and 75th percentiles, we

[5] These data are obtained from the Texas Education Agency and appended to individual records.

[6] We convert ACT scores if available or predict missing SAT scores using students' decile class rank, high school curriculum, most recent math and English grades, whether they have taken English and math AP courses, whether languages other than English are spoken at home, race/ethnicity, parental education, high school types, and several high school attributes including % enrolled in grades 11–12 taking AP courses, % AP exams passed, % students passed algebra test, % with college plans, and high school dropout rate.

substitute the 25th and 75th percentile means for institutions of their selectivity category.[7] Because 2-year colleges have virtually open admissions, we assign 200 and 700 as their 25th and 75th percentile values; these scores qualify virtually all students for admissions at 2-year institutions. Tables 5 and 6 in Appendix, respectively, provide summary statistics for 2- and 4-year enrollees according to the economic composition of the high school attended.[8]

Study Limitations

Many studies show that positive college experiences are associated with persistence and graduation (Carey 2004; Hill 2008; Roderick et al. 2009), and also that financial aid is an important correlate of both enrollment and persistence, particularly for economically disadvantaged students (Bettinger 2004; DesJardins et al. 2002; Dynarski 2003; Goldrick-Rab et al. 2011). For example, Tinto (1975) maintains that high school economic composition likely influences college persistence indirectly through differential college experiences, including enrollment intensity, employment status during enrollment, and social and academic integration.

Although THEOP data includes information about college experiences and financial aid, these data items are available only in the Wave 3 interviews and refer to respondents current institution, not the first institution or prior institutions. The lack of financial aid and college experience data for the institution first attended is most problematic for students who first enrolled at a 2-year institution because over half of the subsample transferred. Among 4-year enrollees, one in five students transferred college during the observation period. It is highly unlikely that the experiences (e.g., stop-out episodes, academic performance, social fit and academic preparedness) of students who withdrew or transferred are similar to those of students who graduate from or persist at their first institution. Consequently, we are unable to ascertain how financial aid and early experiences influence withdrawal behavior. In particular, we cannot confirm whether the reduced-form estimates of school socioeconomic composition on persistence are truly direct effects, as Tinto (1975) maintains, or whether they operate indirectly through on-campus experiences and the availability of financial aid prior to enrollment.

Descriptive Results

Table 1 presents the distribution of first college enrollment by type of postsecondary institution attended and high school economic composition for students who enrolled within 6 months of high school graduation. Paralleling national estimates of college enrollees for the 2003 cohort of high school seniors (Bozick and Deluca 2005), about 60 % of 2002 Texas college enrollees matriculated at 4-year colleges, 35 % enrolled at 2-year community colleges and the rest enrolled in a vocational program that lasted less than 2 years. Because the Texas college admission regime in force since 1998 favors students

[7] Using Barron's selectivity index, we group 4-year institutions into four categories, non/less competitive (e.g., UT-El Paso), competitive (e.g., Texas Tech), very competitive (e.g., UT-Dallas and Texas A&M), highly and most competitive (e.g., Rice University and UT-Austin). For each category, we obtain SAT 25th and 75th percentile mean scores.

[8] About 13 % of 4-year enrollees missing SAT 25th percentile scores for their 1st enrolled institution, and 12 % missing SAT 75th percentile scores. However, only 6 % of students are missing the information among those attending institutions with competitive admissions.

Table 1 College enrollment outcome by high school economic composition and class rank

	4-year	2-year	Technical/ vocational	*N*
All seniors				
Affluent	65	32	3	1,055
Average	60	34	6	1,087
Poor	52	42	6	610
Total	60	35	5	
N	1,766	836	150	2,752
Top decile				
Affluent	89	11	0	239
Average	86	11	3	300
Poor	75	25	1	155
Total	85	14	1	
N	608	77	9	694
Non-top decile				
Affluent	59	38	4	816
Average	50	43	7	790
Poor	44	48	8	455
Total	52	42	6	
N	1,158	759	141	2,058

Texas public high school seniors in 2002 (row %)

who graduate in the top decile of their high school, we report enrollment outcomes separately for top decile and lower ranked students. Not surprisingly, larger shares of top decile students matriculated at 4-year institutions compared with their lower ranked classmates −85 % of top decile students and 52 % of non-top decile students did so within a year of graduating from high school; however, as hypothesized, there are large disparities according to high school economic composition.

Top 10 % class rank does not equalize enrollment choices between graduates from poor and affluent high schools. Three-fourths of top decile graduates from poor schools enrolled in a 4-year institution compared with 89 % of comparably ranked graduates from affluent schools. Furthermore, 11 % of top decile graduates from affluent high schools enrolled in a 2-year institution compared to 25 % of comparably ranked graduates from poor high schools. Similar disparities obtain for lower ranked students, with the notable difference that the distribution between 2- and 4-year institutions is smaller.

Transfer status is an important dimension of persistence that requires separate consideration both because it involves additional adjustment costs and because its occurrence depends on the initial institutional type. The majority of students who begin their college careers at 2-year colleges do so intending to transfer to a degree-granting institution; some do so before receiving an associate's degree and others transfer afterwards. A less typical switch is for 2-year enrollees to transfer to another community college or vocational school (lateral transfer). Likewise, students who enroll at 4-year colleges may decide to continue their baccalaureate studies at another degree-granting institution (lateral transfer); although less common than lateral transfers, some students who first enroll in a 4-year institution transfer to a 2-year or vocational school (reverse transfer) (Goldrick-Rab and Pfeffer 2009).

Table 2 shows that one-third of enrollees at 4-year institutions graduated on time. As expected, on-time graduation was more common among graduates from affluent compared

Table 2 College persistence outcome by high school economic composition and institution type

	Graduated	Continue	Transfer to		Dropout	*N*
			4-Year institution	2-Year or vocational institution		
All 4-year enrollees						
Affluent	44	35	13	5	3	724
Average	29	39	16	7	9	706
Poor	21	46	6	13	13	336
Total	34	38	13	7	7	
N	615	685	220	132	114	1,766
4-Year enrollees						
Top decile grads						
Affluent	65	29	5	1	1	220
Average	44	39	10	3	3	269
Poor	43	36	7	3	12	119
Total	51	35	8	3	4	
N	326	202	45	17	18	608
Non-top decile grads						
Affluent	35	38	16	6	4	504
Average	19	39	20	10	13	437
Poor	8	51	6	20	15	217
Total	25	40	16	10	9	
N	289	483	175	115	96	1,158
All 2-year enrollees						
Affluent	7	12	39	30	12	331
Average	16	14	37	13	19	381
Poor	16	18	21	17	27	274
Total	13	14	34	20	18	
N	136	154	349	169	178	986

Texas public high school seniors in 2002 (row %)

Source: Texas higher education opportunity project, senior wave 1–3 data

with graduates from poor high schools −44 % versus 21 %, respectively, and their abandonment rates were much lower −3 versus 13 %, respectively. Another third of 4-year matriculants persisted at their first institution, but 20 % had transferred to another institution. Consistent with Goldrick-Rab and Pfeffer's (2009) study on college transfers, students from poor high schools are least likely to make lateral transfers and most likely to engage in reverse transfers. Lateral transfers between degree-granting institutions were most common among students who attended average high schools.

Compared with their classmates who did not graduate in the top decile of their class, on-time graduation rates are higher for top 10 % students, and their withdrawals from the post-secondary system also are considerably lower. Nevertheless, there are noteworthy disparities in college persistence according to high school economic composition. Only 1 % of graduates from affluent high schools and 3 % of their rank counterparts from

average high schools withdrew from a 4-year college and did not re-enroll anywhere during the observation period. By comparison, roughly 12 % of top-ranked students from poor high schools withdrew from college. Only 4 % of non-top 10 % students from affluent high schools had abandoned higher education by the 2006–2007 academic year compared with 13 and 15 %, respectively, of their rank counterparts who attended average and poor high schools.

The bottom panel of Table 2 reports college persistence outcomes for 2-year enrollees (including those enrolled at vocational/technical institutions).[9] Over one-third of students who initially enrolled at a 2-year college transferred to a 4-year institution; this transfer rate is similar to the national rate reported by Adelman (2006) for the high school class of 1992.[10] Transfer rates vary directly with high school economic composition: nearly 40 % of affluent school graduates transferred to degree-granting institutions compared with 37 % of students who attended average high schools, only 21 % of graduates from poor high schools. Over one quarter of poor high school students who enrolled at community colleges discontinued their postsecondary studies altogether. By comparison, only 12 % of affluent high school students who enrolled at 2-year institutions withdrew from college.

Not only do smaller shares of affluent high school graduates begin their college careers at 2-year institutions compared with students from average or poor high schools, but community colleges also appear to serve different functions for them. A mere 7 % of affluent high school graduates who begin college at 2-year institutions receive a terminal associate's degree, compared with 16 % of graduates from average and poor high schools. Auxiliary tabulations reveal that nearly 60 % of affluent school graduates who begin their college at 2-year institutions transfer before receiving an associate's degree, compared with about 30 % of graduates from average and poor high schools.[11] Community colleges both permit experimentation in higher education and serve as a pathway to a 4-year degree for graduates from affluent high schools, but more often become the final education destination for college-bound graduates from poor high schools (Dougherty 1994; Dougherty and Kienzl 2006).

The descriptive results reported in Tables 1 and 2 are consistent with a vast literature about social class variation in postsecondary persistence, but reveal little about the underlying mechanisms. Therefore we turn to a multivariate analysis to consider whether the economic composition of high school attended directly influences college persistence among students of comparable academic preparation and family background, or whether social class sorting of students among schools of varying quality are responsible for the observed inequities.

Multivariate Analyses

Most analyses of college persistence use discrete choice models (e.g., Ganderton and Santos 1995; Goldrick-Rab and Pfeffer 2009; Manski and Wise 1983; Stratton et al. 2008). Following Stratton et al. (2008), we use the multinomial logit model to evaluate claims about the association between high school socioeconomic composition and college

[9] We do not disaggregate 2-year college enrollees by class rank because very few top decile graduates enroll in community colleges, and vocational institutions in particular. Results are available on request.

[10] These transfer rates are based on 4 years after initial enrollment, unlike Adelman's (2006), which are based on outcomes 8 years after initial enrollment.

[11] These tabulations are available from the authors on request.

persistence (Jencks and Mayer 1990). Because 2- and 4-year colleges serve different purposes and populations, we analyze enrollees at 4- and 2-year institutions separately. Formally, the probability that the *i*th student achieves outcome j is given by:

$$\text{prob}(Y_i = j) = \frac{e^{\beta(j)w(i)}}{\sum_k e^{(k)w(i)}} \quad (1)$$

where $k = 1, 2, 3$ for college graduation, continuation/transfer and dropout, respectively, for enrollees at 4-year institutions. For 2-year college enrollees, $k = 1, 2, 3, 4$, indicate, respectively: (1) graduate with a terminal associate degree and pursue no further education during the observation period; (2) transfer to a 4-year institution; (3) continue or transfer to another 2-year institution; and (4) drop out. For both 4- and 2-year enrollees, we use dropout as the reference category to highlight two forms of college persistence: graduation and continuation/transfer.

Our primary substantive focus is on $\boldsymbol{\beta}$, the parameter indicating the association between high school economic composition and persistence. **W** is a vector of individual, high school and college characteristics known to influence college persistence. Summary statistics reported in Tables 5 and 6 in Appendix reveal that most of the covariates vary monotonically according to the economic composition of high schools. For example, compared with poor schools, affluent schools offer more AP courses, and higher shares of students from affluent schools earn passing grades on the AP exam as well as on the state algebra test. The latter is a strong predictor of college enrollment (Schneider et al. 2006).

Student background characteristics also show clear gradients by high school economic composition. Over half of the affluent school graduates enrolled at a 4-year institution have college-educated parents, compared with about 40 % of those from average high schools and less than 20 % of graduates from poor high schools. Texas high schools also differ in their demographic composition, with poor schools disproportionately populated by minority students. Furthermore, students' college orientation and academic preparedness also varies directly with their high schools' economic composition. Enrollees from affluent schools averaged an SAT score of 1,134 compared with 911 for those from poor high schools. Students who first enroll in 2-year institutions have weaker academic profiles and lower SES backgrounds compared with 4-year enrollees, but the pattern of variation according to high school economic status is similar.

Finally, students' institutional choices also differ systematically according to the economic composition of their high schools (see Niu and Tienda 2008). Over 80 % of affluent school graduates enrolled at a competitive institution compared with 55 % of graduates students from poor high schools. Annual college costs average about $13,000 for affluent schools graduates compared with less than $9,500 for graduates from poor high schools. There is limited information to differentiate among 2-year institutions; nevertheless, it is noteworthy that 13 % of affluent school graduates who enrolled at a 2-year institution opted for a private college compared with only 7 % of those from poor high schools.

Estimation Strategy

We estimate four models to evaluate the association between college persistence and high school economic status. In the baseline model (model 1), vector **W** includes only high school economic composition; therefore, the associated parameters summarize the associations portrayed in Table 2. Subsequently, we expand **W** by sequentially adding high school characteristics that measure differences in college orientation and rigor of the

academic curriculum (model 2); measures of family background and student academic preparation (model 3); and college characteristics and student- institution fit (model 4).

Empirical Results: Four-Year Enrollees

Given the monotonic variation between high school economic composition and students' academic attainments, it is plausible that the association between high school economic composition and collegiate persistence is spurious. The relative risk ratios (RRRs) presented in Table 3 indicate otherwise. The baseline model shows that compared with on-time enrollees who attended average high schools, students from affluent high schools were five times as likely to graduate from college and 2.78 times as likely to remain enrolled at the end of the observation period relative to dropping out. In contrast, graduates from poor high schools were only half as likely to graduate and .64 times as likely to persist in their pursuit of a baccalaureate degree versus withdrawing from college, compared with students from average high schools.[12]

For graduates from affluent schools, the persistence and completion differentials are attenuated by modeling the college orientation and academic rigor of the curriculum, as represented by the availability of advanced placement (AP) courses and math course offerings, and they largely explain the persistence differentials between students who attend poor compared with average high schools. Only the share of students who pass AP exams is significantly associated with persistence and graduation outcomes, but the pseudo R-squared statistic indicates that the explanatory power of this set of covariates is weak. A comparison of the RRRs between models 1 and 2 reveals that cross-school variation in the rigor of academic programs explains about one-third of the on-time college completion advantage and about a quarter of the persistence advantage enjoyed by affluent school graduates compared with students who attended average high schools.

The persistence and completion advantages associated with high school economic composition partly reflect social class variation and academic performance of enrollees, but the RRR statistics for affluent school students are only slightly attenuated (from 3.2 to 2.9) for on-time graduation and are unaltered for continued enrollment. As shown by a vast empirical literature (Adelman 2006), parental education is the strongest predictor of college persistence and completion; compared with students whose parents lack any postsecondary schooling, those with college-educated parents are about two times as likely to graduate on time or remain enrolled relative to withdrawing. Consistent with other studies reporting gender differences in college success (Adelman 2006; Horn et al. 2001), girls are twice as likely as boys to graduate on time, and 1.5 times as likely to remain enrolled relative to withdrawing, but like Kane (1994), we find no race differences in completion or persistence among students of comparable family background who attended schools of similar socioeconomic composition.

Except for class rank, measures of academic preparation are only weakly associated with completion and persistence outcomes. Students who graduated in the top decile of their class are 3.7 times as likely to graduate on time relative to their lower ranked classmates, but the RRR associated with continued enrollment, while positive, is not statistically significant.[13] Only two measures of academic preparation are positively

[12] Table 7 in Appendix, which presents robustness checks using different working samples, reports the baseline model estimates of high school economic composition.

[13] We estimated a model that interacted class rank and high school economic composition. The interaction terms indicated no difference in persistence odds among top decile graduates who attended affluent, average and poor high schools. Therefore, we report only results from the additive specification.

Table 3 Relative risk ratios for college persistence outcomes relative to dropouts: 4-year enrollees ($N = 1{,}766$)

Model	(1)		(2)		(3)		(4)	
	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer
HS economic composition								
Affluent high school	5.06 (1.305)***	2.78 (0.687)***	3.20 (0.938)***	2.07 (0.597)**	2.86 (0.872)***	2.09 (0.616)**	2.13 (0.658)**	1.65 (0.497)†
Poor high school	0.49 (0.162)*	0.64 (0.162)†	0.68 (0.201)	0.76 (0.182)	1.21 (0.482)	0.73 (0.217)	1.03 (0.422)	0.69 (0.207)
High school characteristics								
Percent students with college plans			1.00 (0.005)	0.99 (0.004)	1.00 (0.006)	1.00 (0.005)	1.00 (0.006)	1.00 (0.005)
Percent passing algebra			0.99 (0.005)	0.99 (0.0005)	1.00 (0.006)	1.00 (0.004)	1.00 (0.006)	1.00 (0.005)
Number of AP courses			1.01 (0.023)	1.02 (0.020)	1.04 (0.024)	1.05 (0.021)*	1.03 (0.026)	1.04 (0.023)†
Percent passing AP exams			1.01 (0.006)*	1.01 (1.006)	1.01 (0.006)†	1.00 (0.006)	1.01 (0.007)†	1.00 (0.006)
Background characteristics								
Parental education (high school)								
Less than high school					0.84 (0.362)	1.15 (0.401)	0.70 (0.328)	1.15 (0.430)
Some college					2.13 (0.782)*	1.95 (0.679)†	1.95 (0.717)†	1.85 (0.643)†
College and higher					2.44 (0.808)**	1.98 (0.617)*	2.18 (0.698)*	1.92 (0.587)*
Home ownership (own)								
Rent					0.46 (0.173) *	0.62 (0.182)†	0.44 (0.166) *	0.62 (0.184)†
Location								
South–East					1.13 (0.311)	0.84 (0.181)	1.32 (0.384)	0.97 (0.225)
Race/ethnicity (white)								
Black					1.01 (0.371)	1.00 (0.317)	1.18 (0.460)	1.19 (0.404)
Hispanic					0.95 (0.357)	1.26 (0.365)	0.99 (0.389)	1.28 (0.400)
Asian					1.26 (0.632)	0.99 (0.427)	1.58 (0.757)	1.02 (0.435)

Table 3 continued

Model	(1)		(2)		(3)		(4)	
	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer
Sex (male)								
Female					2.03 (0.455)**	1.57 (0.294)*	1.99 (0.436)**	1.54 (0.285)*
Academic preparation								
First thought about college (always)								
Middle high school					0.50 (0.177)*	0.67 (0.189)	0.52 (0.179)†	0.70 (0.193)
High school					0.99 (0.266)	0.97 (0.246)	1.06 (0.294)	1.02 (0.271)
Class rank								
Top decile					3.73 (1.163)***	1.54 (0.743)	3.13 (1.022)***	1.22 (0.386)
HS subject grades								
English A					1.42 (0.355)	1.06 (0.243)	1.45 (0.369)	1.04 (0.247)
Math A					1.34 (0.402)	1.26 (0.326)	1.35 (0.409)	1.24 (0.312)
Social science A					1.30 (0.311)	0.95 (0.196)	1.20 (0.285)	0.92 (0.191)
Science A					1.14 (0.292)	1.19 (0.269)	1.06 (0.282)	1.16 (0.268)
Courses								
Pre-calculus					1.33 (0.374)	1.62 (0.383)*	1.35 (0.395)	1.55 (0.378)†
AP science					0.83 (0.219)	0.76 (0.196)	0.84 (0.221)	0.79 (0.194)
AP math					1.26 (0.399)	1.28 (0.403)	1.23 (0.384)	1.22 (0.389)
Test score								
SAT (100)					1.13 (0.103)	0.97 (0.071)	1.27 (0.140)*	1.14 (0.112)
SAT missing					0.73 (0.281)	0.80 (0.217)	0.75 (0.294)	0.74 (0.198)
College characteristics								
Competitive							1.31 (0.384)	0.96 (0.251)
Private							1.10 (0.435)	1.36 (0.580)
In-state							2.47 (0.880)**	1.75 (0.602)†

Table 3 continued

Model	(1)		(2)		(3)		(4)	
	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer	Graduated	Continue/ Transfer
Distance (100 miles)							1.19 (0.120)†	1.00 (0.091)
Distance sq							0.99 (0.004)†	1.00 (0.003)
Cost ($1,000)							0.95 (0.081)	0.91 (0.083)
Cost Sq							1.00 (0.004)	1.00 (0.004)
Enrollment (1,000)							0.98 (0.036)	1.05 (0.041)
Enrollment Sq							1.00 (0.001)	1.00 (0.001)
Student SAT < Institution's 25th percentile							1.39 (0.438)	1.40 (0.413)
Student SAT > Institution 75th percentile							0.44 (0.155)*	0.43 (0.141)**
Pseudo R^2	0.03		0.03		0.13		0.16	

Clustered SE in *parentheses*; reference category for predictors in *parentheses*

Source: Texas higher education opportunity project, senior wave 1–3 data

Notes: All models include indicator flags for missing data for parental education, homeownership, race/ethnicity and first thought about college. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

associated with persistence: completion of pre-calculus, which increases the likelihood of persistence relative to dropping out compared with students who completed lower level math courses, and college orientation.

Although further attenuated, the graduation and continuation advantages associated with affluent school attendance remain even after inclusion of institutional characteristics (Model 4). That is, graduates from affluent high schools are over twice as likely to graduate on time and 1.65 times as likely to remain enrolled relative to withdrawing compared with graduates from average high schools. Results from model 4 confirm claims of Roderick et al. (2009) regarding the importance of the student-institution match for college success. Students whose SAT score is at or above their institution's 75th percentile are less than half as likely to graduate on-time or remain enrolled relative to withdrawing compared with their statistical counterparts whose SAT score is between their institution's 25th and 75th percentiles. Furthermore students who enroll at an in-state institution are 2.5 times as likely to graduate in 4 years and 1.75 times as likely to remain enrolled relative to withdrawing compared with their statistical counterparts who attend college out of state.

Empirical Estimates: Two-Year Enrollees

Table 4 reports results for students who first enrolled in 2-year institutions within 6 months of high school graduation. The relative risk ratios indicate that, compared with students who graduated from average Texas high schools, those who attended affluent high schools are 1.87 times more likely to transfer to a 4 year institution relative to withdrawing altogether, but graduates from poor high schools are only half as likely to do so. Affluent high schools graduates also are more likely than graduates from average high schools to remain enrolled at a 2-year/vocational institution relative to dropping out, but students from poor high schools are as likely as average high school graduates to persist in a 2-year institution. There are no differences in the likelihood of receiving terminal associate degrees according to the economic composition of high schools.

Model 2 incorporates high school characteristics that are associated with postsecondary enrollment. A comparison of RRRs from the baseline model and model 2 reveals that the 4-year transfer advantage enjoyed by graduates from affluent high schools compared with students from average high schools derives from their schools' postsecondary orientation, notably the percent of students with college plans. Although the RRR for affluent school graduates who transfer to a 4-year institution is positive, the point estimates is imprecisely estimated. Compared with graduates from average high schools, however, students from poor high schools are about half as likely to transfer to a 4-year institution relative to dropping out altogether, even after modeling high school attributes that are associated with postsecondary enrollment.

Family background and academic preparation partly account for the higher 4-year transfer rates among students from affluent high schools, but do not explain the lower transfer rates for students from poor high schools, as revealed by a comparison of the associated relative risk ratios among the three models: Compared with model 2, the model 3 RRR for affluent high school graduates is attenuated, yet for graduates from poor high schools the magnitude and statistical significance of the RRR is unchanged. As expected, the results confirm the salience of parental education for the transition from 2- to 4-year institutions. Specifically, compared with students whose parents lack any postsecondary schooling, students with college-educated parents are, respectively, two to four times as likely to persist enrolled or transfer to a 4-year institution relative to withdrawing.

Table 4 Relative risk ratios for college persistence outcomes relative to dropout: 2-year enrollees ($N = 986$)

Model	(1)			(2)			(3)			(4)		
	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational
HS economic composition												
Affluent high school	0.61 (0.207)	1.87 (0.400)**	1.70 (0.396)*	0.67 (0.316)	1.54 (0.430)	1.59 (0.508)	0.82 (0.386)	1.32 (0.404)	1.73 (0.563)†	0.83 (0.375)	1.29 (0.360)	1.73 (0.566)†
Poor high school	0.70 (0.176)	0.54 (0.185)†	1.04 (0.278)	0.71 (0.212)	0.56 (0.153)*	1.01 (0.257)	0.50 (0.168)*	0.55 (0.176)†	0.82 (0.266)	0.64 (0.183)	0.58 (0.195)†	0.80 (0.248)
High school characteristics												
Percent students with college plans				1.01 (0.004)	1.01 (0.005)*	1.00 (0.004)	1.01 (0.005)	1.01 (0.004)*	1.00 (0.004)	1.00 (0.006)	1.01 (0.004)†	1.00 (0.005)
Percent passing algebra				0.99 (0.007)	1.00 (0.006)	0.99 (0.007)	1.00 (0.008)	1.01 (0.007)	0.99 (0.007)	1.00 (0.008)	1.01 (0.007)	1.00 (0.007)
Number of AP courses				0.99 (0.026)	1.02 (0.021)	1.02 (0.021)	0.99 (0.029)	1.02 (0.022)	1.01 (0.023)	0.99 (0.026)	1.02 (0.021)	1.02 (0.023)
Percent passing AP exams				0.99 (0.007)	0.99 (0.007)	1.00 (0.006)	0.99 (0.008)	0.99 (0.006)	1.00 (0.006)	1.00 (0.007)	1.00 (0.006)	1.00 (0.006)
Background characteristics												
Parental education (high school)												
Less than high school							1.26 (0.474)	1.03 (0.409)	1.03 (0.295)	1.15 (0.468)	1.04 (0.428)	1.01 (0.302)
Some college							1.11 (0.386)	1.86 (0.552)*	1.46 (0.431)	0.92 (0.319)	1.89 (0.567)*	1.45 (0.420)
College and higher							1.90 (0.862)	3.99 (1.357)***	2.58 (0.821)**	2.36 (1.088)†	4.36 (1.541)***	2.81 (0.936)**
Home ownership (own)												
Rent							0.97 (0.442)	1.05 (0.423)	1.07 (0.372)	0.83 (0.370)	1.10 (0.429)	1.10 (0.376)

Table 4 continued

Model	(1)			(2)			(3)			(4)		
	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational
Location												
South–East							0.93 (0.261)	1.46 (0.308)†	1.16 (0.243)	1.46(0.478)	1.84 (0.468)*	1.35 (0.334)
Race/ethnicity (white)												
Black							1.16 (0.543)	1.29 (0.544)	1.55 (0.635)	1.09 (0.521)	1.30 (0.542)	1.51 (0.639)
Hispanic							1.90 (0.612)*	2.00 (0.732)†	2.34 (0.728)**	2.05 (0.662)*	2.13 (0.791)*	2.40 (0.736)**
Asian							0.55 (0.389)	2.42 (0.929)*	1.29 (0.653)	0.71 (0.538)	2.53 (1.307)†	1.46 (0.822)
Sex (male)												
Female							1.18 (0.274)	1.37 (0.308)	1.30 (0.305)	1.67 (0.469)†	1.51 (0.366)†	1.42 (0.356)
Academic preparation												
Firs thought about college (always)												
Middle school							1.60 (0.512)	0.68 (0.196)	0.92 (0.234)	1.41 (0.485)	0.70 (0.209)	0.92 (0.235)
High school							1.65 (0.483)†	0.97 (0.281)	0.93 (0.239)	1.67 (0.484)†	1.03 (0.309)	0.96 (0.259)
Class rank												
Top decilne							1.31 (0.706)	1.01 (0.420)	1.10 (0.493)	1.12 (0.646)	0.89 (0.382)	0.97 (0.459)
HS subject grades												
English A							1.14 (0.323)	1.39 (0.321)	1.17 (0.254)	1.20 (0.370)	1.43 (0.355)	1.19 (0.271)

Table 4 continued

Model	(1)			(2)			(3)			(4)		
	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational
Math A							1.02 (0.379)	1.46 (0.441)	1.04 (0.316)	0.89 (0.329)	1.50 (0.456)	1.02 (0.310)
Social science A							0.76 (0.177)	1.63 (0.329)*	0.95 (0.173)	0.76 (0.204)	1.61 (0.306)**	0.97 (0.180)
Science A							1.67 (0.566)	1.77 (0.539)†	2.09 (0.625)**	1.83 (0.632)†	1.96 (0.616)*	2.21 (0.679)**
Courses taken												
Pre-calculus							1.01 (0.321)	1.03 (0.255)	0.88 (0.212)	0.77 (0.262)	0.98 (0.260)	0.84 (0.224)
AP science							0.90 (0.373)	0.82 (0.272)	0.97 (0.350)	0.75 (0.334)	0.79 (0.271)	0.91(0.351)
AP math							2.11 (0.881)†	2.21 (0.901)*	1.68 (0.668)	2.82 (1.191)**	2.36 (0.967)	1.83 (0.713)
Test scores												
SAT 100							0.97 (0.126)	1.19 (0.118)†	1.04 (0.109)	0.93 (0.125)	1.17 (0.138)	1.01 (0.129)
SAT Missing							0.94 (0.230)	0.30 (0.066)***	0.70 (0.127)*	0.56 (0.151)*	0.27 (0.064)***	0.60 (0.130)*
College characteristics												
Nonvocational (vocational)										0.09 (0.043)***	0.66 (0.302)	0.38 (0.171)*
Private										0.43 (0.210)†	2.17 (1.117)	1.20 (0.567)
In-state										0.14 (0.165)†	0.22 (0.274)	0.45 (0.501)

Table 4 continued

Model	(1)			(2)			(3)			(4)		
	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational	Graduated & no more	Transfer to a 4-year	Continue/ transfer to a 2-year or vocational
Distance (100 miles)										0.91 (0.248)	1.54 (0.343)*	1.11 (0.291)
Distance sq										1.01 (0.023)	0.96 (0.019)*	0.99 (0.028)
Cost ($ 1,000)										0.76 (0.066)**	0.83 (0.089)†	0.78 (0.059)***
Cost Sq										1.01 (0.003)***	1.00 (0.007)	1.01 (0.003)**
Enrollment (1,000)										0.93 (0.049)	1.03 (0.046)	1.04 (0.037)
Enrollment Sq										1.00 (0.001)	1.00 (0.001)	1.00 (0.001)
Student SAT>institution 75th Percentile										1.87 (0.996)	1.41 (0.638)	1.40 (0.669)
Pseudo R^2		0.02			0.02			0.11			0.14	

Clustered SE in *parentheses*; reference category for predictors in *parentheses*

Source: Texas higher education opportunity project, senior wave 1–3 data

Notes: All models include indicator flags for missing data for parental education, homeownership, race/ethnicity and first thought about college. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Although Table 3 shows no race and ethnic differences in persistence behavior among students who first enroll in a 4-year institution, this is not the case for those who first enroll in 2-year institutions. Hispanics are about twice as likely as whites to graduate with a terminal degree, transfer to a 4-year institution, or remain enrolled at a 2-year college relative to withdrawing altogether, and Asian students are 2.4 times as likely as whites to transfer to a baccalaureate-granting institution. There are no differences in the persistence behavior of black and white students who first enroll in 2-year colleges, however.

Institutional characteristics and the student-institution match also are relevant for understanding the persistence and transfer behavior of enrollees at 2-year institutions, although the insights are more limited compared with those based on 4-year college enrollees. There is less variation in characteristics of 2-year versus 4-year institutions, especially in size, cost and distance (see Appendix tables), yet college attributes help understand variation in persistence behavior. Specifically, students who enroll in 2-year institutions with general academic curricula are 0.9 times as likely to achieve a terminal degree versus withdrawing compared with their counterparts who enroll in a vocational institution. Furthermore, cost is an important predictor of persistence for students who enroll in 2-year institutions. Attending a more expensive college is associated with a lower likelihood of receiving a terminal degree or transferring to a 4-year institution relative to withdrawing altogether. It is striking that graduates from poor high schools are only 0.58 times as likely to transfer to a 4-year institution relative to withdrawing compared with their statistical counterparts who attended average high schools. Although the RRR is on the margin of statistical significance, the magnitude remains very much the same across the four specifications.

Conclusions and Implications

Using a longitudinal sample of Texas high school seniors of 2002, we investigate variation in college persistence by high school economic status. Our findings are generalizable to students who enrolled in college within the calendar year of high school graduation, which represents 66 % of the 2002 senior class. Specifically, we find that the advantages in on-time graduation from 4-year colleges enjoyed by graduates of affluent high schools cannot be fully explained by the rigor of a high school's academic curriculum and college orientation, family background and students' secondary academic preparation. Even controlling for characteristics of the college attended does not fully explain the higher persistence and on-time graduation rates enjoyed by graduates from affluent schools who enroll at 4-year colleges.

Empirical results also show that high school curriculum, and in particular the availability of AP courses, accounts for the lower persistence and completion rates of graduates from poor high schools, but this estimate is likely conservative both because of the prior sorting between 2- and 4-year institutions and because many students who are qualified for automatic admission do not enroll in college—resulting in what Niu et al. (2008) dub the "talent loss." For students who first enrolled in a 2-year college, high school college orientation, family background and academic preparation largely explain why graduates from affluent high schools are more likely to transfer to a 4-year institution compared with their counterparts who graduate from average high schools; however, neither these factors nor college characteristics account for the low transfer rates for graduates from high schools that serve large numbers of low-income students.

That students from affluent high schools are appreciably more likely to graduate on time or persist in their pursuit of a degree relative to dropping out compared with students who attended average high schools supports Jencks and Mayer's (1990) claims about the salience of high school economic composition as a predictor of college success. Thus, our results are in line with the handful of studies that have attempted to establish links between secondary schools and collegiate persistence and suggest that, as a proxy for unmeasured high school attributes that are conducive to academic success, the economic composition of high schools can serve as a focus of policy initiatives to improve both secondary and postsecondary graduation outcomes. Although Bowen et al. (2009) caution against overstating high school influences on postsecondary outcomes, they concede that high schools are a potential policy lever that can be used to improve postsecondary outcomes.

One such factor, which is highlighted in a few recent studies (Bowen et al. 2009; Roderick et al. 2008, 2009) concerns the adequacy of the institutional match achieved by college-bound students. Our results support this assessment for students who first enroll in 4-year institutions. We find that those whose SAT score is at or above an institution's 75th percentile were significantly less likely to remain enrolled or graduate within 4 years. Simply stated, under-matching undermines persistence (Bowen et al. 2009).

Building on insights from Hill (2008) and our discussions with Texas high school administrators, we suspect that the persistence advantages enjoyed by graduates of affluent high schools partly derive from the better institutional matches afforded by the guidance staff of these schools. Hill (2008) argues that students from lower performing schools, which are usually populated by large shares of low-income students, would most benefit from strong counseling services that can optimize institutional matches for college-bound students. In the short or medium term, however, it is highly unlikely that Texas high schools, particularly those that disproportionately serve low income students, will expand their counseling staff with the goal of optimizing institutional matches.

Because Texas does not have a state income tax, public school funding relies heavily on property taxes. Although this funding arrangement virtually ensures perpetuation of inequities between schools that serve affluent and low-income students, it need not seal the fate of those who are economically disadvantaged. The policy issue at hand requires creative, revenue-neutral solutions that can be implemented to promote academic success at both the secondary and postsecondary level. According to Bowen et al. (2009), public universities have a particularly important role to play in equalizing postsecondary outcomes, both in the identification and recruitment of academically talented low-income students and in strengthening the curricula of high schools that are not part of their traditional feeder systems.

The Federal TRIO Programs, which are designed precisely to broaden the college pipeline by targeting low-income and first generation college students from middle school through post-baccalaureate programs, offer a promising opportunity for public institutions to improve persistence rates even as they diversify the economic background of their incoming students. Whether qualifying schools have the necessary leadership to apply for such federal programs is unclear, but this further underscores the importance of university outreach to schools that fall outside of their typical feeding patterns to establish TRIO programs that build on best practices and are amenable to rigorous evaluation. In addition, university administrators are well positioned to evaluate the adequacy of high school curricula, to identify weaknesses in courses required for college success, and to offer advanced placement courses for talented students. Because many schools that serve low-income students lack advanced placement courses, public universities could take the lead in supplementing secondary school curricula through summer programs for students and

advanced training for teachers. No program innovation can succeed without stalwart commitment on the part of teachers and administrators at both secondary and postsecondary institutions.

Methodological Appendix

Although wave 3 respondents are similar to the random wave 3 subsample in race and ethnic composition, college intentions and attainments, the low response rate (50 %) warrants further scrutiny. Therefore, we evaluate the robustness of our main findings by using different working samples: (1) three-wave longitudinal sample, which is the working sample used in the paper; (2) wave 3 respondents who were interviewed by August of 2006, which restricts the timeline to 4 years after high school graduation; and (3) respondents who were interviewed in both wave 2 and wave 3 surveys, which excludes individuals not interviewed in wave 2 and "recaptured" in wave 3.

The Table 7 in Appendix reports relative risk ratio estimates obtained from the baseline models that include only high school economic status dummies using different working samples. Results reveal highly consistent estimates both in magnitude and statistical significance levels for both 4- and 2-year enrollees. The sole exception corresponds to withdrawal from a 4-year college among students from poor high schools. These students are estimated to be marginally more likely to drop out than graduates from average high schools, but the point estimates are smaller and statistical significance compromised for two of the alternative samples: the subset of wave 3 cases interviewed by August, 2006 and those restricted to cases interviewed in both waves 2 and 3. Differences in estimates obtained from the three alternative samples indicate that students from poor high schools who withdraw from 4-year colleges disproportionally represent observations interviewed only in wave 3 or from cases interviewed after August 2006.

To verify this possibility, we examine distributions by high school status, which confirms that graduates from poor high schools who dropped out of a 4-year institution were more likely to have been interviewed only at wave 3 compared with average school students who withdrew from a 4-year college—20 % for the former and 5 % for the latter. The corresponding figures for cases interviewed after August 2006 are 22 and 14 %, respectively. But, this group of college dropouts is an exception. For other college persistence outcomes, the proportions of wave 3 respondents and late respondents are either very comparable to those of respondents from average and poor high schools, or the proportions are slightly lower for college enrollees from poor high schools. That is, the changes in the magnitude and significance of the 4-year college withdrawal estimates for graduates from poor high schools are consistent with the differences across working samples. This result also highlights that cases interviewed in wave 3 but not in wave 2 (i.e., recapture cases) not only rebalance the longitudinal sample, but also ensure the representativeness of wave 3 respondents.

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Appendix

See Tables 5, 6 and 7.

Table 5 Summary statistics for 4-year enrollees by high school economic composition

	Sample mean	High school economic composition		
		Affluent	Average	Poor
High school characteristics				
Percent students with college plans (SD)	77.00 (17.990)	82.34 (11.929)	73.44 (21.168)	72.97 (18.720)
Percent passing algebra (SD)	37.16 (22.164)	48.52 (21.72)	30.88 (17.493)	25.88 (20.875)
Number of AP courses (SD)	13.95 (5.931)	17.00 (3.742)	12.48 (6.494)	10.43 (5.410)
Percent passing AP exams (SD)	53.50 (25.694)	75.57 (10.525)	45.76 (20.337)	22.20 (14.413)
Background characteristics				
Parental education				
Less than high school	0.08	0.02	0.07	0.21
High school (ref.)	0.16	0.12	0.19	0.21
Some college	0.24	0.25	0.23	0.24
College and higher	0.41	0.52	0.40	0.18
Do not know/missing	0.12	0.09	0.12	0.16
Home ownership				
Rent	0.10	0.05	0.12	0.14
Own (ref.)	0.80	0.85	0.78	0.72
Do not know/missing	0.10	0.09	0.10	0.14
Location				
South–East	0.38	0.36	0.39	0.43
Race/ethnicity				
Black	0.16	0.11	0.14	0.32
Hispanic	0.23	0.07	0.20	0.62
Asian	0.11	0.13	0.14	0.02
White (ref.)	0.48	0.67	0.50	0.03
Other/Missing	0.02	0.02	0.02	0.01

Table 5 continued

	Sample mean	High school economic composition		
		Affluent	Average	Poor
Sex				
Male (ref.)	0.48	0.48	0.47	0.46
Female	0.52	0.52	0.53	0.54
Academic preparation				
Class rank				
Non-top decile (ref.)	0.66	0.70	0.62	0.65
Top decile	0.34	0.30	0.38	0.35
First thought about college				
Always (ref.)	0.73	0.78	0.72	0.62
Middle high school	0.10	0.07	0.11	0.14
High school	0.10	0.07	0.09	0.15
Do not know/missing	0.07	0.07	0.08	0.09
Grades A				
English	0.55	0.58	0.58	0.42
Math	0.35	0.35	0.37	0.27
Social science	0.60	0.59	0.63	0.53
Science	0.43	0.41	0.47	0.37
Courses taken				
Pre-calculus	0.74	0.80	0.71	0.65
AP science	0.34	0.33	0.37	0.31
AP math	0.40	0.40	0.41	0.37
Test score				
SAT (SD)	1,056 (197)	1,134 (179)	1,045 (183)	911 (172)
SAT missing	0.10	0.05	0.09	0.23

Table 5 continued

	Sample mean	High school economic composition		
		Affluent	Average	Poor
College characteristics				
Competitive	0.69	0.82	0.64	0.55
Private	0.19	0.23	0.15	0.19
In-state	0.86	0.82	0.89	0.89
Distance (miles) (SD)	208 (314)	256 (359)	167 (285)	193 (249)
Cost (SD)	11,179 (6,638)	12,920 (7,311)	10,222 (5,733)	9,441 (6,011)
Enrollment (SD)	16,525 (12,854)	19,481 (13,458)	15,474 (12,745)	12,365 (9,965)
Institution 25th percentile < student				
SAT < Institution 75th percentile (ref.)	0.53	0.54	0.54	0.43
Student SAT > Institution 75th percentile (ref.)	0.23	0.28	0.24	0.13
Student SAT < Institution 25th percentile (ref.)	0.24	0.18	0.22	0.44
N	1,766	724	706	336

Texas public high school seniors in 2002 (means, percents or proportions)

Source: Texas higher opportunity project, senior wave 1–3

Note: We convert ACT Sources if available or predict missing SAT scores using arrays of students' high school achievements measures, parental education and high school characteristics

Table 6 Summary statistics for 2-year enrollees by high school economic composition

	Sample mean	High school economic composition		
		Affluent	Average	Poor
High school characteristics				
Percent students with college plans (SD)	74.96 (21.796)	80.21 (11.594)	75.29 (25.286)	68.17 (24.119)
Percent passing algebra (SD)	34.66 (20.035)	46.89 (20.244)	30.53 (17.137)	25.63 (16.032)
Number of AP courses (SD)	12.68 (6.140)	15.89 (4.051)	10.45 (6.570)	11.89 (6.008)
Percent passing AP exams (SD)	45.74 (27.219)	72.68 (12.165)	38.05 (23.716)	23.90 (16.427)
Background characteristics				
Parental education				
Less than high school	0.16	0.07	0.12	0.34
High school (ref.)	0.19	0.17	0.23	0.15
Some college	0.24	0.29	0.23	0.20
College and higher	0.22	0.32	0.23	0.09
Do not know/missing	0.19	0.15	0.19	0.23
Home ownership				
Rent	0.11	0.08	0.10	0.17
Own (ref.)	0.75	0.80	0.78	0.66
Do not know/missing	0.13	0.12	0.11	0.18
Location				
South–East	0.49	0.42	0.46	0.62
Race/ethnicity				
Black	0.15	0.09	0.15	0.21
Hispanic	0.35	0.13	0.30	0.68
Asian	0.07	0.12	0.06	0.01
White (ref.)	0.42	0.66	0.47	0.09
Other/missing	0.01	0.00	0.02	0.01

Table 6 continued

	Sample mean	High school economic composition		
		Affluent	Average	Poor
Sex				
Male (ref.)	0.48	0.51	0.48	0.46
Female	0.52	0.49	0.52	0.54
Academic preparation				
First thought about college				
Always (ref.)	0.57	0.62	0.58	0.50
Middle high school	0.13	0.12	0.12	0.35
High school	0.18	0.16	0.17	0.41
Do not know/missing	0.12	0.10	0.13	0.15
Class rank				
Non-top decile (ref.)	0.91	0.94	0.92	0.87
Top decile	0.09	0.06	0.08	0.13
Grades A				
English	0.32	0.32	0.36	0.26
Math	0.21	0.20	0.22	0.19
Social science	0.39	0.37	0.42	0.36
Science	0.23	0.24	0.26	0.20
Courses taken				
Pre-Calculus	0.37	0.41	0.34	0.36
AP Science	0.16	0.12	0.20	0.15
AP Math	0.16	0.11	0.19	0.18
Test score				
SAT (SD)	905 (150)	969 (135)	902 (146)	833 (140)
SAT missing	0.44	0.35	0.48	0.50

Table 6 continued

	Sample mean	High school economic composition		
		Affluent	Average	Poor
College characteristics				
Not vocational/technical	0.85	0,85	0.83	0.86
Private	0.10	0.13	0.10	0.07
In-state	0.97	0.98	0.95	0.99
Distance (miles)	44 (116)	38 (97)	54 (136)	36 (107)
Cost (SD)	5,971 (3,362)	5,724 (2,965)	6,050 (3,523)	6,161 (3,573)
Enrollment (SD)	9,990 (11,328)	9,486 (11,440)	10,292 (12,671)	10,180 (8,994)
Institution 25th percentile < student				
SAT < institution 75th percentile (ref.)	0.07	0.04	0.07	0.11
Student SAT > institution 75th percentile	0.93	0.96	0.93	0.89
N	986	331	381	274

Texas public high school seniors in 2002 (means, percents or proportions)

Source: Texas higher opportunity project, senior wave 1–3

Note: We convert ACT Sources if available or predict missing SAT scores using arrays of students' high school achievements measures, parental education and high school characteristics

Table 7 Relative risk ratios for college persistence outcomes using different working samples (clustered SE in parentheses)

Sample	Four-year enrollees (references:dropout)		Two-year enrollees (reference:dropout)		
	Graduated	Continue/ transfer	Graduated & no more	Transfer to a 4-year	Continue/transfer to a 2-year or vocational
Waves 2&3					
Affluent	4.63 (1.207)***	2.75 (0.688)***	0.58 (0.204)	1.66 (0.383)*	1.45 (0.366)
Poor	0.54 (0.183)†	0.74 (0.184)	0.64 (0.174)†	0.50 (0.189)†	0.89 (0.252)
N	1,580		853		
Wave 3					
Affluent	5.06 (1.305)***	2.78 (0.687)***	0.61 (0.207)	1.87 (0.400)**	1.70 (0.396)
Poor	0.49 (0.162)*	0.64 (0.162)†	0.70 (0.176)	0.54 (0.185)†	1.04 (0.278)
N	1,766[a]		986[a]		
W3 interviewed before Aug 06					
Affluent	5.11 (1.536)***	2.89 (0.869)***	0.55 (0.185)†	1.82 (0.467)*	1.49 (0.378)
Poor	0.60 (0.193)	0.82 (0.210)	0.60 (0.157)*	0.56 (0.204)	0.99 (0.287)
N	1,489		829		

Source: Texas higher education opportunity project, senior wave 1–3 data

Notes: Results are from base models that only include dummies for high school economic composition

[a] Sample used for estimations reported in Tables 3 and 4

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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