

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

Heather Antecol
Robert Day School of Economics and Finance
Claremont McKenna College
Claremont, CA 91711
hantecol@cmc.edu

Janet Kiholm Smith
Robert Day School of Economics and Finance
Claremont McKenna College
Claremont, CA 91711
jsmith@cmc.edu

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Abstract

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JEL Codes: I2, J7, L3

Keywords: college admission; student diversity; early decision; antitrust

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Abstract

Many schools rely on early decision (ED) as an admission practice. Schools that adopt ED are able to generate additional resources by attracting wealthier students who, upon admission, make binding commitments to attend and to forego shopping for competing aid offers. An unanswered question is whether the resources generated from this price discrimination practice are used by schools during the regular admission process to attract more diverse students. We document the admission practices for private national universities and liberal arts colleges. We model the choice to adopt an ED program and its impact on student racial and geographic diversity. We find that schools that face more competition for students are more likely to adopt ED. While, in theory, it is possible for ED to enable greater diversity over some range of early enrollment percentages, we find that the overall heterogeneity of the students is lower for schools that adopt ED and that heterogeneity falls monotonically as the schools enroll larger percentages of their students through ED. Higher ED enrollment percentages appear to strongly and negatively affect Asian American and Hispanic students and positively affect white students.

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

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, and has become increasingly prevalent over the last two 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 early decision can select *one* school to which to apply for an admission decision 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 forego other financial aid offers. The foregone offers can include merit-based aid, as well as competing packages of need-based aid that are more attractive. This 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 and to identify applicants with strong preferences for their

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 requiring the student to sign, the student’s parents and college counselor also are required to sign the agreement. See the “Early Decision Agreement” that accompanies the “Common Application”. The current version of the agreement is available from NACAC website: <http://www.nacacnet.org>. The agreement is further enforced by mutual monitoring by schools of applicants and reporting of 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 on what is “adequate” is incomplete and student bargaining power is minimal. See National Association of College Admission Counseling, “Early Decision and Early Action: Does the Early Bird Get the Worm?” accessed from NACAC website: <http://www.nacacnet.org>.

schools and generate higher net tuition revenue from ED admits. A school might forgo ED because of additional administrative cost relative to anticipated low ED yield, because its pool of highly qualified applicants is deep enough that it can ration effectively without reliance on ED to signal intensity of demand, or because of concern with the impact on cohort quality.

The net welfare effect on students from ED programs 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 may gain higher probabilities of being admitted.³ 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 would forego 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 demand so that the intensity of competition may be reduced and fewer high-need students may be admitted.

Consistent with use of ED to increase net tuition and reduce competition, Avery, Zeckhauser, and Fairbanks (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 increased risk of receiving a less favorable financial aid offer than if they applied regular admission and received competing aid offers.

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 the applicants. Also, even among the schools that do commit to fully meeting need, the nature of the awards can vary—including the mix of debt, grants, work-study funds, etc. Some schools are need blind but offer merit awards to top students; others are need blind and only meet financial need, and do not make any other awards.

Based on concerns of how ED can skew the cohort, several prominent school administrators have expressed concerns 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 net tuition revenue from ED admits, a school with fixed total enrollment may be able to use the higher revenues from ED admission to fund enrollment of a higher proportion of students who qualify for need-based aid. That is, the higher 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. Cohort quality could possibly be increased by adding diversity without reducing average ability. Alternatively, a school that introduced ED and sought to hold cohort quality constant would have an increase in net tuition revenue that could be applied to other uses. Going still further, a school that sought to maximize 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 et al., 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*⁵ and *Grutter v. Bollinger*⁶. These decisions stand for the proposition that educational diversity is 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. Many of these schools, nonetheless, rely on ED programs for admission.⁷

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. Tamar Lewin, "Early Decision Applications are Up at Colleges, in Spite of the Economy," *New York Times*, November 21, 2008. In their study of highly selective colleges, Avery et al. (2003, pg. 59) report that "among those students for whom financial aid was not a concern, 78.0 percent used early admissions programs to apply to college; among students for whom "financial aid was important to their choice of college, only 48.0 percent applied early."

⁵ *Gratz v. Bollinger*, 539 U.S. 244 (2003)

⁶ *Grutter v. Bollinger*, 539 U.S. 306 (2003)

⁷ 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).

In this study, based on data from 189 private national universities and liberal arts colleges in the US from 2004-2007, we find evidence that ED has a negative impact on cohort diversity, measured as a Herfindahl-Hirshman Index 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% of the observations), we examine how the percentage enrolled through ED varies with racial and geographic diversity. We find that racial heterogeneity decreases as school reliance on ED enrollment increases. The most pronounced negative effects are for Asian Americans and Hispanics, as relative to other groups, their representation falls more as schools increase their reliance on ED and/or early action programs. White student enrollments and out-of-state student enrollments increase significantly, as schools rely more on ED.

The paper is organized as follows: In Section 1 we describe the emergence of early admission programs, and briefly review 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 ED 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 ED, and in section 5 we present the analysis of the impact of ED on student diversity. Section 6 concludes.

1. Emergence of Early Decision as an Admission Practice

The liberal arts colleges in the northeastern US known as the "Seven Sisters" began experimenting with ED programs around 1959.⁸ Amherst, Williams, and other elite small liberal arts

⁸ Barnard, Bryn Mawr, Mount Holyoke, Radcliffe, Smith, Vassar, and Wellesley.

colleges adopted formal ED in the early 1960s.⁹ In their historical account, Duffy and Goldberg (1998) explain that ED was in response to a broader trend in higher education, as students began submitting multiple applications to colleges and universities. This increase in applications per student resulted in institutions competing more aggressively for students while trying to reduce enrollment uncertainty. ED helped to ensure the size of the first-year class. Duffy and Goldberg cite a 1977 report to secondary school counselors by the Dean of Admissions at Amherst College, Edward Wall. Wall explained that Amherst's early decision program "...serves as the foundation of the class. The holes will be filled in later under regular admission." More specifically, early decision provided Amherst with a way to combat its losses to its three top competitors (Harvard, Yale, and Princeton).¹⁰

By the mid-1970s, all the Ivy League schools and MIT had adopted early admission programs-- Brown, Harvard, MIT, Princeton, and Yale initially used non-binding EA and the others used binding ED. In the late 1970s, the EA schools amended their rules to prevent students from applying to more than one school early (known as "restrictive early action").¹¹ 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 Overlap Group Practices

ED 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 was to restrict merit-based aid competition for students who were willing to forgo searching for competitive aid offers, some schools also entered into

⁹ The success of the Seven Sisters' ED plans prompted other selective co-ed 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, Oberlin College, Ohio Wesleyan University, and Wooster.

¹⁰ Cited in Duffy and Goldberg (1998), pg. 50.

¹¹ There currently are two types of "early action" 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 admits them early or to submit a deposit prior to the regular due date. Schools may have both an ED and an EA plan.

agreements to refrain from making merit-based aid awards to students who applied regular decision. As is well-documented elsewhere, during the 1950s, the Ivys plus MIT formed the “Ivy Overlap Group” and began to meet regularly for 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 commonly admitted students and to refrain from awarding merit-based aid.¹² Over time, the practices followed by the Overlap Group spread to fourteen other prestigious northeastern private universities and liberal arts colleges, which all had early admission plans in place.¹³

In 1991, the U.S. Department of Justice (the “DOJ”) filed suit against the Ivy Overlap Group, alleging that the Overlap meetings and related agreements were elements of a conspiracy to eliminate price competition.¹⁴ Upon the suit being filed against the original nine members, the eight Ivys entered into consent agreements with the DOJ. MIT 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 socio-economic diversity of enrolled students.¹⁵

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 Overlap Group.¹⁶ Under the settlement, schools still could engage in some Overlap-type behavior.¹⁷

¹² Carlton et al. (1995) and Hoxby (2000) provide details and an economics perspective of the Overlap procedures related to financial aid offers. Family contribution is the portion of total financial need that is expected to be provided by the student’s family.

¹³ Carlton, et al.(1995) report that “Overlap meetings” included the Ivys, MIT and fourteen others by the 1970s. Eventually, Brown, Columbia, Cornell University, Dartmouth, Harvard, MIT, Princeton, University of Pennsylvania, Yale, Amherst, Barnard, Bowdoin, Bryn Mawr, Colby, Middlebury, Mount Holyoke, Smith, Trinity, Tufts, Vassar, Wellesley, Wesleyan, and Williams were members.

¹⁴ U.S. v. Brown University, et al., 805 F. Supp. 288 (E. D. Pa. 1992).

¹⁵ MIT claimed: (1) the purpose of the 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 Overlap promoted the social ideal of equality of educational access and opportunity. (4) controlling for various factors, the collective actions of the Overlap Group did not result in significantly higher average net tuition. U.S. v. Brown University, et al., 5 F.3d 658 (3rd Cir. 1993). See Bamberger and Carlton (2003) and Carlton, et al. (1995).

¹⁶ U.S. v. Brown University, et al., 5 F.3d 658 (3rd Cir. 1993).

¹⁷ Because Brown University was unable to commit to “need blind” admission for all students, one of the conditions of the agreement, the Overlap process stopped. Carlton et al. (1995). The settlement is reinforced by federal legislation in 1994: The Need-Based Educational Aid Act. Congress has renewed the same bill several times since 1994, most recently in 2008.

Carlton et al. (1995), in their empirical study, find no significant evidence that Overlap practices resulted in higher average tuition for students at Overlap 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 financial needs (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 Overlap 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 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 Overlap 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 Overlap Group remained need blind and committed to fully satisfying need of the admitted applicants, Hoxby points out that there is sufficient flexibility in the definition of need to accommodate small but significant change in actual practice. Hence, there is some evidence that, following the settlement, financial aid practices changed and competition on some dimensions intensified among 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 US. Faced with a long-term demographic shift associated with the end of the post-WWII 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 programs. 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 at ED programs was that it afforded better control over financial aid outlays. This occurs because students applying early generally are wealthier and less likely to apply for financial aid than students applying under regular decision (Avery et al., 2003).¹⁸ Though many private schools describe themselves as need blind, the schools are aware that their ED applicant pool is less concerned about financial aid. The College Board Handbook from 2002 observes: “Some colleges find that they can stretch their limited financial aid budgets by admitting students [in Early Decision] 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.”¹⁹

As reliance on ED was spreading, mechanisms for enforcing ED agreements with admitted students were evolving. ED, 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 (*supra*, note 1). Afram (2006, pgs. 913-914) describes the process: Once a student is admitted under ED, the school notifies the student that the school they 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 ED to more than one school, they would potentially notify

¹⁸ The Avery et al. (2003) study focuses on 14 highly selective colleges for which they have detailed data on each applicant from the 1991-92 to 1996-97 academic year. They show that acceptance rates during early decision rounds are higher than those for regular decision and that students who are admitted through early decision are slightly less qualified than students admitted during the regular decision round. Controlling for SAT scores and rank in class, they find that the admissions rates of early applicants exceeds the admissions rate for regular applicants by 15 percentage points or more.

¹⁹ *Ibid.*, p.177.

the first school, and all schools involved would typically revoke the student's admission.²⁰ The implication is that ED is an effective way for schools to identify inelastic demanders and to augment the inelasticity, enabling them to limit financial aid offers to ED applicants to be need only. Clearly not all schools are compelled to take advantage of this feature. Wealthy, highly selective schools, for example, might view ED as mainly a way to manage enrollment to targeted numbers and not be particularly concerned about the financial aid implications. Moreover, as in the Overlap 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 more-needy students during regular admission 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 et al. study incited widespread criticism of ED on the ground that the practice favors wealthy, less-well-qualified students.²¹ Subsequent studies examine how student 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, leading to higher financial aid awards.²² 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 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.

²⁰ The enforcement of the agreement among schools is also described in Avery, Fairbanks and Zeckhauser (2003, pgs. 54-56).

²¹ There was even a push in Congress, initiated by Massachusetts Senator Edward Kennedy in the fall of 2003, to open ED admissions practices to greater public scrutiny. See S. 1793, 108th Cong. §§3(2) (I), 302 (a), 302(b) (2) (2003). The proposal would require colleges with ED programs to report the percentage of each enrolled class admitted under ED, and broken down by race. Also, 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), pg. 900.

²² See also: Epple, Romano, Sarpca and Sieg (2006), who show, using data from Carnegie Mellon University, how signaling and profiling are important aspects of the college admission process; Epple, Romano, and Sieg (2003); McMillen, Singell and Waddell (2006);

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 decide about college early and their inability to compare financial aid applications. Recognizing the game theoretic aspect of ED, 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.²³ Very recently, Harvard, Princeton and the University of Virginia have eliminated ED, stating as a rationale that it favored wealthier applicants.²⁴ At the same time, though, it is clear that abandoning ED would put less wealthy and less highly selective schools at a competitive disadvantage. See, Avery and Levin (2010) who provide 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 (NACAC) took the initiative in defining and articulating best practices for member institutions.²⁵ 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 for the types of students who are admitted both early and during the regular admission cycle.²⁶

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

In contrast to the Overlap practices, ED presents a more plausible case for competitive harm. As Carlton et al. (1995) note, schools that seek to maximize revenue would want to price discriminate across

²³ "Yale President Wants to End Early Decisions for Admissions," Karen Arenson, *New York Times*, December 13, 2001.

²⁴ *New York Times*, November 21, 2008.

²⁵ Definitions and details regarding acceptable admission plans for EA and ED for member institutions appear in the National Association for College Admission Counseling, *Statement of Principles of Good Practice*, approved by 2007 Assembly. The document is available from the NACAC website.

²⁶ Afram (2006) discusses ED programs in the context of civil rights and antitrust laws.

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 overlap 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, based on 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.²⁷ 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.²⁸

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), in response to the question, "Why do tuitions keep rising?" argues that, "sticker prices

²⁷ See Winston (1999) for an excellent overview of the economics of higher education.

²⁸ *Ibid.* Also, Bowen and Bok (1998) document the origins of diversity as a topic of educational thought and the development of race-sensitive admissions policies.

have risen to allow more price discrimination in the form of financial aid among potential buyers.”²⁹ ED 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 aid awards, ED generates resources a college would not otherwise have. The amount of additional resources varies with the proportion of students admitted through ED. The resources can be used in various ways, including providing financial aid awards to regular-admission students in an effort to improve cohort quality, or funding other priorities of the school.³⁰ 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 potentially could have gone to someone who could contribute more to cohort quality.

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

²⁹ In the four years between 1986-87 and 1990-91, on average, private schools used 42% of their sticker price increases to increase financial aid; in the next four years, the share of the increase in announced prices they committed to financial aid increased to 60%—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 the form of aid—grants as opposed to loans, work-study, etc. Winston (1999), pgs. 30-31.

³⁰ Duffy and Goldberg (1998) 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 early decision students, and another’s attractive packages for affluent applicants (pg. 224). Moreover, our data, consisting of a cross-section of top-ranked schools appearing in the annual *US News and World Report* rankings, show that increases in the percentages of students enrolled through ED are associated with significant decreases in the percentage of students who apply for aid, significant decreases in the percentage of students who demonstrate need, and significant increases in the percentage of students whose needs are fully met. The percentage of those who receive merit aid goes down significantly as school reliance on ED enrollments increases.

to the choice to adopt ED admission and the percentage of students enrolled ED. Figure 1 shows the trade-off between cohort diversity and other objectives for various production possibility frontiers (PPFs). 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 ED. Adopting ED can increase revenue but 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 ED can increase a school's resources and cause an outward shift in the PPF. As long as the percentage of students admitted 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 that 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 enrolled through ED, it necessarily sacrifices the number of spots available to regular decision students. Beyond some point, the percentage admitted through ED becomes a binding constraint on the ability to achieve diversity. Since ED pools are less socio-economically diverse 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, allowing 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 ED 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 percentage enrollment via ED changes. As can be seen from Figure 1, the model implies that with convex objectives, schools do not maximize 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 without ED.

We consider three possibilities, illustrated by revenue expansion paths, REP1, REP2 and REP3, 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 towards 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 ED on other objectives. A second factor is the relative value that a school puts on cohort diversity versus other objectives. The level of enrollment at which the expansion path begins to curve towards the “other objectives” axis should be higher at schools that place more value on cohort diversity.

The testable hypothesis underlying REP1 is that as reliance on ED increases, and the PPF shift outward, cohort diversity increases over a range, and then decreases as the school increases its reliance on ED. REP2 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. REP3 illustrates a third possibility—ED reduces diversity at lower levels of ED enrollment, 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 below 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 four years of admissions and enrollment data for selective private schools in the US—those listed as the “Best National Universities” and “Best Liberal Arts Colleges” by *US 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 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.³¹ 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 below 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 school characteristics, admission, financial aid, etc. were collected from the detailed versions of the “Best College Rankings” reports published annually online (but not archived) by *US News and World Report*, 2004-2007.

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 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 early decision (ED) and/or early action (EA), but they do not break out the percentage by program type. For those schools that only have an ED program (and not an EA program) we know the exact percent enrolled by ED only. However, we do not know the exact percent enrolled by ED only for those schools that have both an ED and EA program (12% 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 all schools that have both ED and EA and impute a value for the

³¹ We excluded Brigham Young University for all years, (as their tuition and admission structure resembles a public rather than private school) and Tulane University in 2004 (as the school’s admission process was dismantled during the rebuilding following hurricane Katrina).

percentage enrolled through ED. The imputed value is based on the statistical information for schools that only have ED programs.³²

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"—i.e., liberal arts colleges vs. national universities, schools that report a religious affiliation, women's colleges, and a control for whether the school is located in an urban environment.

We find that ED is pervasive, as 64% of the schools had an ED program in force during 2004-2007. This percentage is even higher for the most selective schools, where 100% of the top 25 ranked liberal arts colleges and 67% of the top 25 private universities use ED during the sample period. In addition, liberal arts colleges, which enroll significantly smaller student bodies than national universities, rely more heavily on ED admission. Approximately 70% (43%) of the observations with (without) an ED program are liberal arts colleges and, on average, 29% 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 than those that do not have an affiliation, and that schools in more urban areas are less likely to rely on ED compared to schools in suburban and rural areas.

3.1 School Cohort Diversity Measures

School cohort diversity characteristics include the following heterogeneity measure (Herfindahl-Hirshman (HHI)). 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/ethnically heterogeneous cohort will be associated with a lower HHI. We also considered an

³² Specifically, for those schools that have only have an ED program but not an EA program and positive values for the proportion enrolled through ED, we run a regression at the 1st, 2nd, 3rd, and 4th percentile of the proportion enrolled through ED, where 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, % of graduating class who borrowed, % of 1st years who 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 ED and EA programs. For those schools that have both type of 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.

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 minorities for the purpose of admission. The American Council on Education (ACE), reports that Asian Americans and whites are the only two groups where young adults are more educated than prior generations.³³ As the results using this alternative definition are very similar, for expositional ease they are not reported in the paper.

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

3.2 Competitive Environment

Below 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. See for example, Avery and Levin (2010), who 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 standing and geographic market. For the geographic component, we rely on the market definition that was used in the Department of Justice antitrust case against the Overlap Group (selective schools in the northeast US).³⁴ We obtained zip code data for each Overlap school and measure the driving distances between the zip code centroid for each school pair. The longest distance between any pair of schools in the Overlap Group is slightly less than 500 miles. Based on this, we assume that the geographic market

³³ <http://www.acenet.edu>. The website reports annually on overall enrollment and education rates by ethnic groups. In 2006, 61% of Asian Americans aged 18 to 24 were enrolled in college compared with 44% of whites, 32% of African Americans, and 25% of Hispanics and American Indians, respectively.

³⁴ While the Overlap Group's combined market share of total undergraduate enrollments in the US is small (less than 1%), as Bamberger and Carlton (1999) point out, the existence of the Overlap process indicates that the schools had market power (pg. 268).

for each school is defined by a 500-mile radius and we measured competitive pressure based on schools within that radius. The underlying assumption is that while schools may attract students from all regions of the US, 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 (2006) provide supporting evidence that the market for students in higher education depends on proximity of competitors and institutional quality.

The other dimension of competition implicit in the Overlap case is school quality or rank. Schools that compete effectively with each other for a given student generally, share similar 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 one standard deviation of that school's scores), where the standard deviation is measured over all school-years in the sample.³⁵ The number of schools meeting both the distance and SAT criteria are summed to generate the measure for the number of competitors for each school. Because *US News and World Reports'* annual lists of "Best Universities" and "Best Liberal Arts Colleges" 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.³⁶ While for theoretical

³⁵ We measured distance from all possible school combinations as centroid of zip code to centroid of zip code using Zip Code Wizard software.

³⁶ 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 (i.e., there are fewer schools with SAT math scores within one standard deviation of 700 than within one 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 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

reasons we argue it is important to account for this bias, this adjustment does not lead to materially different results.³⁷

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

3.3 Other School Characteristics and Financial Aid Measures

Also shown in Table 1 are percentile rankings (25th and 75th) for SAT math scores for students enrolled in colleges. Schools that adopt ED programs are associated with students who achieve higher SAT math test scores than schools that do not adopt such programs.³⁸ Financial aid characteristics also differ across the school's policy choice to use 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.³⁹

The last variable listed in Table 1 is a variable 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 a 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 total population who are Asian (includes Hawaiian/Pacific Islander), American Indian, Black, Hispanic, and White. The data are drawn from the 2000 U.S. Census.

4. The Determinants of School Choice to Use Early Decision

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

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.

³⁷ 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.

³⁸ These patterns also hold true for SAT verbal scores or a combination of SAT math and verbal scores, and are available upon request.

³⁹ In 1994, Congress created an antitrust exemption that sanctioned efforts by institutions practicing need-blind admissions to discuss and agree upon common principles of financial aid need analysis. The schools that participate in this effort form the "568 Presidents' Group," which currently includes 28 schools: <http://568group.org>.

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

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

X_{it} includes school characteristics—undergraduate student 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 (which includes 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 liberal arts college indicator is positive. The other indicator variables are included as controls for school characteristics.

Additionally, X_{it} includes school aid characteristics (percentage of graduating class who have borrowed and percentage of the first-year class whose financial needs was 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 literature on student application behavior and student-school matching behavior. Avery et al. (2005) reinforce the point that students can observe some characteristics that colleges possess and can make choices based on those attributes (e.g. location, 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 (e.g., Fryer and Greenstone (2007)). We control for this behavior by including indicator variables for women's colleges, historically black 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.⁴⁰ However, the results did not change in any substantive way, so in the tables below show results for the more parsimonious specification.

Finally, based on the analysis above, as constrained optimizers, schools will rationally seek ways to reduce 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 ED adoption to be positively related to the competitive environment that a school faces.

The probability that a school uses early decision (ED) is given by

$$\Pr(ED_{it} = 1) = \Pr(\beta X_{it} + \varepsilon_{it} > 0) = \Phi(\beta X_{it}) \quad (2)$$

where Φ is the standard normal cumulative density function.

Table 2 reports the estimated determinants of a school's choice to use early decision. To facilitate interpretation, we report the marginal effects (evaluated at means) and standard errors (calculated using the delta method). As predicted, holding constant school attributes like student body size, endowment per student, financial aid offers, school type, and community diversity, the number of

⁴⁰ 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 HHI equation, we use total non-white population in the community scaled by school size (total enrollments); For % White, %Black, %Hispanic, %Asian, %Native American equations, we used the total population in the group, scaled by school size. For % out of state we use the total state population; there is no change to the % international equation.

competitors a school faces is positively related to the choice to adopt ED. Specifically, 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 one of their competitors.

As shown, liberal arts colleges are 38 percentage points more likely to have ED programs than national universities. 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 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--small classes, residential campuses, more inclusive athletics programs, etc.--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* expectations 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 the school's endowment per student increases, the likelihood of adopting ED declines. Wealthier schools face lower tuition revenue pressure than less wealthy competitors, implying lower incentives to rely on ED to price discriminate, other things constant.

Finally, the 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 students who are admitted during the regular admission phase). It is possible that a school's aid/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 ED 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 ED is exogenous to cohort diversity, and an instrumental variable (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 $\eta_{it} \sim N(0,1)$. CD_{it} is one of our eight school cohort diversity measures (HHI, percent of students who are: African American, Hispanic, Asian American, Native American, and white; percent of student who are international students, and percent of students who reside out of state). Additionally, ED_{it} is the measure of school's choice in year t to use ED and Z_{it} is a vector of school characteristics (undergraduate student size, endowment per student, indicators for school type, and SAT math scores⁴¹), school aid characteristics (percentage of graduating class who have borrowed and percentage of the first-year class whose financial needs was fully met), a community diversity measure, and year fixed effects.

Panel A of Table 3 presents the OLS estimates of the effect of ED on each of our eight cohort diversity measures. The OLS results show that ED is associated with more student body homogeneity, measured by higher levels of HHI. The results also show that ED is negatively related to percentage enrolled from *all* non-white racial groups except for African Americans. Under ED, white student enrollment is higher by 3.0 percent, which is offset by the reduction in the representation of the other non-white racial groups. Also, schools with ED programs have more out-of-state students relative to other schools, which is a measure of geographic diversity. These findings seem to support the notion that

⁴¹ Results in this regression, and others that follow, are not sensitive to using alternative measures of SAT scores (including verbal or using a combination of math and verbal).

schools with ED are using the extra revenues from this program to fund priorities of the school other than cohort diversity.

5.2 Accounting for Omitted-Variable Bias

The single-equation estimates discussed above 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 (e.g., importance of legacy, intellectual passion, leadership attributes, participation in athletics, etc.) is likely to affect both the decision to adopt ED and cohort diversity. An omitted-variable bias implies $E(\eta_{it} | ED_{it}) \neq 0$ leading OLS regression models to produce biased estimates of the effects of ED. If a school's underlying admission criteria decreases diversity and also 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 a high importance on legacy are more likely to be ED adopters and also 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 re-estimate 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.⁴² 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. Table 2 provides support for the identification strategy, as schools that face more competitors (defined in both geographic and student quality dimensions) are significantly more likely to adopt ED. ED allows schools facing more competition to better manage their

⁴² We utilize 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, i.e., two-stage least squares (2SLS), TREATREG allows the first stage equation to be non-linear (i.e., a probit model). Although the 2SLS results on the variable of interest (i.e., the decision to adopt early decision) appear to be somewhat larger in magnitude than the TREATREG results, "Hausman-like" tests reveal that the results are not statistically different.

enrollments and to generate revenue from these efforts, which can then be used for various priorities, including possibly attracting more minority students during regular admission. 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 (i.e., SAT scores), wealth (i.e., endowment per student), an urban indicator variable, and a community diversity measure. Furthermore, the F-statistic from the first-stage regression exceeds 10, indicating that weak instruments are not a concern (see Staiger and Stock, 1997).⁴³

To further assess the validity of the instrument, we construct a “placebo” test that uses OLS 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 measuring diversity by school HHI (coefficient and robust standard error are 7.105 and 6.524), and is not significant for the components of HHI (the enrolled percentages of various racial groups), with the expectation of Native American students. Also, competition is not significant in the regressions of geographic diversity measured as the percentages of international students and out-of-state students.⁴⁴

As a final check on the identification approach, we used 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 (excludes competition in X_{it}), and conclude that the unrestricted model is stronger (LR Chi Square test statistic of 75.06, p -value=0.000).⁴⁵ Second, we compare the Pseudo R^2 from the unrestricted model and the restricted model, and we find that the Pseudo R^2 increases from 0.27 to 0.35, providing further evidence

⁴³ The F-statistic from the first stage ranges from 12 to 16 with a P-value of 0.00 depending on the measure of diversity under consideration in the second stage.

⁴⁴ 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.

⁴⁵ A Wald test re-confirms the findings of the likelihood ratio test (Wald Chi-Square test statistic 15.07, P-value 0.000).

that adding competition improves the fit of the model.⁴⁶ Taken together, the findings suggest competition is an important determinant of the choice to adopt early decision.

Panels A and B of Table 3 present 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, respectively. The IV results are qualitatively consistent with OLS, although the magnitudes of the effects of ED are larger under the IV specification. For instance, the IV (OLS) results show that Asian 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. Specifically, the impact of schools that adopt ED is to increase student body homogeneity by 15 (5) percent relative to the mean for the IV (OLS) results. Similarly, schools that adopt ED increase white student enrollment, relative to the mean, by 9.0 (4.0) percent for the IV (OLS) results. ED is associated with an increase in out-of-state student enrollment of 21.0 (14.0) percent for IV (OLS).⁴⁷

Second-stage results for the other independent variables are shown in Panel B Table 3. The results indicate the importance of school type in predicting diversity. For example, holding other things constant, including the presence of ED, the estimates indicate that schools with religious affiliations, historically black 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 production possibilities are enhanced with adoption of ED, these initial results suggest that additional revenues associated with the programs are not being used to attract more diverse student cohorts during the regular admission phase. In fact, both the OLS and IV equations indicate that adoption of ED decreases the racial diversity of the student body.

⁴⁶ We also calculated the percentage of assignments correctly predicted in the unrestricted model relative to a number of alternative restricted models (e.g., 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.

⁴⁷ There are a small number of few colleges that switch ED status during our panel but too few to confidently employ a difference-in-difference model to estimate the effect of ED.

5.3 The Relation 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 depending on the intensity of use of ED, as proxied by the percentage of enrolled students who were admitted through ED. The range of reliance on ED enrollments is very large—from a low of 3% to a high of 58% (the mean is 28.9%). The relationship between percentage 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. Specifically, to formally take into account the intensity of the use of ED, we re-estimate equation (1) using OLS for those schools that adopted an ED program and for which we have a precise measure of percent enrolled through ED (365 observations).⁴⁸ In cases where the school offers both EA and ED, the school reports an aggregate percentage “admitted early,” without distinguishing between those admitted EA versus ED, and, thus, we omit these schools from the analysis.⁴⁹ We replace the ED variable with indicator variables representing the proportion of freshman enrolled in ED programs by quartiles. Specifically, we construct indicator variables for each quartile: The indicator for the 1st quartile equals one if the percentage of freshman enrolled in ED programs is less than 20% and zero otherwise; for the 2nd quartile, the indicator equals one if the percentage enrolled in ED programs is between 20% and 30% and zero otherwise; for the 3rd quartile, the indicator equals one if the percentage of freshman enrolled in ED programs is between 31% and 38% and zero otherwise; and for the 4th quartile, the indicator equals one if the percentage of freshman enrolled in ED programs is greater than 38% and zero otherwise.

⁴⁸ 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.

⁴⁹ We also ran the same regressions for all schools that have ED, including those that also have EA, and impute a value for the percent enrolled through ED for schools that have both programs (see footnote 25 for details). The results reveal the same general patterns, although somewhat less precisely estimated, and are available upon request.

Table 4 shows the results of an OLS regression analysis of the effect of the percentage of ED enrollments on the nine diversity measures. The table shows the coefficients for indicator variables for the 2nd, 3rd, and 4th quartiles (1st quartile is omitted). The regression models also includes controls for community diversity (HHI-C), school type, number of students enrolled, school wealth, controls for student financial aid and test scores, and year dummies (available upon request).

The results should be viewed with caution, as the percentage enrolled arguably is endogenous but we were not able to find satisfactory instruments. With this caveat in mind, the results show that our summary measures of racial diversity fall as schools rely more on ED, and there is no range of early enrollment over which diversity increases. Referring to Figure 1, the overall pattern is most consistent with REP2. HHI is at a maximum (diversity is at a minimum) when schools enroll over 38% of their students through ED. The results for specific racial groups punctuate this general pattern. Higher enrollments generated by ED students negatively affect Hispanic students. The evidence for Hispanics suggests that increasing the percentage enrolled early beyond 20% 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 enrollments is significant and negative for schools enrolling more than 38% of their students early. For African American students the effects of more school reliance on early decision are not significant.

The results for Asian Americans are statistically strong, indicating that increased school reliance on ED results has a monotonic and negative effect on enrollments of Asians. This may occur either because schools shy away from enrolling Asian student as they rely more on ED, or these students may tend to “opt out” of ED programs, preferring instead to rely on the regular admission process, which offers choice across competing schools and aid offers. Our data do not allow us to distinguish between these two hypotheses. Also, as shown, reliance on ED generally has a negative effect on international student enrollments (it is most negative for the 3rd 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, early decision (ED) has the *potential* to benefit both students and schools. It can, of course, reduce uncertainty for the student and reduce risk associated with enrollment management for colleges and universities. In particular, though, we consider the implications of ED for school incentives to price discriminate through ED. 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 improved through ED. However, in a resource-constrained environment, the marginal revenue from admitting full-pay students early can be used for other priorities such as improving faculty, investing in physical plant, augmenting technology on campus, and so on.

We examine several measures of diversity--percentage of students enrolled who are African American, Asian American Native American, Hispanic, an Herfindahl-Hirshman (HHI) index 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 the school's choice to adopt ED is exogenous, as well as 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 (treatment effects) 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 to adopt ED.

The evidence on 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 a significant negative impact on cohort racial diversity of ED. 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 the students through ED. The results of impact for specific racial groups are more nuanced. Compared to other racial groups, Asian Americans and Hispanic students are the most likely to be squeezed out as school reliance on ED enrollments increases. The magnitude of the effect is more severe for Asian Americans. This may be attributable to those students opting out of ED programs, deciding instead to use regular decision and the benefits associated with being able to generate competing offers of admission and financial aid. For ED schools, one of the clear benefits of enrolling more students early is that they attract more geographic diversity, enrolling 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 appears to be serving other institutional goals.

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Figure 1. Production Possibilities and Revenue Expansion Paths as Schools Vary Early Decision Enrollment and School Revenue Increases

The figure shows a school's production possibilities (PPF) for cohort diversity and other objectives. Each curve assumes a percentage enrolled through ED decision and a given level of school revenue. O_1C_1 assumes that the ED program is break-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, illustrated by O_2C_2 . However, as the percentage enrolled early increases, the PPF shifts eventually results in a shift inward on the x-axis, as it is not possible to increase diversity with a very large percentage enrolled early (100% at the maximum). Curve O_4C_4 illustrates the PPF associated with a high percentage enrolled early. The revenue expansion paths represent utility-maximizing tangencies. Several possibilities are shown: REP_1 (cohort diversity increases and then decreases as the percentage enrolled early increases and revenue increases); REP_2 (other objectives dominate cohort diversity as revenue and ED enrollment increases); REP_3 (cohort diversity decreases over a range, but is associated with gains in diversity as percentage enrolled early and revenue increases).

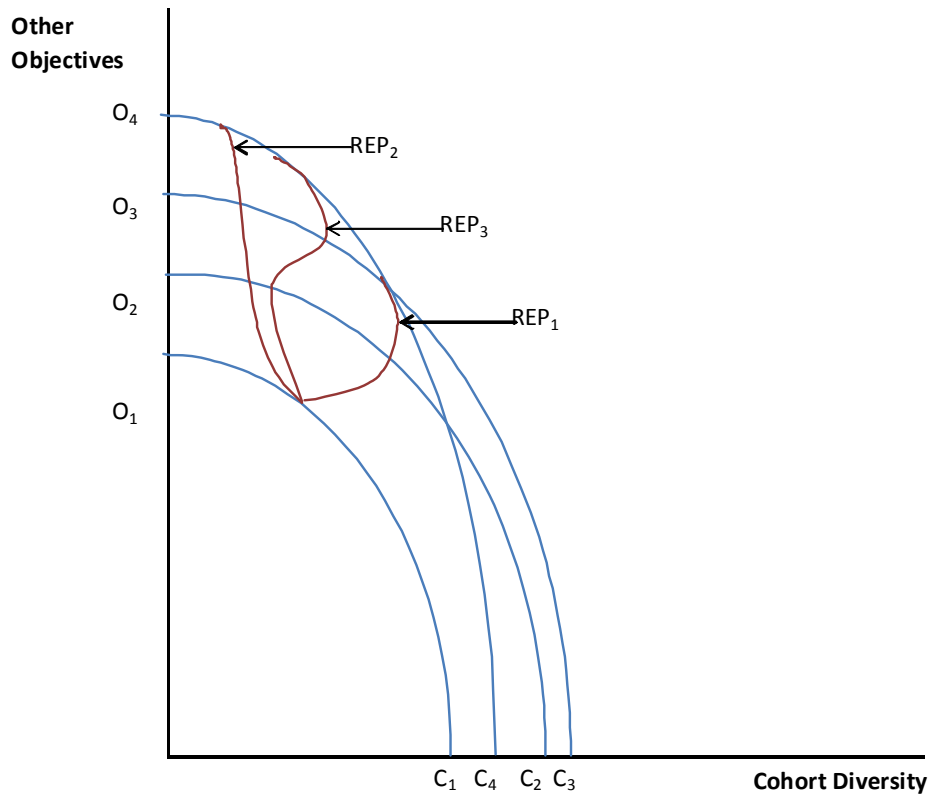


Table 1. Summary Statistics, Variable Definitions, and Differences in Means by the Decision to Adopt Early Decision

	Definition	All Schools	Has ED Program	Has no ED Program	t-test (p-value)
<i>School Cohort Diversity Measures</i>					
HHI	An index of the homogeneity of the student body, defined as the sum of the squared shares of the five racial groupings	6355.147 (1590.508)	6402.661 (1446.022)	6271.717 (1816.710)	0.540 (0.592)
Percentage of First Year Students:					
African American	% first year students who are African American	5.901 (9.262)	5.444 (7.431)	6.705 (11.785)	-1.260 (0.208)
Asian American	% first year students who are Asian American	7.463 (6.490)	7.352 (5.680)	7.657 (7.718)	-0.300 (0.766)
Hispanic	% first year students who are Hispanic	5.017 (4.148)	4.522 (3.300)	5.886 (5.215)	-2.120 (0.035)
Native American	% first year students who are Native American	0.641 (1.381)	0.567 (1.298)	0.772 (1.510)	-1.480 (0.140)
White	% first year students who are white	76.753 (14.196)	77.803 (12.060)	74.909 (17.193)	1.430 (0.155)
International	% first year students who are international	4.410 (3.500)	4.455 (3.306)	4.331 (3.823)	0.240 (0.813)
Out-of-State	% first year students who are out-of-state	60.386 (23.688)	66.794 (20.115)	49.134 (25.280)	5.160 (0.000)
<i>School Selection Measures</i>					
Early Decision (ED) Program	Equals 1 if school has ED program, and 0 otherwise	0.637 (0.481)			
% 1st Years Enrolled ED	% of first year students who enrolled as part of the ED program; N=619 and 365 for, respectively, all schools and schools with an ED program.	17.069 (16.762)	28.947 (11.500)		
<i>School Characteristics</i>					
Undergraduate Student Body Size	The total number of enrolled undergraduate students	3709.001 (3514.383)	3329.395 (3352.661)	4375.555 (3694.992)	-1.950* (0.053)
Endowment per Student (\$000)	Endowment per student in thousands of dollars	265.450 (466.223)	258.301 (326.314)	278.003 (642.656)	-0.250 (0.805)
25th percentile for SAT Math	25th percentile for the SAT scores in math	586.981 (61.184)	601.193 (54.357)	562.028 (64.532)	4.490 (0.000)

Table 1, cont.

	Definition	All Schools	Has ED Program	Has no ED Program	t-test (p-value)
75th percentile for SAT Math	75th percentile for the SAT scores in math	683.141 (51.062)	692.866 (47.166)	666.067 (53.209)	3.650 (0.000)
Liberal Arts	Equals 1 if school is a liberal arts college, and 0 if a national university	0.604 (0.489)	0.702 (0.458)	0.433 (0.496)	3.760 (0.000)
Religious	Equals 1 if the school reports a religious affiliation, and 0 otherwise	0.346 (0.476)	0.242 (0.429)	0.528 (0.500)	-4.070 (0.000)
Women	Equals 1 if the school is a women's college, and 0 otherwise	0.034 (0.182)	0.047 (0.212)	0.012 (0.108)	1.610 (0.109)
Black	Equals 1 if the school's mission identifies it as an historically black or predominantly African American college or university.	0.011 (0.106)	0.007 (0.082)	0.020 (0.139)	-1.270 (0.206)
Urban	Equals 1 if the school is located in an urban area, and 0 otherwise	0.497 (0.500)	0.424 (0.495)	0.626 (0.485)	-2.800 (0.006)
Competitive Environment Measure					
Competitors	The number of competitors the school faces, determined by both geography and SAT scores, adjusted for truncation reporting bias (see text)	34.572 (21.760)	37.833 (19.882)	28.847 (23.690)	3.000 (0.003)
School Aid/Award Measures					
% of Graduating Class who Borrowed	% of graduating class who borrowed money to finance their college education	58.244 (13.234)	56.211 (13.937)	61.815 (11.052)	-3.340 (0.001)
% 1st Years Needs were Fully Met	% of 1st 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 (0.000)
Community Diversity Measure					
HHI-C	Sum of the squared shares of racial groups living within 500-miles of the school, based on the US Census, 2000.	6226.603 (582.219)	6194.096 (455.450)	6283.680 (752.700)	-0.920 (0.359)
No. Obs		700	446	254	

The table shows variable definitions, means, and standard deviations for the key variables used in the study, measured over all years and schools, and by two categories: schools with and without ED programs. 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 2004-2007, as reported in *US News and World Report*, various issues. All data are from *US News and World Report* unless otherwise noted. t-statistics and p-values of differences in means between groups are shown (standard errors are adjusted for clustering by school). Bold (*) indicates t-statistic is significant at the .05 (.10) level, two-tailed test.

Table 2. Determinants of the Decision to Adopt an Early Decision Program

All Years/All Schools	
<i>School Characteristics</i>	
Undergraduate Student Body Size/1000	0.003 (0.014)
Endowment per Student/(\$100,000)	-0.029 (0.008)
25th percentile for SAT Math	0.002 (0.002)
75th percentile for SAT Math	0.002 (0.002)
Liberal Arts	0.380 (0.116)
Religious	-0.192 (0.091)
Women	0.290 (0.052)
Black	0.038 (0.269)
Urban	-0.034 (0.080)
<i>Competitive Environment Measure</i>	
Competitors	0.009 (0.002)
<i>School Aid/Award Measures</i>	
% of Graduating Class who Borrowed	-0.007 (0.003)
% of 1st Years Whose Needs were Fully Met	0.003* (0.002)
<i>Community Diversity Measure</i>	
HHI-C/100	-0.007 (0.007)
Year Fixed Effects	Yes

The table presents a probit model of the choice to adopt an ED program, based on 700 school-year observations. Marginal effects and standard errors reported. Standard errors are robust and adjusted for clustering by school. Bold (*) indicates significant at the 5 (10)% level, two-tailed test.

Table 3. Determinants of School Cohort Diversity Measures

	HHI	Percent of First Year Students:						
		African American	Asian American	Hispanic	Native American	White	International	Out-of-State
Panel A: OLS Models								
<i>School Selection Measure</i>								
Early Decision (ED) Program	290.888* (170.162)	0.612 (0.431)	-1.980 (0.710)	-1.466 (0.533)	-0.391 (0.142)	2.979 (1.337)	0.010 (0.592)	8.754 (3.656)
Panel B: IV (Treatment Effects) Models								
<i>School Selection Measure</i>								
Early Decision (ED) Program	921.393 (282.494)	-0.017 (4.702)	-3.362 (1.287)	-2.899 (0.735)	-1.189* (0.613)	6.833 (1.974)	-0.076 (1.002)	12.933 (4.267)
<i>School Characteristic Measures</i>								
Undergraduate Student Body Size/1000	-56.108 (36.213)	0.130 (0.100)	0.134 (0.154)	0.246 (0.125)	-0.026 (0.020)	-0.350 (0.309)	-0.146 (0.090)	0.154 (0.455)
Endowment per Student/(\$100,000)	-11.401 (18.088)	0.149 (0.121)	-0.009 (0.085)	0.001 (0.054)	0.001 (0.020)	-0.205 (0.168)	0.047 (0.051)	0.402 (0.266)
25th percentile for SAT Math	12.299 (3.330)	-0.005 (0.024)	0.011 (0.015)	-0.001 (0.009)	-0.008* (0.005)	0.033 (0.030)	-0.034 (0.010)	0.079 (0.064)
75th percentile for SAT Math	-20.617 (3.757)	-0.018 (0.023)	0.061 (0.016)	-0.004 (0.015)	0.010 (0.005)	-0.087 (0.035)	0.042 (0.010)	-0.009 (0.072)
Liberal Arts	899.030 (292.665)	-1.601 (1.263)	-2.510 (1.202)	-0.838 (1.001)	0.724 (0.272)	7.148 (2.453)	-2.160 (0.693)	-1.555 (4.316)
Religious	759.304 (172.547)	0.177 (1.035)	-2.132 (0.642)	-1.148 (0.528)	-0.324 (0.161)	5.031 (1.247)	-1.737 (0.599)	-6.081* (3.243)
Women	-1949.573 (543.126)	5.476 (2.760)	7.301 (2.401)	0.722 (0.797)	-0.201 (0.350)	-16.210 (4.402)	2.874* (1.470)	6.163 (5.509)
Black	2814.451 (474.817)	78.707 (4.673)	-9.047 (1.886)	-5.907 (0.973)	-1.091 (0.417)	-60.855 (5.423)	-2.385* (1.395)	50.090 (9.574)
Urban	-119.823 (168.826)	-0.012 (0.540)	0.569 (0.612)	-0.116 (0.624)	0.175 (0.132)	-0.904 (1.298)	0.614 (0.433)	-0.667 (2.924)
<i>School Aid/Award Measures</i>								
% of Graduating Class who Borrowed	6.963 (7.011)	-0.043 (0.022)	0.040 (0.029)	-0.012 (0.020)	0.001 (0.005)	0.014 (0.056)	0.005 (0.021)	-0.479 (0.092)
% of 1st Years Whose Needs were Fully Met	-7.030* (3.701)	0.006 (0.015)	-0.002 (0.014)	0.016 (0.010)	0.007 (0.003)	-0.035 (0.028)	0.013 (0.011)	0.069 (0.069)
<i>Community Diversity Measure</i>								
HHI-C/100	0.769 (0.148)	0.000 (0.000)	-0.003 (0.001)	-0.003 (0.001)	-0.001 (0.000)	0.006 (0.001)	0.000 (0.000)	0.005 (0.002)

The table shows coefficient estimates from OLS and IV (treatment effects) models of the effect of the availability of ED on eight dependent variables that measure aspects of cohort diversity. The table also shows coefficient estimates from IV (treatment effects) models of the effect of school characteristics, school aid/award measures, and a community diversity measure on nine dependent variables that measure aspects of cohort diversity. The IV (treatment effects) models also include controls for year fixed effects. The OLS regression models also include controls for school characteristics, school aid/award measures, a community diversity measure, and year fixed effects. Models are estimated based on 700 school-year observations. Standard errors are

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

Quartile Percentage Enrolled Early Decision	2nd (20-30%)	3rd (31-38%)	4th (>38%)
<i>School Cohort Diversity Measures:</i>			
HHI	443.166 ^a (225.148)	679.473 ^a (237.506)	838.507 ^{a,b} (257.565)
Percentage of First-year Students:			
African American	-0.017 (0.474)	0.351 (0.458)	0.309 (0.548)
Asian American	-1.120 (0.924)	-2.474 ^a (0.946)	-3.859 ^{a,b,c} (1.002)
Hispanic	-1.053 (0.653)	-1.493 ^a (0.726)	-1.967 ^a (0.812)
Native American	0.037 (0.203)	0.217 (0.274)	-0.362 ^{b,c} (0.227)
White	3.204 ^a (1.682)	4.943 ^a (1.773)	6.052 ^{a,b} (1.903)
International	-0.832 (0.735)	-1.485 ^a (0.733)	-0.465 ^c (0.872)
Out-of-State	2.8 (3.406)	7.648 ^{a,b} (3.725)	7.724 ^a (4.563)

The table shows coefficient estimates (std errors) from OLS regressions of the effects of early decision (ED) enrollments on eight cohort diversity measures. Results are based on 365 observations of schools with ED programs, 2004-2007. For each observation, ED enrollment percentages are classified into the 1st, 2nd, 3rd and 4th quartiles to create an indicator for the relevant quartile. Regressions include the quartile indicators (1st quartile is omitted) and controls for school characteristics, school aid/award measures, a community diversity measure, and year fixed effects. Standard errors are adjusted for clustering by school.