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The Early Decision Option in College Admission and Its Impact on Student Diversity

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Abstract

Colleges and universities that adopt early decision (ED) as an admission practice can generate additional resources by attracting wealthier students who make binding commitments to attend and forgo shopping for competing aid offers. An unanswered question is whether the resources generated from price discrimination are used by schools during the regular admission process to attract more diverse students. Using a sample of private national universities and liberal arts colleges, we model the choice to adopt an ED program and its impact on students' racial and geographic diversity. We find that schools facing more competition for students are more likely to adopt an ED program. The overall heterogeneity of students is lower for schools that adopt ED, and heterogeneity decreases as schools enroll larger percentages of students through ED. Higher ED enrollment percentages appear to strongly and negatively affect Asian American and Hispanic students and positively affect white students.

1. Introduction

Each year, tens of thousands of college applicants compete for spots at universities and colleges and may have opportunities to decide whether to apply to a school under an early admission program or to use the regular admission process. There are two basic types of early admission programs—early decision (ED) and early action (EA). The primary distinction is that ED requires that the student enroll in the school, but EA does not. Our study focuses on ED, which is more common

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than EA and has become increasingly prevalent over the last 2 decades. Under ED, students receive early notification of admission in return for a binding commitment to attend a specific school. A student who desires an ED can select one school to apply for an ED and is notified of the decision several months before the regular decision announcement date.

Particularly interesting from an economics perspective is the binding aspect of the ED option, which is explicit in the agreement that the student signs.¹ Applying early both reveals a student's inelastic demand for the selected school and augments the inelasticity through the student's commitment to forgo other financial aid offers. The forfeited offers may include merit-based aid and have competing packages of need-based aid that are more attractive. This agreement enables schools to price discriminate across students to a greater extent than would be possible if schools were required to compete for all students.²

Just as students must decide whether to apply early, school administrators must decide whether to adopt an ED program and, if so, what percentage of the matriculating class to admit early. Schools may use ED programs to help manage enrollments, identify applicants with strong preferences for their schools, and generate higher net tuition revenue. A school might forgo an ED program because of additional administrative costs relative to the anticipated low ED yield, because its pool of highly qualified applicants is deep enough that it can ration its funds effectively without reliance on an ED program to signal intensity of demand, or because of concern about the impact on cohort quality.

The net welfare effect of ED programs on students is unclear. Students who do not qualify for need-based financial aid and apply early lose the benefit of competitive merit-based aid offers, but they may gain higher probabilities of being admitted. Students who qualify for need-based aid and apply early to a need-blind school that does not offer merit-based aid lose the benefit of competitive (potentially more attractive) need-based aid offers and forgo the potential for merit-based aid, but they may gain higher probabilities of being admitted.³

¹ A student who violates the agreement, such as by applying early to more than one school or by shopping for other admission offers after having been admitted early, is subject to having the admission decision and financial aid offer withdrawn. In addition to the student, the student's parents and college counselor also are required to sign. See, for example, The Common Application, 2012–2013 Early Decision Agreement (https://www.commonapp.org/CommonApp/Docs/DownloadForms/2013/2013EarlyDecision_download.pdf). The agreement is further enforced through schools' mutual monitoring of applicants and reporting of early decision (ED) violators to the admitting school.

² For students admitted early, the college financial aid office provides a financial aid package along with the admission letter. If the initial aid offer is viewed as inadequate, the student is encouraged to consult with the financial aid director and resolve the problem. However, the student does not have the benefit of observing competing offers, so information about what is adequate is incomplete, and students' bargaining power is minimal. For articles describing the ED process, see the National Association of College Admission Counseling (<http://www.nacacnet.org>).

³ "Need blind" means that schools make admission decisions independent of the applicant's financial need, although not all need-blind schools commit to fully meeting the financial need of applicants. Even among the schools that do commit to fully meeting students' financial needs, the nature of the awards can vary—including a mix of debt, grants, work-study funds, and so forth. Some schools are need blind but offer merit awards to top students; others are need blind and only meet financial needs and do not make any other awards.

It is reasonable to expect that students who qualify for need-based financial aid are less likely to apply ED because by doing so they forgo the opportunity to seek competing offers of either merit- or need-based aid. Moreover, if schools admit high percentages of students early, the aggregate capacity for non-ED admission is reduced relative to the demand, so the intensity of competition may be reduced and fewer high-need students may be admitted.

Consistent with the use of ED programs to increase net tuition and reduce competition, Avery, Fairbanks, and Zeckhauser (2003) find that ED applicants gain an admissions advantage that is approximately equivalent to 100 additional SAT points. They confirm that these applicants tend to come from affluent socioeconomic backgrounds. For those students who are concerned about financial aid, applying early may subject them to an increased risk of receiving a less favorable financial aid offer than if they had applied for regular admission and were able to review competing aid offers.

Because of concerns about how ED can skew a cohort, several prominent school administrators have expressed reservations about the merits of ED, a few wealthy, highly selective schools have abandoned it, and a compelling public debate has ensued.⁴

Because ED programs can increase the net tuition revenue, a school with a fixed total enrollment may be able to use the higher revenues from ED admissions to fund enrollment of a higher proportion of students who qualify for need-based aid. That is, the higher than average net tuition paid by affluent ED students could subsidize students who qualify for need-based aid to a greater extent than if the school had to use its financial aid resources to compete for meritorious wealthy students. The cohort quality could be increased by adding diversity without reducing average ability. Alternatively, a school that introduced ED and sought to hold the cohort quality constant would have an increase in net tuition revenue that could be applied to other uses. In addition, a school that sought to maximize its net tuition revenue and was willing, on the margin, to sacrifice cohort quality would generate still more revenue for alternative uses and would have a shift toward wealthier students.

While there is evidence that the ED option is used more often by wealthier students (see Avery, Fairbanks, and Zeckhauser 2003), there is no systematic study of how reliance on ED programs affects the racial and geographic diversity of enrolled students. The research question of how admission programs affect diversity takes on even more importance in light of the Supreme Court decisions in *Gratz v. Bollinger* (539 U.S. 244 [2003]) and *Grutter v. Bollinger* (539 U.S. 306 [2003]). These decisions stand for the proposition that educational diversity is

⁴ Harvard, Princeton, and the University of Virginia recently eliminated ED, citing evidence that it favored wealthy applicants who do not need to compare financial aid offers (Lewin 2008). In their study of highly selective colleges, Avery, Fairbanks, and Zeckhauser (2003, p. 59) report that “among those students for whom financial aid was not a concern, 78.0 percent applied early to some college”; among students for whom “financial aid was important to their choice of college, only 48.0 percent applied early.”

a compelling interest that justifies the consideration of race in admission practices. Dozens of schools joined the University of Michigan in these cases, arguing that a diverse student body is essential to their missions (see, for example, Brief of Amherst College et al. as Amici Curiae Supporting Respondents at 4, *Grutter v. Bollinger* [2003] [no. 02-242] and *Gratz v. Bollinger* [2003] [no. 02-516]). Many of these schools, nonetheless, rely on ED programs for admission.

In this study, based on data from 189 private national universities and liberal arts colleges in the United States from 2004 to 2007, we find evidence that ED has a negative impact on cohort diversity, measured as a Herfindahl-Hirshman index (HHI) of student body ethnic heterogeneity and as percentages of enrolled students who are white, African American, Asian American, Hispanic, and Native American. We also consider geographic origin as an aspect of diversity and find a positive significant effect of ED on the percentage of students enrolled from out of state. The tests we employ control for the endogeneity of school choice to adopt an ED program and for other variables such as school type and size, endowment, test scores, and the heterogeneity of the school's primary market area.

For the subset of schools that use ED programs (64 percent of the observations), we examine how the percentage of students enrolled through an ED program varies with racial and geographic diversity. We find that racial heterogeneity decreases as schools' reliance on ED enrollment increases. The most pronounced negative effects are for Asian Americans and Hispanics, relative to other groups, and their representation decreases more as schools increase their reliance on ED and/or EA programs. Enrollments of white students and out-of-state students increase significantly as schools rely more on ED programs.

The paper is organized as follows: In Section 1, we describe the emergence of early admission programs and briefly review the literature regarding historical admission and financial aid practices in the market for higher education. In Section 2, we provide a model of a school's policy choice to use an ED program and how the choice might affect its ability to meet multiple objectives. Section 3 describes our data. In Section 4, we examine the empirical determinants of a school's choice to use an ED program, and in Section 5, we present the analysis of the impact of ED on student diversity. Section 6 concludes.

2. Emergence of Early Decision as an Admission Practice

The liberal arts colleges in the northeastern United States known as the Seven Sisters began experimenting with ED programs around 1959.⁵ Amherst College, Williams College, and other elite small liberal arts colleges adopted formal ED

⁵ The Seven Sisters are Barnard College, Bryn Mawr College, Mount Holyoke College, Radcliffe College, Smith College, Vassar College, and Wellesley College.

programs in the early 1960s.⁶ In their historical account, Duffy and Goldberg (1998) explain that ED programs were developed in response to a broader trend in higher education, as students began submitting applications to multiple colleges and universities. This increase in applications per student resulted in institutions competing more aggressively for students while trying to reduce their enrollment uncertainty. Early decision programs helped to ensure the size of the first-year class. Duffy and Goldberg (1998, p. 50) cite a 1977 report to secondary school counselors by the dean of admissions at Amherst College, Edward Wall. Wall explained that Amherst's ED program "serves as the foundation of the class. The holes will be filled in later under regular admission." More specifically, the ED program provided Amherst with a way to combat its losses to its three top competitors (Harvard University, Yale University, and Princeton University).

By the mid-1970s, all the Ivy League schools and the Massachusetts Institute of Technology (MIT) had adopted early admission programs—Brown University, Harvard, MIT, Princeton, and Yale initially used nonbinding EA agreements, and the others used binding ED agreements. In the late 1970s, the EA schools amended their rules to prevent students from applying to more than one school early (this type of agreement is known as restrictive early action).⁷ These elite schools have continued to refine their approaches to early admission, making headlines whenever a major change is announced. Princeton, for example, has made several changes to its policy, moving from EA to ED and most recently deciding to abandon early admission altogether.

1.1. The Ivy Overlap Group Practices

Early decision policies evolved, along with other financial aid policies, as colleges and universities tried to adapt to the demands of a more mobile society and to compete for talented students from middle-income and lower-income families. Whereas a direct effect of ED programs was to restrict merit-based aid competition for students who were willing to forgo searching for competitive aid offers, some schools also entered into agreements to refrain from making merit-based aid awards to students who applied during the regular admission decision period. As is well documented elsewhere, during the 1950s, the eight Ivy League schools and MIT formed the Ivy Overlap Group and began to meet

⁶ The success of the Seven Sisters' ED plans prompted other selective coed and all-male colleges to adopt similar policies during the early 1960s. Duffy and Goldberg (1998) identify the Ohio Five as early adopters: Denison University, Kenyon College, Oberlin College, Ohio Wesleyan University, and the College of Wooster.

⁷ There currently are two types of early action (EA) plans—regular and restrictive. Neither requires a binding commitment, and, consequently, neither generates the same type of strategic implications for the student or school as does ED. The restrictive EA plans allow students to apply to an institution of preference and receive a decision well in advance of the institution's regular response date, but the school restricts student applications to other early plans (Stanford, for example, currently uses this plan). Regular EA plans also allow students to apply for an early decision, but students are free to apply to other schools and to other EA plans (MIT). Under neither plan is the student obligated to attend the institution that offers early admission or to submit a deposit prior to the regular due date. Schools may have both an ED and an EA plan.

regularly to collectively determine the amount of family contribution that would be used by each school to determine the financial assistance that would be awarded to students admitted to multiple member schools and to refrain from awarding merit-based aid.⁸ Over time, the practices followed by the Ivy Overlap Group spread to 14 other prestigious northeastern private universities and liberal arts colleges, which all had early admission plans in place.⁹

In 1991, the U.S. Department of Justice (DOJ) filed suit against the Ivy Overlap Group, alleging that its meetings and related agreements were elements of a conspiracy to eliminate price competition (see *United States v. Brown University*, 805 F. Supp. 288 [E.D. Pa. 1992]). Soon after the suit was filed, the eight Ivy League schools entered into consent agreements with the DOJ. Massachusetts Institute of Technology did not settle and chose to argue the merits of the practice on several grounds, including effective use of the school's limited resources to promote the socioeconomic diversity of enrolled students.¹⁰

After an initial adverse district court ruling, MIT appealed and eventually settled with the DOJ, entering into a consent decree that limited cooperative activity among schools in the Ivy Overlap Group (*United States v. Brown University*, 5 F.3d 658 [3d Cir. 1993]). Under the settlement, schools still could engage in some Overlap-type behavior.¹¹

Carlton, Bamberger, and Epstein (1995), in their empirical study, find no significant evidence that Overlap practices resulted in higher than average tuition for students at those schools. In their view, the evidence is consistent with the schools' avowed public interest objective of refraining from merit awards to make more resources available to students with high levels of financial need

⁸ Carlton, Bamberger, and Epstein (1995) and Hoxby (2000) provide details and an economic perspective of the Ivy Overlap Group procedures related to financial aid offers. The family contribution is the portion of the total financial need that is expected to be provided by the student's family.

⁹ Carlton, Bamberger, and Epstein (1995) report that Ivy Overlap Group meetings included the Ivy League schools, MIT, and 14 others by the 1970s. Eventually, Brown University, Columbia University, Cornell University, Dartmouth College, Harvard University, MIT, Princeton University, the University of Pennsylvania, Yale University, Amherst College, Barnard College, Bowdoin College, Bryn Mawr College, Colby College, Middlebury College, Mount Holyoke College, Smith College, Trinity College, Tufts University, Vassar College, Wellesley College, Wesleyan University, and Williams College were members.

¹⁰ Massachusetts Institute of Technology claimed that (1) the purpose of the Ivy Overlap Group was "to advance educational access and socioeconomic diversity and to maximize the effective use of private charitable funds. In so doing, they neither sought nor obtained any financial or commercial benefit"; (2) because not-for-profit firms have multifaceted objectives, it is not possible to infer the consequences of price fixing on price output or quality; (3) the practice was justified on social welfare grounds—that the Ivy Overlap Group promoted the social ideal of equality of educational access and opportunity; and (4) controlling for various factors, the collective actions of the Ivy Overlap Group did not result in significantly higher average net tuition (*United States v. Brown University*, 5 F.3d 658 [3d Cir. 1993]). See Bamberger and Carlton (2004) and Carlton, Bamberger, and Epstein (1995).

¹¹ Because Brown University was unable to commit to need-blind admission for all students, one of the conditions of the agreement, the Ivy Overlap Group process stopped (Carlton, Bamberger, and Epstein 1995). The settlement was reinforced by federal legislation in 1994: the Need-Based Educational Aid Act. Congress has renewed the bill several times since 1994, most recently in 2008.

(augmented by the need-blind admission policy). They also reasoned that the heterogeneity of school choices would make successful collusion unlikely. The settlement and subsequent legislation are consistent with this view. Under current law, permissible conduct includes pooling information about students, agreeing not to give merit-based aid, and using common principles to determine aid. While discussions about financial aid awards to individual students are not permitted, audits are allowed, for the purpose of detecting school practices that deviate from agreed-upon principles.

Afram (2006) argues that the Ivy Overlap Group decision opened up financial aid as a form of competition among selective private schools (also see Hoxby [2000] for empirical support that the end of the Ivy Overlap Group meetings created a catalyst for increased competition for high-achieving students). She finds that, as a result of the suit, financial aid at the Ivy Overlap Group colleges became less progressive with respect to parents' income and more sensitive to merit, as measured by standard aptitude tests. Even though many of the schools in the Ivy Overlap Group remained need blind and were committed to fully satisfying the needs of their admitted applicants, Hoxby points out that there is sufficient flexibility in the definition of need to accommodate small but significant changes in actual practice. Hence, there is some evidence that, following the settlement, financial aid practices changed and competition on some dimensions intensified among Ivy Overlap Group members.

1.2. The Diffusion of Early Admission Programs

The early adopters of early admission programs paved the way for significant changes in admission practices of other leading colleges and universities throughout the United States. Faced with a long-term demographic shift associated with the end of the post-World War II baby boom and an increase in the intensity of shopping behavior by college applicants, colleges and universities in the 1980s and 1990s turned increasingly to reliance on early admission programs to help manage enrollment, increase yield, and control financial aid awards. In addition, especially during the mid- to late 1990s, when the economy was growing rapidly, private schools faced increased competitive pressure from public schools, which began offering merit-based scholarships. However, as the economy slowed and higher education resources became more constrained, even public institutions began to look for ways to limit their financial aid expenditures. A beneficial result for schools adopting ED programs was that it afforded them better control over their financial aid outlays. This control was possible because students applying early generally are wealthier and less likely to apply for financial aid than are students applying during the regular admission period (Avery, Fairbanks, and Zeckhauser 2003).¹² Although many private schools describe themselves as

¹² Avery, Fairbanks, and Zeckhauser (2003) focused on 14 highly selective colleges for which they had detailed data on each applicant from the 1991–92 to 1996–97 academic years. They show that acceptance rates during early decision rounds are higher than those for the regular decision periods

need blind, the schools are aware that their ED applicant pool is less concerned about financial aid. The 2002 *College Handbook* observes, "Some colleges find that they can stretch their limited financial aid budgets by admitting students [through ED programs] who are not only bright and committed to their school, but who are also 'full pay students', i.e., ones who are not relying on financial aid" (quoted in Avery, Fairbanks, and Zeckhauser 2003, p. 177).

As reliance on ED was spreading, mechanisms for enforcing ED agreements with admitted students were evolving. Early decision, after all, would have no effect if students who were admitted early could costlessly renege on their commitments. Thus, the effectiveness of ED as a means to soften competition for students depends on the threat of mutual enforcement by adopting schools. Schools typically require an ED applicant to sign a statement in which the student promises not only to attend if admitted but also to withdraw all applications pending at other institutions (see note 1). Afram (2006, pp. 913–14) describes the process: once a student is admitted under an ED program, the school notifies the student that it may send a list of the students it has admitted early to its most important competitors. Those schools may check the list and may terminate any application that an ED-admitted student has submitted. If a school discovers that the student had applied under ED to more than one school, that school would potentially notify the first school, and all schools involved would typically revoke the student's admission.¹³ The implication is that ED is an effective way for schools to identify inelastic demanders and to augment the inelasticity, thereby enabling them to limit their financial aid offers to ED applicants to be need-based ones only. Clearly, not all schools are compelled to take advantage of this feature. Wealthy, highly selective schools, for example, might view an ED program as mainly a way to manage their enrollments to targeted numbers and might not be particularly concerned about the financial aid implications. Moreover, as in the Ivy Overlap Group case, schools with limited financial aid budgets may argue that the approach allows them to create public goods by enabling them to more effectively recruit minority and needier students during the regular admission period and thereby generate a more diverse student body.

From at least the mid-1990s, the impact of ED programs began to come under scrutiny from several perspectives. The 2003 Avery, Fairbanks, and Zeckhauser study incited widespread criticism of ED on the ground that the practice favors wealthy, less well qualified students.¹⁴ Subsequent studies examined how student

and that students who are admitted through an ED program are slightly less qualified than students admitted during the regular decision round. Controlling for SAT scores and rank in class, they find that the admission rate of early applicants exceeds that for regular applicants by 15 percentage points or more.

¹³ The enforcement of the agreement among schools is also described in Avery, Fairbanks, and Zeckhauser (2003, pp. 54–56).

¹⁴ There was even a push in Congress, initiated by Senator Edward Kennedy of Massachusetts in the fall of 2003, to open ED admissions practices to greater public scrutiny (see S. 1793, 108th Cong., 1st sess., sec. [2][I], 302[a], 302[b][2]). The proposal would require colleges with ED programs to report the percentage of each enrolled class admitted under ED and broken down by race. In addition,

bargaining power can affect financial aid offers. Lang (2007), for example, finds evidence of a strategic advantage for students who have two or more college acceptances, which leads to higher financial aid awards.¹⁵ However, these studies leave one important question partially unanswered. How does reliance on ED affect the overall socioeconomic diversity of the student body? It is possible that admitting students early, particularly those who do not require financial aid, results in a larger financial aid pool available for attracting a diverse student body. Such a result would be consistent with the purported Ivy Overlap Group effort to reduce merit-based price competition for high-quality students in order to serve the social goal of improving the socioeconomic diversity of matriculated students.

Additional expressions of concern about the merits of ED came from a few of the most highly selective schools. In 2001, the president of Yale, Richard Levin, announced that he wanted to end Yale's ED program. He cited the pressure ED programs put on high school students to make decisions early and their inability to compare financial aid offers. Recognizing the game-theoretic aspect of ED programs, he also noted that Yale could not go it alone without disadvantaging Yale relative to other schools. He argued that a collective end of the program would be desirable and indicated that he was investigating the antitrust implications of such collective action (Arenson 2001). In 2008, Harvard, Princeton, and the University of Virginia eliminated their ED programs, stating as a rationale that the programs favored wealthy applicants (Lewin 2008). At the same time, though, it is clear that abandoning ED programs would put less wealthy and less highly selective schools at a competitive disadvantage. (See Avery and Levin [2010], which provides a model that explains why selective schools, particularly those not at the very top, may benefit from EA programs.)

However, at the same time that a few of the very top schools, in terms of applicant demand and endowment per student, are reviewing and sometimes abandoning their ED programs, others are adding them. In our sample, the majority of liberal arts colleges and almost half of the national private universities use ED. In 2007, the National Association for College Admission Counseling took the initiative in defining and articulating best practices for member institutions.¹⁶ All participating schools (all of those in our sample) agree to abide by these principles. Moreover, ED options are an increasingly prevalent feature of admission for graduate degree programs offered by law schools and medical schools. Hence, it is important to understand the implications of these programs

cognizant of the competitive implications of ED, the bill would have waived federal antitrust regulations to allow schools to develop guidelines to eliminate binding ED admission policies (see Afram 2006, p. 900).

¹⁵ See also Epple et al. (2006), who show, using data from Carnegie Mellon University, how signaling and profiling are important aspects of the college admission process. See also Epple, Romano, and Sieg (2003) and McMillen, Singell, and Waddell (2007).

¹⁶ Definitions and details regarding acceptable admission plans for EA and ED for member institutions appear in National Association for College Admission Counseling (2007).

for the types of students who are admitted both early and during the regular admission cycle.¹⁷

2. The Market for Higher Education: Cohort Quality and Other Objectives

In contrast to the Ivy Overlap Group practices, ED programs present a more plausible case for competitive harm. As Carlton, Bamberger, and Epstein (1995) note, schools that seek to maximize revenue would want to price discriminate across all students, not just those with financial need, and price discrimination against wealthy students should be more revenue enhancing than price discrimination limited to needy students. Moreover, their observation that price collusion among heterogeneous institutions is unlikely to be effective does not apply when the agreement has the potential to divide up the market as ED does.

As with the Ivy Overlap Group practices, ED financial aid savings might be used to increase support for financially needy students and increase overall cohort diversity. However, it is not possible, on the basis of casual observation, to determine what objectives colleges seek to maximize with their ED programs. In contrast to for-profit entities, not-for-profit colleges are not simply profit maximizers. Much of the current research on the market for higher education identifies multiple objectives—among other things, cohort quality, value added to human capital, a consumable academic experience, and faculty welfare—as potential dimensions of the college objective function.¹⁸ Some scholars consider reputation, financial strength, academic quality, research, and social objectives such as promoting diversity as probable components of a college's objective function (Winston 1999).¹⁹

One way a school can pursue its objectives is through its admissions practices. Rothschild and White (1995) theorize that colleges and universities produce human capital as an output and view students as inputs and argue that some types of students enhance the value of the output through their influence on other students. In return for their contributions, students receive a net wage equivalent to the value of the subsidized education they receive less their net tuition cost. In this context, we assume that having more net tuition revenue from ED students enables colleges to spend more on student inputs, including socioeconomic diversity of the cohort, which is perceived to add value to the education the students receive.

The role of price discrimination among private schools in higher education is well recognized. Winston (1999, p. 30), in response to the question, “Why do tuitions keep rising?” argues that “sticker prices have risen to allow more price

¹⁷ Afram (2006) discusses ED programs in the context of civil rights and antitrust laws.

¹⁸ See Winston (1999) for an excellent overview of the economics of higher education.

¹⁹ In addition, Bowen and Bok (1998) document the origins of diversity as a topic of educational thought and the development of race-sensitive admissions policies.

discrimination in the form of financial aid among potential buyers.”²⁰ Early decision facilitates price discrimination as it effectively identifies those students who have the most inelastic demand and binds them to an agreement to enroll if their needs are fully met. By reducing merit-based aid awards, an ED program generates resources a college would not otherwise have. The amount of additional resources varies with the proportion of students admitted through an ED program. The resources can be used in various ways, including to provide financial aid awards to regular-admission students in an effort to improve cohort quality or to fund other priorities of the school.²¹ For a school with a fixed entering class size, the ability to use ED to increase socioeconomic diversity by reallocating resources to financially needy students is constrained by the ED program itself, as each additional student admitted by ED eliminates a spot that could have gone to someone who could contribute more to cohort quality.

How ED programs actually affect cohort diversity is an empirical question. Indeed, Bowen and Bok (1998) argue that the low number of minority applicants under early admission programs would lead to lower enrollments of minority students than usual unless race-sensitive policies were employed to counteract the effect. However, we reason that additional revenue from ED-admitted students may be used to augment affirmative action and other race-sensitive admission programs and to encourage socioeconomic diversity. If this augmentation occurs to a sufficient degree, then we would expect to see a positive correlation between an ED program and cohort diversity.

We assume that each school seeks to maximize an objective function over two arguments: cohort diversity (as an aspect of cohort quality) and other objectives. The school seeks to maximize with respect to the choice to adopt ED admission and the percentage of students enrolled under ED. Figure 1 shows the trade-off between cohort diversity and other objectives for various production possibility

²⁰ In the 4 years between 1986–87 and 1990–91, on average, private schools used 42 percent of their sticker price increases to increase financial aid; in the next 4 years, the share of the increase in announced prices they committed to financial aid increased to 60 percent—with the changes concentrated in the hardest pressed part of the private sector. This trend undoubtedly has continued, as schools are increasingly competing not only on the amount of the aid but also on the form of aid—grants as opposed to loans, work-study programs, and the like (Winston 1999, pp. 30–31).

²¹ Duffy and Goldberg (1998, p. 224) document how schools may use knowledge about students’ price elasticities as a tool to manage enrollment and shape a class. Examples they provide include one school’s generous financial aid packages to prospective humanities majors, another’s modest packages for ED students, and another’s attractive packages for affluent applicants. Moreover, our data, consisting of a cross section of top-ranked schools appearing in the annual *U.S. News and World Report* rankings, show that increases in the percentages of students enrolled through ED programs are associated with significant decreases in the percentages of students who apply for aid, significant decreases in the percentages of students who demonstrate need, and significant increases in the percentages of students whose needs are fully met. The percentages of those who receive merit aid decrease significantly as schools’ reliance on ED enrollments increases.

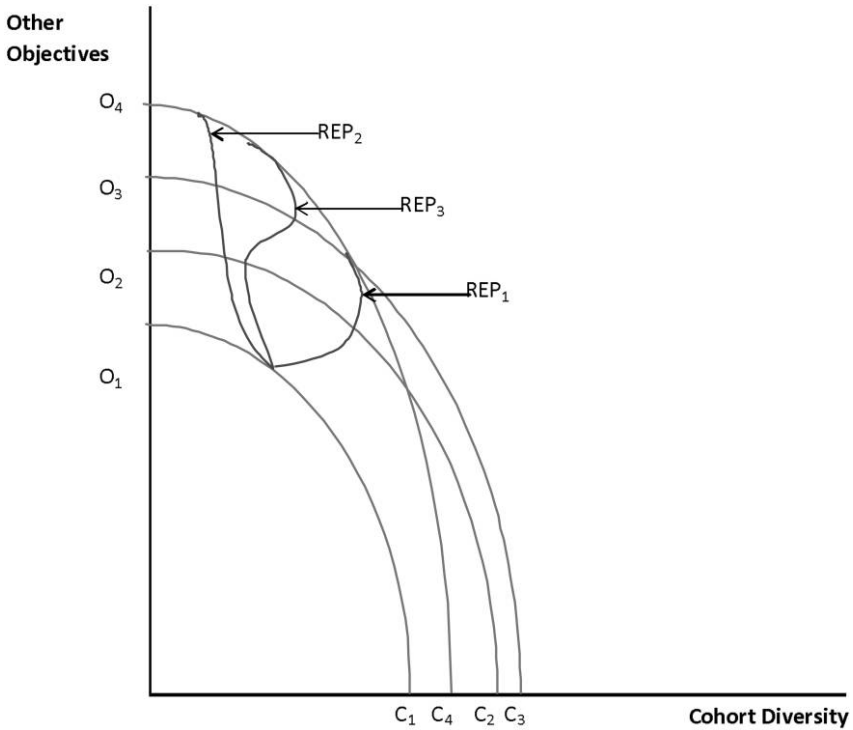


Figure 1. Production possibility frontiers and revenue expansion paths

frontiers (PPFs).²² We assume that there are diminishing returns to expenditures on both objectives. Curve O_1C_1 illustrates feasible combinations of cohort diversity and other objectives when no students are enrolled through an ED program. Adopting ED can increase revenue, but it also involves higher administrative costs. Thus, a school that is unlikely to attract a large enough pool of qualified ED applicants is unlikely to offer ED as an option. For schools that can attract enough ED students, adoption of an ED program can increase a school’s resources and cause an outward shift in the PPF. As long as the percentage

²² Figure 1 shows a school’s production possibility frontiers (PPFs) for cohort diversity and other objectives. Each curve assumes a percentage enrolled through an ED program and a given level of school revenue. The curve O_1C_1 assumes that the ED program breaks even (incremental revenues equal incremental costs of the program). Increasing the percentage of the class enrolled through ED produces a technological change that shifts the curve outward. As the percentage of students enrolled early increases, the PPF shift eventually results in a shift inward on the x-axis, as it is not possible to increase diversity with a very large percentage of students enrolled early (100 percent at the maximum). Curve O_4C_4 illustrates the PPF associated with a high percentage of students enrolled early. The revenue expansion paths represent utility-maximizing tangencies. Three possibilities are shown: REP_1 , REP_2 , and REP_3 .

of students admitted under ED is not too large, each additional ED student adds to the resource pool and shifts the curve outward. The ED enrollment rate determines the magnitude of the shift, so curve O_2C_2 corresponds to a specific (low) enrollment rate, and curve O_3C_3 corresponds to a somewhat higher ED enrollment rate.

However, as a school with fixed enrollment increases the percentage of students enrolled through ED, it necessarily sacrifices the number of spots available to students during the regular admission process. Beyond some point, the percentage of students admitted through ED becomes a binding constraint on the ability to achieve diversity. Since ED pools are less socioeconomically diverse than an average pool and a school may sacrifice academic quality when it admits ED students, a school that enrolls a high percentage of its students through ED would be expected to experience a reduction in the ability to achieve cohort diversity (curve O_4C_4).

Initially, increasing the ED enrollment rate shifts the PPF outward, which allows a school to achieve both greater diversity and a higher level of other objectives. For any given percentage of students admitted through ED, the point of tangency of a school's indifference curve and the PPF is the objective-maximizing combination of cohort diversity and other objectives. The expansion path in response to increases in revenue sources from an ED program is an empirical question. Assuming that schools have objective functions with the typical properties, we can trace out possible expansion paths (points of tangency of PPFs and objective functions) as a school's wealth changes and as the percentage of enrollment via an ED program changes. As can be seen from Figure 1, the model implies that with convex objectives, schools do not maximize their current cohort diversity. Rather, they always select a point where some degree of cohort diversity (relative to the maximum achievable) is sacrificed for other objectives. However, the selected policy may yield a level of cohort diversity that is greater or less than the level possible without an ED program.

We consider three possibilities, illustrated by revenue expansion paths REP_1 , REP_2 , and REP_3 , each of which corresponds to testable implications that we analyze below. The effect of ED enrollment on cohort diversity can be either positive or negative depending on several factors. One is the percentage of ED enrollment. For all schools, there is a maximum level of enrollment above which the expansion path begins to curve back toward the other objectives axis. The diminishing ability to improve cohort diversity at high rates of ED enrollment will encourage all schools to spend additional resources from an ED program on other objectives. A second factor is the relative value that a school puts on cohort diversity compared with other objectives. The level of enrollment at which the expansion path begins to curve toward the other objectives axis should be higher at schools that place more value on cohort diversity.

The testable hypothesis underlying REP_1 is that as reliance on ED increases and the PPF shifts outward, cohort diversity increases over a range and then decreases as the school increases its reliance on ED. The path REP_2 suggests that

as reliance on ED increases, cohort diversity falls continuously, as the school uses additional revenue generated from higher ED enrollments on other objectives. The path REP₃ illustrates a third possibility: ED reduces diversity at lower levels of ED enrollment and then increases until the constraining effect of high ED enrollment becomes binding on the ability to increase diversity, beyond which point diversity falls. (The empirical model we employ to test these hypotheses appears in Section 5.) Our results are most consistent with REP₂: cohort diversity is generally decreasing over all ranges of ED enrollment.

3. Data and Descriptive Statistics

Our empirical analysis is based on 4 years of admissions and enrollment data for selective private schools in the United States—those listed as the “Best National Universities” and “Best Liberal Arts Colleges” by *U.S. News and World Report*. To provide consistency in admission and financial aid policies, we include only private schools. Public schools have financing sources that are very different from those of private colleges, and their admission decisions commonly are significantly influenced by public policy, in contrast to those of private schools. To provide roughly similar numbers of schools from each category each year, and because so many of the top national universities are public, we draw our sample from the top 150 national universities and from the entire list of the “Best Liberal Arts Colleges,” which is generally around 110 colleges.²³ In contrast to national universities, these colleges are predominantly private. Our data consists of 700 school-year observations representing 189 unique private schools. Unless otherwise noted, when we refer to national universities, liberal arts colleges, or schools, we are referring to private schools. In the results below, we include an indicator variable for liberal arts college, which equals one if the school is a liberal arts college and zero if the school is a national university. All data on schools’ characteristics, admissions, financial aid, and so forth were collected from the detailed versions of the “Best College Rankings” reports published annually online (but not archived) by *U.S. News and World Report* for 2004–7.

Our main variable of interest is a school’s decision to adopt an ED program. We create an indicator variable for ED, which equals one if the school has an ED program and zero otherwise. We are also interested in the intensity of the use of ED, as proxied by the percentage of first-year students enrolled through ED. Unfortunately, when schools report their enrollment information for first-year students, they report the total percentage who enrolled through ED and/or EA, but they do not break out the percentages by program type. For those schools that have only an ED program (and not an EA program), we know the

²³ We exclude Brigham Young University for all years (because its tuition and admission structure resembles that of a public rather than a private school) and Tulane University in 2004 (because the school’s admission process was dismantled during the rebuilding following Hurricane Katrina).

exact percentage enrolled through ED. However, we do not know the exact percentage enrolled through ED for those schools that have both an ED and an EA program (12 percent of our observations). We deal with this issue in two ways. In the results below, we include only those schools that have an ED program and do not have an EA program. We test the sensitivity of the results by running the same regressions for schools that have both an ED and an EA program and impute a value for the percentage enrolled through ED. The imputed value is based on the statistical information for schools that have only ED programs.²⁴

Table 1 provides variable definitions and the overall summary statistics for the key variables used in the study, as well as summary statistics by a school's decision to adopt an ED program. We also consider and control for different school types—namely, liberal arts colleges versus national universities, schools that report a religious affiliation, women's colleges, and whether the school is located in an urban environment.

We find that ED is pervasive, as 64 percent of the schools had an ED program in force during 2004–7. This percentage is even higher for the most selective schools, as 100 percent of the top 25 ranked liberal arts colleges and 67 percent of the top 25 private universities used ED during the sample period. In addition, liberal arts colleges, which enroll significantly smaller student bodies than do national universities, rely more heavily on ED admission programs. Approximately 70 percent (43 percent) of the observations with (without) an ED program are liberal arts colleges and, on average, 29 percent of the first-year class enrolls through ED. The results also suggest that schools with a religious affiliation are significantly less likely to use ED and that schools in more urban areas are less likely to rely on ED than are schools in suburban and rural areas.

3.1. School Cohort Diversity Measures

School cohort diversity characteristics include the HHI as a heterogeneity measure. The HHI is measured as the sum of the squared shares of the incoming first-year class who are (1) African American, (2) Asian American, (3) Hispanic, (4) Native American, and (5) white. A more racially and ethnically heterogeneous cohort will be associated with a lower HHI. We also considered an alternative measure that combines Asian Americans and whites as a single category, as many institutions of higher education do not include Asian Americans as targeted

²⁴ For those schools that have only an ED program and not an EA program and positive values for the proportion enrolled through ED, we run a regression at the first, second, third, and fourth percentiles of the proportion enrolled through ED, in which the dependent variable is equal to the reported percentage enrolled through ED and the independent variables are undergraduate student size, endowment per student, a dummy for liberal arts, the percentage of the graduating class who borrowed, the percentage of first-year students whose financial needs were fully met, community diversity, and year dummies. Using the betas from each of the percentile regressions, we predict what the values would be for the percentage enrolled through ED for schools that have both an ED program and an EA program. For those schools that have both programs, the imputed percentage enrolled through ED equals the predicted value from the 25th percentile from the above regression and whose actual proportion enrolled was in the 25th percentile; we repeat for all the percentiles.

Table 1
 Summary Statistics, Variable Definitions, and Differences in Means by the Decision to Adopt an Early Decision Program

	Definition	All Schools (<i>N</i> = 700)	Has ED Program (<i>N</i> = 446)	No ED Program (<i>N</i> = 243)	<i>t</i> -Test (<i>p</i> -Value)
School cohort diversity measures:					
HHI	Index of the homogeneity of the student body, defined as the sum of the squared shares of the five racial groupings	6,355.147 (1,590.508)	6,402.661 (1,446.022)	6,271.717 (1,816.710)	.540 (.592)
Student diversity measures:					
African American	Percentage of first-year students who are African American	5.901 (9.262)	5.444 (7.431)	6.705 (11.785)	-1.260 (.208)
Asian American	Percentage of first-year students who are Asian American	7.463 (6.490)	7.352 (5.680)	7.657 (7.718)	-3.00 (.766)
Hispanic	Percentage of first-year students who are Hispanic	5.017 (4.148)	4.522 (3.300)	5.886 (5.215)	-2.120* (.035)
Native American	Percentage of first-year students who are Native American	.641 (1.381)	.567 (1.298)	.772 (1.510)	-1.480 (.140)
White	Percentage of first-year students who are white	76.753 (14.196)	77.803 (12.060)	74.909 (17.193)	1.430 (.155)
International	Percentage of first-year students who are international	4.410 (3.500)	4.455 (3.306)	4.331 (3.823)	.240 (.813)
Out-of-state	Percentage of first-year students from out of state	60.386 (23.688)	66.794 (20.115)	49.134 (25.280)	5.160* (.000)
School selection measures:					
ED program	Equals one if the school has an ED program and zero otherwise	.637 (.481)			
% First years enrolled in ED	Percentage of first-year students who enrolled by ED; for all schools, <i>N</i> = 619; for schools with an ED program, <i>N</i> = 365	17.069 (16.762)	28.947 (11.500)		
School characteristics:					
Undergraduate student body size	Total number of enrolled undergraduate students	3,709,001 (3,514,383)	3,329,395 (3,352,661)	4,375,555 (3,694,992)	-1.950* (.053)
Endowment per student (\$1,000s)	Endowment per student in thousands of dollars	265.450 (466.223)	258.301 (326.314)	278.003 (642.656)	-2.50 (.805)

25th Percentile for SAT math	25th Percentile for SAT scores in math	586.981 (61.184)	601.193 (54.357)	562.028 (64.532)	4.490* (.000)
75th Percentile for SAT math	75th Percentile for SAT scores in math	683.141 (51.062)	692.866 (47.166)	666.067 (53.209)	3.650* (.000)
Liberal arts	Equals one if the school is a liberal arts college and zero if a national university	.604 (.489)	.702 (.458)	.433 (.496)	3.760* (.000)
Religious	Equals one if the school reports a religious affiliation and zero otherwise	.346 (.476)	.242 (.429)	.528 (.500)	-4.070* (.000)
Women	Equals one if the school is a women's college and zero otherwise	.034 (.182)	.047 (.212)	.012 (.108)	1.610 (.109)
Black	Equals one if the school's mission identifies it as a historically black or predominantly African American college or university	.011 (.106)	.007 (.082)	.020 (.139)	-1.270 (.206)
Urban	Equals one if the school is located in an urban area and zero otherwise	.497 (.500)	.424 (.495)	.626 (.485)	-2.800* (.006)
Competitive environment measure: competitors	Estimate of the number of competitors the school faces, determined by geography and comparable SAT scores of matriculated students, adjusted for truncation reporting bias	34.572 (21.760)	37.833 (19.882)	28.847 (23.690)	3.000* (.003)
School aid and award measures: % Graduating class who borrowed	Percentage of the graduating class who borrowed money to finance their college education	58.244 (13.234)	56.211 (13.937)	61.815 (11.052)	-3.340* (.001)
% First years with needs fully met	Percentage of first-year students whose financial needs were fully met by the school	67.271 (31.680)	76.377 (28.454)	51.283 (30.759)	5.870* (.000)
Community diversity measure: HHI-C	Index of the homogeneity of the community within a 500-mile radius of the school, defined as the sum of the squared shares of the racial groupings reported by the 2000 U.S. census	6,226.603 (582.219)	6,194.096 (455.450)	6,283.680 (752.700)	-.920 (.359)

Note. Variables are measured over all years and schools. Standard deviations are in parentheses. Data are based on 700 school-year observations for private schools ranked as a top-100 liberal arts college or a top-150 national university over the years 2004-7, as reported in *U.S. News and World Report*. All data are from *U.S. News and World Report* unless otherwise noted. The *t*-statistics and *p*-values of the differences in means between groups are shown; standard errors are adjusted for clustering by school. HHI = Herfindahl-Hirschman index.

* $p < .10$.

* $p < .05$.

minorities for the purpose of admission. According to the American Council on Education, Asian Americans and whites are the only two groups in which young adults are more educated than prior generations (Ryu 2009, p. 1).²⁵ As the results using this alternative definition are very similar, for expositional ease they are not reported in the paper.

As shown in Table 1, the average heterogeneity of the incoming student body appears to be similar for schools with and without ED programs. Moreover, schools that adopt ED enroll significantly fewer Hispanics, but the summary statistics do not reveal any other significant differences in enrollments by racial and ethnic categories. Schools that adopt ED attract significantly more out-of-state students.

3.2. *Competitive Environment*

We test the hypothesis that the competitive environment, defined as the number of competitors a school faces, has a positive impact on the choice to use ED. Avery and Levin (2010), for example, provide a theoretical model of early admission that emphasizes that by adopting an ED policy, lower ranked schools can attract some highly qualified (but cautious) students from more highly ranked schools. The more competition a school faces, the more likely it is that the school will try to preempt competition by securing students early (most likely, the inelastic demanders) and will try to preserve financial aid for the more price-sensitive students.

To construct a proxy for the number of competitors, we identify schools with similar academic standings and geographic markets. For the geographic component, we rely on the market definition that was used in the DOJ antitrust case against the Ivy Overlap Group (selective schools in the northeastern United States).²⁶ We obtained zip code data for each Ivy Overlap Group school and measured the driving distances between the zip code centroid for each school pair. The longest distance between any pair of schools in the Ivy Overlap Group is slightly less than 500 miles. On the basis of this, we assume that the geographic market for each school is defined by a 500-mile radius, and we measure competitive pressure based on schools within that radius. The underlying assumption is that while schools may attract students from all regions of the United States, and even internationally, on the margin, students of a given quality will find it more desirable to attend college close to home. McMillen, Singell, and Waddell (2007) provide supporting evidence that the market for students in higher education depends on proximity of competitors and institutional quality.

²⁵ The American Council on Education reports annually on enrollment and education rates by ethnic groups. In 2006, 61 percent of Asian Americans ages 18–24 were enrolled in college, compared with 44 percent of whites, 32 percent of African Americans, and 25 percent of Hispanics and Native Americans (Ryu 2009).

²⁶ While the Ivy Overlap Group's combined market share of total undergraduate enrollments in the United States is small (less than 1 percent), as Bamberger and Carlton (2004) point out, the existence of the Overlap process indicates that the schools had market power.

The other dimension of competition implicit in the Ivy Overlap Group case is school quality or rank. Schools that compete effectively with each other for a given student generally share selectivity measures. Using this reasoning, we assume that a given school competes for students who have similar SAT scores. For each school, i , in the database, we count the number of schools within a 500-mile radius that reported incoming average SAT math scores within 50 points (approximately 1 standard deviation of that school's scores), where the standard deviation is measured over all school years in the sample.²⁷ The number of schools meeting both the distance and the SAT criteria are summed to generate the measure for the number of competitors for each school. Because the annual lists of "Best National Universities" and "Best Liberal Arts Colleges" from *U.S. News and World Reports* concentrate on relatively selective schools, we may not observe all potential competitors of the lower ranked schools in our sample. By inspection, the potential for truncation to bias the estimated number of competitors could begin to affect the estimated number of competitors for universities ranked below about 150 and liberal arts colleges ranked below about 100. To correct for this truncation bias, we make a conservative upward adjustment to the observed number of competitors for schools near the bottom of the rankings, where the adjustment is based on the observed distributions of the number of schools ordered by SAT math score.²⁸ While for theoretical reasons we argue that it is important to account for this bias, this adjustment does not lead to materially different results.²⁹

On average, on the basis of our measure, the number of competitors a school faces is 34.6. As we predicted, schools that adopt an ED program face a larger number of competitors (mean of 38) than do schools that do not adopt an ED program (mean of 29).

²⁷ We measured the distance from all possible school combinations as centroid of zip code to centroid of zip code using Zip Code Wizard software.

²⁸ To account for truncation bias, we assume that the national number of schools within 50 points of a given SAT math score is decreasing in score (that is, there are fewer schools with SAT math scores within 1 standard deviation of 700 than there are within 1 standard deviation of 600). We order schools by SAT math scores and determine the maximum number of schools nationally that are within 50 points of each school's SAT math score average. That number is 122 (associated with an SAT math score of 626). We assume no truncation bias for schools with that mean SAT math score or higher. For each school with a lower mean SAT math score, we multiply the number of observed competitors within 500 miles by $(122/n)$, where n is the national number of sample schools that have SAT math scores within 50 points of the subject school's SAT score. This process is equivalent to assuming that for scores below 626, the national number of schools within 50 SAT math score points is expected to be constant at 122 and that observed lower numbers reflect the probability of truncation. As mean SAT math scores fall, adjustments are made, with most adjustment factors only slightly above 1.0. The size of the adjustment increases at the lower end of the rankings, with nine schools having adjustment factors greater than 2.0.

²⁹ We tested the robustness of the results by deleting those schools whose competition measures were most affected by the truncation adjustment factor (those with factors greater than 3 and greater than 5) as well as by using the unadjusted competition measure. The results are not affected materially.

3.3. Other School Characteristics and Financial Aid Measures

Table 1 also presents percentile rankings (25th and 75th) for SAT math scores for students enrolled in college. Schools that adopt ED programs are associated with students who achieve higher SAT math test scores compared with schools that do not adopt such programs.³⁰ Financial aid characteristics also differ across schools' policy choices about ED. Schools that adopt ED tend to rely less on loans for financial aid and are more likely to fully meet the financial needs of first-year students.³¹

The variable HHI-C is intended to capture the diversity of the population in the geographic area surrounding the school, which we expect will affect the ability of the school to attract a diverse student body. To consider this, we construct the community diversity measure (HHI-C) for each school and use zip code radius software to determine the composition of the population in a 500-mile radius from the centroid of the zip code of the school's location. The measure is the sum of the squared shares of the percentages of the total population who are Asian (which includes those with Hawaiian and Pacific Islander ancestry), Native American, African American, Hispanic, and white. The data are drawn from the 2000 U.S. census.

4. The Determinants of Schools' Choice to Use Early Decision

Which schools use ED? To analyze this question, we model the propensity to use ED (ED^*) as

$$ED_{it}^* = \beta X_{it} + \varepsilon_{it}, \quad (1)$$

where $\varepsilon_{ij} \sim N(0, 1)$, I indexes schools, and t indexes time. The term ED_{it} equals one if a school chooses to use ED and zero otherwise.

The vector X_{it} includes school characteristics—undergraduate student body size, endowment per student, indicator variables for school type (liberal arts, religious, women's, black, and urban), SAT math scores, and year fixed effects. Endowment per student is a proxy for the wealth of the school. We expect it to be negatively related to the choice to offer ED—those schools that are the most resource constrained are likely to be those that adopt ED as a revenue-generating device. Relative to universities, liberal arts colleges (including all women's colleges) are likely to face tighter resource constraints—they do not benefit as much from economies of scale, they do not have sports teams that generate revenues, and they are less likely to attract grant money. Thus, the expected sign on the

³⁰ These patterns also hold true for SAT verbal scores or a combination of SAT math and verbal scores. Those results are available from the authors upon request.

³¹ In 1994, Congress created an antitrust exemption that sanctioned efforts by institutions practicing need-blind admissions to discuss and agree on common principles of financial aid need analysis. The schools that participate in this effort form the 568 Presidents' Group, which currently includes 25 schools (568 Presidents' Group, Membership [<http://www.568group.org/membership>]).

liberal arts college indicator is positive. The other indicator variables are included as controls for school characteristics.

In addition, X_{it} includes school aid characteristics (the percentage of the graduating class who have borrowed and the percentage of the first-year class whose financial needs were fully met) and year fixed effects. To control for the possibility that the choice to use ED may be influenced by the heterogeneity of the population of the community in which the school is located, X_{it} also includes HHI-C as an exogenous variable.

The variables we include in X_{it} are consistent with the findings in the literature on students' application behavior and student-school matching behavior. Avery, Fairbanks, and Zeckhauser (2005) reinforce the point that students can observe some characteristics that colleges possess and can make choices on the basis of those attributes (for example, location, the expected quality of peer group, tuition, and financial aid characteristics) but that latent indices of desirability of the school cannot be measured directly and will vary by student. While latent attributes undoubtedly affect college selection, there is no reason to believe that these attributes vary systematically with our outcome variables. Avery and Levin (2010) point out that ED can be used to signal student interest in a specific school, thereby facilitating matching.

There also is evidence of self-selection into schools with specific clienteles (see, for example, Fryer and Greenstone 2007). We control for this behavior by including indicator variables for women's colleges, historically black or predominantly African American colleges, and colleges with religious affiliations. Finally, we evaluated some alternative community demographic measures to consider the possibility that the community HHI measure only partially controls for the pool of potential students from which the school draws.³² However, the results did not change in any substantive way, so the tables show results for the more parsimonious specification.

Finally, on the basis of the analysis above, as constrained optimizers, schools will rationally seek ways to reduce their competitive pressure. In this context, ED can be used to identify students with inelastic demand for the school and then make binding, preemptive admission offers to those students. Thus, X_{it} includes controls for the competitive environment (the number of competitors), and we expect the adoption of ED to be positively related to the competitive environment that a school faces.

The probability that a school uses ED is given by

³² As a potentially more refined measure, we include the absolute number of members of different demographic groups in the community. The additional measure takes on varying values depending on the diversity measure. For the school Herfindahl-Hirshman index (HHI) equation, we use the total nonwhite population in the community scaled by school size (total enrollments). For the equations for the percentages of white, African American, Hispanic, Asian American, and Native American students, we use the total population in the group scaled by school size. For the percentage of out-of-state students, we use the total state population; there is no change to the equation for the percentage of international students.

Table 2
 Determinants of the Decision to Adopt an Early Decision
 Program: All Schools, 2004–7

	Marginal Effect	SE
School characteristics:		
Undergraduate student body size/1,000	.003	.014
Endowment per student/(\$100,000)	-.029*	.008
25th Percentile for SAT math	.002	.002
75th Percentile for SAT math	.002	.002
Liberal arts	.380*	.116
Religious	-.192*	.091
Women	.290*	.052
Black	.038	.269
Urban	-.034	.080
Competitive environment measure: competitors	.009*	.002
School aid and award measures:		
% Graduating class who borrowed	-.007*	.003
% First years with needs fully met	.003 ⁺	.002
Community diversity measure: HHI-C/100	-.007	.007

Note. Results are from a probit model of the choice to adopt an early decision (ED) program. The data are based on 700 school-year observations. Year fixed effects are included. Robust standard errors are adjusted for clustering by school.

⁺ $p < .10$.

* $p < .05$.

$$\Pr(\text{ED}_{it} = 1) = \Pr(\beta\mathbf{X}_{it} + \varepsilon_{it} > 0) = \Phi(\beta\mathbf{X}_{it}), \quad (2)$$

where Φ is the standard normal cumulative density function.

Table 2 reports the estimated determinants of a school's choice to use ED. To facilitate interpretation, we report the marginal effects (evaluated at means) and standard errors (calculated using the delta method). As predicted, when school attributes such as undergraduate student body size, endowment per student, financial aid offers, school type, and community diversity are held constant, the number of competitors a school faces is positively related to the choice to adopt ED. To be specific, the larger the number of competitors, the more likely it is that a school will offer an ED option in an attempt to lock in students who might choose to go to a competitor.

As shown in Table 2, liberal arts colleges are 38 percentage points more likely than national universities to have ED programs. Because all women's colleges are also liberal arts colleges, the coefficient for the variable shows the impact of the women's college attribute relative to other liberal arts colleges. It is significant and positive. This result is not surprising, as liberal arts colleges enroll fewer students and offer a smaller array of majors to prospective students than do national universities but compete in the broader market nonetheless. They provide a distinct product—such as small classes, residential campuses, and more inclusive athletics programs—that appeals to a segment of the student population. We expect that the strategic use of ED will be, on net, more beneficial to liberal arts colleges than to national universities. We had no a priori expect-

tations regarding the other school type indicator variables, but the results suggest that schools reporting a religious affiliation may be able to successfully attract their desired cohort without relying on ED. The results also show that as a school's endowment per student increases, the likelihood of adopting ED declines. Wealthier schools face lower tuition revenue pressure than their less wealthy competitors, which implies that they have less incentive to rely on ED programs to price discriminate, with other factors holding constant.

Finally, financial aid characteristics are significantly related to ED—if schools adopt ED and can effectively price discriminate, they are better positioned to ensure that they can meet the full financial needs of the first-year class and can be less reliant on loans as a component of that financial aid (presumably for students who are admitted during the regular admission phase). It is possible that a school's aid and award measures are endogenously determined with ED. That is, ambitious financial aid programs, such as those that commit to fully meeting need and to eliminating loans, may create an incentive for a school to adopt or rely more on an ED program to make these financial aid programs more affordable. While we do not try to unravel this possibility here, our results based on the regression models that follow are robust to the exclusion of these variables.

5. The Effect of Early Decision on Cohort Diversity

We use two approaches to estimate the effect of ED on cohort diversity—a single-equation, ordinary least squares (OLS) estimate that assumes that ED is exogenous to cohort diversity and an instrumental variables (IV) approach that does not. We discuss each in turn.

5.1. Single-Equation Estimates

First, we assume that a school's choice to use ED is exogenous to cohort diversity. Our model of cohort diversity is

$$CD_{it} = \gamma Z_{it} + \delta ED_{it} + \eta_{it} \quad (3)$$

where $\eta_{it} \sim N(0, 1)$. The term CD_{it} is one of our eight school cohort diversity measures (HHI and the percentages of students who are African American, Hispanic, Asian American, Native American, white, international, and reside out of state). The term ED_{it} is the measure of a school's choice in year t to use ED, and Z_{it} is a vector of school characteristics (undergraduate student body size, endowment per student, indicators for school type, and SAT math scores),³³ school aid characteristics (the percentage of the graduating class who have borrowed and the percentage of the first-year class whose financial needs were fully met), a community diversity measure, and year fixed effects.

³³ Results in this regression, and others that follow, are not sensitive to using alternative measures of SAT scores (including verbal scores or a combination of math and verbal scores).

Table 3 presents the OLS estimates of the effect of ED on each of our eight cohort diversity measures. The OLS results indicate that ED is associated with more student body homogeneity, measured by a higher HHI. The results also show that ED is negatively related to the percentage of students enrolled from all nonwhite groups except for African Americans. Under ED, enrollment of white students is higher by 3.0 percent, which is offset by the reduction in the representation of the other nonwhite groups. In addition, schools with ED programs have more out-of-state students relative to student populations at other schools, which is a measure of geographic diversity. These findings seem to support the notion that schools with ED programs are using the extra revenue from such programs to fund priorities of the school other than cohort diversity.

5.2. Accounting for Omitted-Variable Bias

The single-equation estimates assume that a school's decision to adopt ED is exogenous to the cohort diversity of a school. However, it could be that heterogeneity in schools' underlying admission criteria (for example, the importance of legacy, intellectual passion, leadership attributes, participation in athletics, and the like) is likely to affect both the decision to adopt ED and cohort diversity. An omitted-variable bias implies that $E(\eta_{it}|ED_{it}) \neq 0$, which leads OLS regression models to produce biased estimates of the effects of ED. If a school's underlying admission criteria decreases diversity and increases the propensity to adopt ED, then the OLS estimates of the effect of ED on diversity will be understated. For example, if schools that tend to place great importance on legacy are more likely to be ED adopters and are also more likely to appeal to white students, then the OLS estimates of the effect of ED on cohort diversity will be understated. Because we are agnostic about possible sources of bias, we do not attempt to sign the possible bias.

In an attempt to address the omitted-variable bias, we reestimate equations (1) and (3) using a treatment-effects model that allows us to account for the possible correlation in the unobserved determinants of ED and cohort diversity.³⁴ For the model to be identified, X_{it} must contain at least one extra variable not contained in Z_{it} . We use the number of competitors of the observed school, i , as our instrument, as it is expected to influence the choice to adopt ED but to influence cohort diversity only indirectly through the choice to adopt ED. The data in Table 2 provide support for this identification strategy, as schools that face more competitors (defined on both geographic and student quality dimensions) are significantly more likely to adopt ED. Early decision programs allow schools facing more competition to better manage their enrollments and to

³⁴ We use the TREATREG command in STATA 10.0 to estimate the treatment-effects model using a two-step consistent estimator. Unlike the standard instrumental variable approach, namely, two-stage least squares, TREATREG allows the first-stage equation to be nonlinear (a probit model). Although the two-stage least squares results on the variable of interest (the decision to adopt ED) appear to be somewhat larger in magnitude than the TREATREG results, Hausman-like tests reveal that the results are not statistically different.

generate revenue from these efforts, which can then be used for various priorities, including possibly attracting more minority students during the regular admission process. Moreover, the number of competitors is unlikely to contribute directly to cohort diversity in any measurable way given that our cohort diversity equation already includes detailed measures of student quality (SAT scores), wealth (endowment per student), an urban indicator variable, and a community diversity measure. Furthermore, the F -statistic from the first-stage regression exceeds 10, which indicates that weak instruments are not a concern (see Staiger and Stock 1997).³⁵

To further assess the validity of the instrument, we construct a placebo test that uses OLS regressions to estimate the effect of the competition instrument on college diversity for those schools that did not adopt ED, *ceteris paribus*. Finding no effect supports the validity of the instrument in that diversity does not covary with competition when ED is not adopted. The results show that the competition instrument is not significant in the diversity regression when we measure diversity by school HHI (7.105, with a robust standard error of 6.524) and is not significant for the components of HHI (the enrolled percentages of various racial and ethnic groups), with the exception of the percentage of Native American students. In addition, competition is not significant in the regressions of geographic diversity measured as the percentages of international students and out-of-state students.³⁶

As a final check on the identification approach, we use restriction tests to evaluate the added explanatory power of the competition measure in equation (1). First, using a likelihood ratio (LR) test, we compare the unrestricted model (which includes competition in X_{it}) and the restricted model (which excludes competition in X_{it}) and conclude that the unrestricted model is stronger (LR $\chi^2 = 75.06$, $p = .000$).³⁷ Second, we compare the pseudo- R^2 values from the unrestricted model and from the restricted model, and we find that the pseudo- R^2 value increases from .27 to .35, which provides further evidence that adding competition improves the fit of the model.³⁸ Taken together, the findings suggest that competition is an important determinant of the choice to adopt ED.

Table 3 presents the results for the effect of ED programs on our measures of cohort diversity from the OLS model and the second stage of the IV (treatment effects) model. The IV results are qualitatively consistent with those of the OLS,

³⁵ The F -statistic from the first stage ranges from 12 to 16 with a p -value of .00, depending on the measure of diversity under consideration in the second stage.

³⁶ We evaluated another potential instrument that proxies for competition—a measure of the growth in state population ages 5–17 in the years leading up to the sample period. However, this measure is less precise than the competition measure, and it does not adequately identify the first stage.

³⁷ A Wald test reconfirms the findings of the likelihood ratio test (Wald $\chi^2 = 15.07$; $p = .000$).

³⁸ We also calculated the percentage of assignments correctly predicted in the unrestricted model relative to a number of alternative restricted models (for example, including competition only or excluding competition in X_{it}). While the order in which the variables are added affects the relative importance of the variables, we find that competition explains between 3 and 21 percent of the overall variation.

Table 3
**Determinants of School Cohort Diversity Measures and the Adoption of Early Decision Programs:
 Ordinary Least Squares and Instrumental Variables Models**

	Percentage of First-Year Students						Out of State	
	HHI	African American	Asian American	Hispanic American	Native American	White		International
Ordinary least squares model:								
School selection measure: ED program	290.888 ⁺ (170.162)	.612 (.431)	-1.980* (.710)	-1.466* (.533)	-.391* (.142)	2.979* (1.337)	.010 (.592)	8.754* (3.656)
Instrumental variables model:								
School selection measure: ED program	921.393* (282.494)	-.017 (4.702)	-3.362* (1.287)	-2.899* (.735)	-1.189 ⁺ (.613)	6.833* (1.974)	-.076 (1.002)	12.933* (4.267)
School characteristic measures:								
Undergraduate student body size/1,000	-56.108 (36.213)	.130 (.100)	.134 (.154)	.246* (.125)	-.026 (.020)	-.350 (.309)	-.146 (.090)	.154 (.455)
Endowment per student/(\$100,000)	-11.401 (18.088)	.149 (.121)	-.009 (.085)	.001 (.054)	.001 (.020)	-.205 (.168)	.047 (.051)	.402 (.266)
25th Percentile for SAT math	12.299* (3.330)	-.005 (.024)	.011 (.015)	-.001 (.009)	-.008 ⁺ (.005)	.033 (.030)	-.034* (.010)	.079 (.064)
75th Percentile for SAT math	-20.617* (3.757)	-.018 (.023)	.061* (.016)	-.004 (.015)	.010 (.005)	-.087* (.035)	.042* (.010)	-.009 (.072)
Liberal arts	899.030* (292.665)	-1.601 (1.263)	-2.510* (1.202)	-.838 (1.001)	.724* (.272)	7.148* (2.453)	-2.160* (.693)	-1.555 (4.316)

Religious	.177	-2.132*	-1.148*	-.324*	5.031*	-1.737*	-6.081 ⁺
	(172.547)	(.642)	(.528)	(.161)	(1.247)	(.599)	(3.243)
Women	-1,949.573*	7.301*	.722	-.201	-16.210*	2.874*	6.163
	(543.126)	(2.401)	(.797)	(.350)	(4.402)	(1.470)	(5.509)
Black	2,814.451*	-9.047*	-5.907*	-1.091*	-60.855*	-2.385*	50.090*
	(474.817)	(4.673)	(1.886)	(.973)	(5.423)	(1.395)	(9.574)
Urban	-119.823	-.012	-.569	.175	-.904	.614	-.667
	(168.826)	(.540)	(.612)	(.132)	(1.298)	(.433)	(2.924)
School aid and award measures:							
% Graduating class who borrowed	6.963	-.043*	-.040	.001	.014	.005	-.479*
	(7.011)	(.022)	(.029)	(.005)	(.056)	(.021)	(.092)
% First years with needs fully met	-7.030*	.006	-.002	.016	-.007*	-.013	.069
	(3.701)	(.015)	(.014)	(.010)	(.003)	(.011)	(.069)
Community diversity measure: HHI-C/100	.769*	.000	-.003*	-.001*	.006*	.000	.005*
	(.148)	(.000)	(.001)	(.001)	(.001)	(.000)	(.002)

Note. Both models are based on 700 school-year observations and include controls for year fixed effects. The ordinary least squares models also include controls for school characteristics, school aid and award measures, and a community diversity measure. The instrumental variables (treatment effects) models use the number of competitors of the observed school, i , as an instrument. Standard errors, in parentheses, are adjusted for clustering by school.

⁺ $p < .10$.

* $p < .05$.

although the magnitudes of the effects of ED are larger under the IV specification. For instance, the IV (OLS) results show that Asian American student enrollment is higher by 3.4 (2.0) percent. Relative to the mean, whether one considers the OLS or the IV results, the effects seem reasonable. To be specific, adoption of ED increases student body homogeneity by 15 (5) percent relative to the mean for the IV (OLS) results. Similarly, schools that adopt ED increase enrollment of white students, relative to the mean, by 9.0 (4.0) percent for the IV (OLS) results. Early decision is associated with an increase in out-of-state student enrollment of 21.0 (14.0) percent for the IV (OLS) regressions.³⁹

Second-stage results for the other independent variables are also shown in Table 3. The results indicate the importance of school type in predicting diversity. For example, holding other factors, including the presence of ED, constant, we find that schools with religious affiliations, historically black and predominantly African American colleges, and liberal arts colleges are associated with less diversity, while women's colleges are associated with more diversity.

The results shed light on the underlying hypotheses generated from Figure 1. To the extent that a school's PPFs are enhanced with the adoption of ED, these initial results suggest that additional revenues associated with ED programs are not being used to attract more diverse student cohorts during the regular admission phase. In fact, both the OLS and IV results indicate that adoption of ED decreases the racial diversity of the student body.

5.3. The Relationship between Early Decision Enrollment Rates and Cohort Diversity

A further refinement of the hypotheses generated by Figure 1 suggests that there may be varying effects of ED on cohort diversity that depend on the intensity of the use of ED, as proxied by the percentage of enrolled students who were admitted through an ED program. The range of reliance on ED for enrollment is very large—from a low of 3 percent of the student body to a high of 58 percent (the mean is 28.9 percent). The relationship between the percentage of students enrolled early and cohort diversity need not be monotonic, and as Figure 1 suggests, there may be some levels of ED enrollment that are associated with more cohort diversity.

Because we have no a priori expectation as to the functional relationship between ED enrollment and diversity, we analyze the data by enrollment quartile. To formally take into account the intensity of the use of ED, we reestimate equation (1) using OLS for those schools that adopted an ED program and for which we have a precise measure of the percentage of students enrolled through ED (365 observations).⁴⁰ For cases in which the school offers both EA and ED,

³⁹ A small number of colleges switched ED status during our panel, but there are too few to confidently employ a difference-in-differences model to estimate the effect of ED.

⁴⁰ Given that the OLS results and the IV (treatment-effects) results in the previous section are qualitatively similar, and because we are unable to identify two additional instruments, we do not address the potential endogeneity of the intensity of use of ED.

the school reports an aggregate percentage of students who were admitted early without distinguishing between those admitted via EA versus those admitted via ED, and, thus, we omit these schools from the analysis.⁴¹ We replace the ED variable with indicator variables representing the proportion of first-year students enrolled through ED programs by quartile. We construct indicator variables for each quartile: the indicator for the first quartile equals one if the percentage of first-year students enrolled in ED programs is less than 20 percent and zero otherwise; for the second quartile, the indicator equals one if the percentage of students enrolled through ED programs is between 20 percent and 30 percent and zero otherwise; for the third quartile, the indicator equals one if the percentage of first-year students enrolled through ED programs is between 31 percent and 38 percent and zero otherwise; and for the fourth quartile, the indicator equals one if the percentage of first-year students enrolled through ED programs is greater than 38 percent and zero otherwise.

Table 4 shows the results of an OLS regression analysis of the effect of the percentage of ED enrollments on the eight diversity measures. The regression models also include controls for community diversity (HHI-C), school type, the number of students enrolled, school wealth, student financial aid, SAT scores, and year dummies (results for control variables are available upon request).

The results should be viewed with caution, as the percentage of students enrolled is arguably endogenous, but we were not able to find satisfactory instruments. With this caveat in mind, we can interpret the results to show that our summary measures of diversity decline as schools rely more on ED, and there is no range of early enrollment over which diversity increases. Referring to Figure 1, we see that the overall pattern is most consistent with REP₂. The HHI is at a maximum (diversity is at a minimum) when schools enroll more than 38 percent of their students through an ED program. The results for specific racial and ethnic groups punctuate this general pattern. Higher enrollments of ED students negatively affect enrollments of Hispanic students. The evidence for Hispanic students suggests that increasing the percentage of students who are enrolled early beyond 20 percent is significant and negative, but the effects for the upper quartiles are not statistically different from each other. The evidence is weaker for Native American students, but the impact on Native American students' enrollments is significant and negative for schools enrolling more than 38 percent of their students early. For African American students, the effects of more school reliance on ED are not significant.

The results for the effects on Asian American students are statistically strong, which indicates that increased school reliance on ED has a monotonic and negative effect on enrollments of Asian Americans. These lower enrollments may occur either because schools shy away from enrolling Asian American students

⁴¹ We also ran the same regressions for all schools that have an ED program, including those that also have an EA program, and impute a value for the percentage enrolled through ED for schools that have both programs (see note 25 for details). The results reveal the same general patterns, although they are somewhat less precisely estimated, and are available upon request.

Table 4
The Effect of Intensity of Use of Early Decision on Cohort Diversity Measures

School Cohort Diversity Measure	Second Quartile	Third Quartile	Fourth Quartile
HHI	443.166 ^a (225.148)	679.473 ^a (237.506)	838.507 ^{a,b} (257.565)
Student diversity measures:			
African American	-.017 (.474)	.351 (.458)	.309 (.548)
Asian American	-1.120 (.924)	-2.474 ^a (.946)	-3.859 ^{a,b,c} (1.002)
Hispanic	-1.053 (.653)	-1.493 ^a (.726)	-1.967 ^a (.812)
Native American	.037 (.203)	.217 (.274)	-.362 ^{b,c} (.227)
White	3.204 ^a (1.682)	4.943 ^a (1.773)	6.052 ^{a,b} (1.903)
International	-.832 (.735)	-1.485 ^a (.733)	-.465 ^c (.872)
Out of state	2.800 (3.406)	7.648 ^{a,b} (3.725)	7.724 ^a (4.563)

Note. Coefficient estimates are from ordinary least squares regressions. Results are based on 365 observations of schools with early decision (ED) programs during 2004–7. For each observation, ED enrollment percentages are classified into the first, second, third, and fourth quartiles to create an indicator for the relevant quartile. Regressions include the quartile indicators (the first quartile is omitted) and controls for school characteristics, school aid and award measures, a community diversity measure, and year fixed effects. Observations for historically black and predominantly African American colleges are excluded. Standard errors, in parentheses, are adjusted for clustering by school. HHI = Herfindahl-Hirschman index.

^a Means between the proportion of first-year students enrolled in ED programs at the second, third, and fourth quartiles and the first quartile are significantly different at $p < .10$.

^b Means between the proportion of first-year students enrolled in ED programs at the third and fourth quartiles and the second quartile are significantly different at $p < .10$.

^c Means between the proportion of first-year students enrolled in ED programs at the fourth quartile and the third quartile are significantly different at $p < .10$.

as they rely more on ED or because these students may tend to opt out of ED programs, preferring instead to rely on the regular admission process, which offers choices across competing schools and aid offers. Our data do not allow us to distinguish between these two hypotheses. In addition, as is shown, reliance on ED generally has a negative effect on international students' enrollments (it is most negative for the third quartile) but has a positive impact on enrollments of students from out of state.

6. Conclusions and Discussion

From an economics perspective, as described here and elsewhere, ED programs have the potential to benefit both students and schools. They can, of course, reduce uncertainty for the student and reduce the risk associated with enrollment management for colleges and universities. In particular, though, we consider the implications of ED for schools' incentives to price discriminate through ED programs. Schools that adopt ED effectively bifurcate their admission process.

In the ED phase, they are positioned to identify and admit inelastic demanders who are more likely to be full-pay students. They then are positioned to compete more effectively in the regular admission phase on financial aid and merit-based offers to students who contribute to the quality and diversity of the student body. Hence, we might expect that diversity is increased through ED. However, in a resource-constrained environment, the marginal revenue from admitting full-pay students early can be used for other purposes, such as improving the faculty, investing in the physical plant, augmenting technology on campus, and so on.

We examine several measures of diversity: the percentages of students enrolled who are African American, Asian American, Native American, Hispanic, and white in an HHI of the overall heterogeneity of the student body and geographic diversity (international students and students enrolled from out of state). To study the impact of ED on diversity, we use a single-equation framework that implicitly assumes that the school's choice to adopt ED is exogenous and a treatment-effects model that incorporates the endogeneity of a school's choice to adopt ED. An obvious candidate for an instrument for the IV estimation is the number of competitors a school faces for students, a measure that reflects the geographic density of schools with students of similar academic standing. Our statistical analysis reinforces the validity of competition as an instrument, and we find that schools that face more competition are more likely than other schools to adopt ED.

The evidence for the impact of ED does not support a view that cohort diversity is improved (or is unaffected) by the adoption of these programs. Instead, we find that ED has a significant and negative impact on cohort racial diversity. We also study the subset of schools that have adopted ED and find that the overall heterogeneity of the students, measured by HHI, falls monotonically as schools enroll greater percentages of their students through ED programs. The results of the impact on specific racial and ethnic groups are more nuanced. Compared to other groups, Asian American and Hispanic students are the most likely to be squeezed out as schools' reliance on ED enrollments increases. The magnitude of the effect is more severe for Asian American students. This may be attributable to those students who opt out of ED programs and decide instead to apply during the regular admission period and gain the benefits associated with being able to generate competing offers of admission and financial aid. For schools with ED programs, one of the clear benefits of enrolling more students early is that they attract more geographic diversity, as they enroll significantly more out-of-state students.

It is likely that ED is a policy that is here to stay, and only the very top schools are in positions to abandon it unilaterally. It is a useful tool for enrollment management, but for most schools, it does not appear to be used as a means to furthering goals they may have to improve student diversity. Instead, any additional revenue generated by ED programs appears to be serving other institutional goals.

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