Expanding College Opportunities for High-Achieving, Low Income Students

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Abstract

Only a minority of high-achieving, low-income students apply to colleges in the same way that other high-achieving students do: applying to several selective colleges whose curriculum is designed for students with a level of achievement like their own. This is despite the fact that selective colleges typically cost them high-achieving, low-income students *less* while offering them more generous resources than the non-selective postsecondary institutions they mainly attend. In previous work, we demonstrate that the vast majority of high-achieving, low-income students are unlikely to be reached by traditional methods of informing students about their college opportunities since such methods require the students to be concentrated geographically. In this study, we use a randomized controlled trial to evaluate interventions that provide students with semi-customized information on the application process and colleges' net costs. The interventions also provide students with no-paperwork application fee waivers. The ECO Comprehensive (ECO-C) Intervention costs about $6 per student, and we find that it causes high-achieving, low-income students to apply and be admitted to more colleges, especially those with high graduation rates and generous instructional resources. The students respond to their enlarged opportunity sets by enrolling in colleges that have stronger academic records, higher graduation rates, and more generous resources. Their freshman grades are as good as the control students', despite the fact that the control students attend less selective colleges and therefore compete with peers whose incoming preparation is substantially inferior. Benefit-to-cost ratios for the ECO-C Intervention are extremely high, even under the most conservative assumptions.

JEL Codes: I21,I23,I24*

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1 Introduction

In previous work (Hoxby and Avery, forthcoming), we show that the vast majority of very high-achieving students from low-income families do not apply to any selective college or university.[2] (We call these students "income-typical.") Only a small minority of high-achieving, low-income students apply in a manner that resembles that of their high-achieving counterparts from more affluent families--namely, applying to several colleges that enroll students whose incoming achievement is similar to their own. (We call these students "achievement-typical.") What puzzles many observers is that income-typical students, having worked hard in high school to prepare themselves extremely well for college, do not even apply to the colleges whose curriculum is most geared toward students with their level of preparation. We hereafter call these "peer" colleges as a reminder that these are the colleges where most of their peers would be similarly prepared and where the curriculum is designed with such students in mind.

In the aforementioned work, we eliminate several explanations for this puzzle. First, the

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to Education, and the Smith Richardson Foundation. We are grateful to Harriet Zuckerman of Mellon, Michael McPherson of Spencer, and Mark Steinmeyer of Smith Richardson for key seminal discussions. The interventions, survey, and evaluation were supported by grant R305A100120 from the U.S. Department of Education's Institute for Education Sciences (IES) and by a generous grant from the Bill & Melinda Gates Foundation. We have been greatly helped by discussions with our IES program officers Karen Douglas and Hiromi Ono and by the energy and creativity of our Bill & Melinda Gates Foundation program officer Greg Ratliff. We had important conversations with William Bowen (Mellon), Catherine Hill (Vassar), and Henry Bienen (Northwestern). Joshua Leake-Campbell and LaTonya Page at the National Student Clearinghouse have been a great help with data. Finally, we are grateful to the ECO Project staff and the *many* research assistants who made the interventions and surveys come to life. We would like especially to thank Stephanie Adams, Christina Harvey, Alexandra Cowell, Jacqueline Basu, and Casey Cox. Deborah Carvalho, Marian Perez, Karen Prindle, and Shehnaz Kahn of the Stanford Institute for Economic Policy Research ably assisted us in project management.

[2] Hereafter, "high-achieving" refers to a student who scores at or the 90th percentile on the ACT comprehensive or the SAT I (math and verbal) and who has a high school grade point average of A- or above. This is approximately 4 percent of U.S. high school students. Hereafter, "low income" and "high income" mean, respectively, the bottom tercile and top quartile of the income distribution for families with a child who is a high school senior. Note that these are slightly income categories than we study in Hoxby and Avery (forthcoming). When we say "selective college" in a generic way, we refer to colleges and universities that are in categories from Very Competitive Plus to Most Competitive in Barron's *Profiles of American Colleges*. There were 236 such colleges in the 2008 edition. Together, they have enrollment equal to 2.8 times the number of students who scored at or above the 90th percentile on the ACT or SAT I. Later, we are more specific about colleges' selectivity: we define schools that are peer schools for an individual student, based on a comparison between his college aptitude test scores and the median aptitude test scores of enrolled students at the school.

income-typical students are not using reliable information to predict that they will fail at peer colleges because the high-achieving, low-income students who *do* apply are admitted, enroll, progress, and graduate at the same rates as high-income students with equivalent test scores and grades.[3] Second, the income-typical students are not deterred by *accurate* information about colleges' net costs (the total a student will pay for tuition, fees, and living expenses). For high-achieving, low-income students, the peer institutions that will admit them have *lower* net costs than the far less selective or non-selective post-secondary institutions that most of them attend. (See Appendix Table 1.[4]) Third, low-income students can have most application fees and testing fees waived for them if they complete sufficient paperwork, so the actual availability of fee waivers is not itself a problem. Fourth, achievement-typical students come from households and neighborhoods that are just as disadvantaged, on numerous socio-economic dimensions, as income-typical students do.[5]

In our previous work, we observe that achievement-typical students are concentrated in a small number of high schools and in very large metropolitan areas. Therefore, they are likely reached by traditional methods of informing students about their college opportunities, including (i) expert college guidance counseling at high schools with a critical mass of high-achievers, (ii) admissions staff visiting high schools or areas with a critical mass of high-achievers, (ii) colleges' encouraging visits by local students. In contrast, income-typical students--who are the vast majority of high-achieving, low-income students--are *dispersed*. They are often the sole or one of only a few high-achieving students in their school or area. Thus, their high school counselor is unlikely to have much expertise about selective colleges and probably must focus on other issues. Admissions staff cannot visit their high school or area in a cost effective manner. Income-typical students tend not to live

[3] See Hoxby and Avery (forthcoming) for information on high-achieving, low-income students. For broader evidence that the application stage is where students' behavior differs most, see Avery, Hoxby, Jackson, Burek, Pope, and Raman (2006), Bowen, Kurzweil, and Tobin (2005), Roderick, Nagaoka, Coca, and Moeller (2009), Avery and Turner (2009), Pallais (2009), Bowen, Chingos and McPherson (2009), Dillon and Smith (2012), Smith, Pender, and Howell (forthcoming).

[4] This evidence is also discussed at some length in Hoxby and Avery (forthcoming), Pallais and Turner (2006), and Hill, Winston, and Boyd (2005).

[5] See Hoxby and Avery (forthcoming).

in metropolitan areas that are home to multiple, selective colleges. In short, many high-achieving, low-income students may be unreached by traditional information methods even if counselors and admissions staff conscientiously do everything that is cost-effective for them to do.

There are two remaining explanations for the behavior of income-typical students. First, income-typical students could be well informed about their college opportunities, net costs, probabilities of success, and the availability of fee waivers. However, because they come from high schools and communities where students with their achievement are rare, they could have formed preferences or relationships that make them averse to attending postsecondary institutions that differ from those that many of their high school classmates attend. For instance, an income-typical student could be extremely well-informed but could prefer to attend a local, non-selective institution because he has a family member who needs daily help or because he is romantically involved with a low-achieving student who could not attend a selective college. Second, income-typical students could be poorly informed about their college opportunities and/or deterred by apparently small costs such as the paperwork associated with fee waivers. Although a great deal of information is apparently available on the internet, it is not easy for a neophyte to distinguish reliable sources of information on colleges' curricula, peers, and net costs from the numerous unreliable (sometimes egregiously misleading) sources that are available. Furthermore, the information available is not only not customized, it tends to assume that low-income students are low-achieving and gives them guidance that corresponds to this assumption. Probably because they are atypical, *high-achieving*, low-income students might find very little information oriented toward them.

These two explanations--income-typical students are informed but prefer non-selective colleges, income-typical students uninformed but would prefer peer colleges if they knew about them-- are not mutually exclusive. What matters, from society's point of view, is *not* whether the second explanation accounts for most or all of the income-typical students' behavior. What matters is (i) whether the second explanation accounts for *any* of the income-typical students behavior and (ii) whether there exists a cost-effective way to give such students the information and means they need to realize their full array of college opportunities. It is crucial to understand why these two things (and only these two things) matter.

Any income-typical student has *already* academically prepared himself for college through a

combination of his own effort and society's investments in him (through tax support of public schools, income transfers, other social insurance programs, philanthropy, etc.). These investments are not small: approximately 14,000 hours of the student's own time in school plus thousands of hours spent on homework, $180,000 in public school expenditures on the average student from kindergarten to grade twelve, Medicaid and related health expenditures directed to low-income families, Earned Income Tax Credits, and so on. For many students, these personal and social investments may not bear obvious fruit, but for the income-typical student they have: excellent test scores and grades that indicate that he is well-prepared for college and the careers that college graduates pursue. If the only reason that the student does not take advantage of his full range of college opportunities is that he is unaware of these opportunities or deterred from exploring them for essentially trivial reasons (such as the paperwork associated with fee waivers), then much of the enormous investment already made is potentially wasted. That is, the investment potentially earns much smaller returns than it could because of barriers that should be insignificant. Society should care about the *number* of such income-typical students because the social loss is proportional to that number. The *ratio* of income-typical students who fit under the two explanations is, in contrast, unimportant except insofar as the ratio affects the cost effectiveness of any intervention. Put another way, income-typical students who are already fully informed and prefer not to apply to peer colleges cannot be hurt by receiving information that, according to the first explanation, they already have. Thus, providing them with information can reduce the cost effectiveness of an intervention, but can do nothing more.

In this study, we simultaneously test (i) whether there are income-typical students who would change their behavior if they knew more about colleges and (ii) whether we can construct a cost-effective way to inform and help such students realize their full array of college opportunities. We implement this test by randomly assigning interventions that contain semi-customized information and/or no-paperwork application fee waivers to 39,677 students, including 7,749 students who serve as controls (they are evaluated but receive no treatment). The interventions are designed to be low-cost (about $6 per student) and fully scalable. Crucially, the interventions are delivered directly to the students and, therefore, do not depend on students being concentrated geographically or having a counselor who has time to work with them. The interventions are specifically designed to test

prominent hypotheses about the information and other barriers most often thought to affect high-achieving, low-income students. We survey the students and also use the National Student Clearinghouse's (NSC's) administrative data to ascertain how the interventions affect students' college applications, admissions, enrollment, and --to a limited extent given the recentness of the interventions-- success in college.

We show both intention-to-treat and treatment-on-the-treated effects of the interventions. We set a very conservative standard for a student's having been treated: whether he or she was aware of having seen the intervention materials at all. The intention-to-treat effects are dilute versions of the treatment-on-the-treated effects because a good share of the interventions were not actually received or noticed by participants–most often owing to family members' discarding the intervention materials because they did not recognize the *bona fides* of the intervention organization, The Expanding College Opportunities project (ECO). The lack of recognition of ECO is inherent in the randomized control trial: ECO could not establish a high-profile among the public without contaminating the control group. Because this dilution would likely not occur if the interventions were brought to scale by a highly reputable organization such as The College Board, ACT, or another third party, the treatment-on-the-treated effects are the best guide to the likely effects of the interventions at scale.

The remainder of this paper is organized as follows. In the next section, we explain the interventions and how they were targeted to students. We describe the data we use to select potential participants and to evaluate their responses. In section 3, we demonstrate that the randomization worked --that is, each of the treatment and control groups looks alike on observable characteristics. We also show that there was no differential survey response or differential NSC coverage that could plausibly bias our results. In section 4, we present the effects of the ECO-C Intervention, which combines semi-customized information and low-paperwork fee waivers, on students' application, admissions, and enrollment. In section 5, we demonstrate that the ECO-C Intervention had its greatest effects on students in our target group: low-income students who are relatively isolated high-achievers. In section 6, we evaluate the role played by specific elements of the intervention by examining the outcomes of students who were assigned only parts of the ECO-C Intervention. We perform a variety of cost-benefit analyses in Section 7, and we conclude in Section 8.

Owing the large amount of material we cover in this paper, we have written a companion paper that more thoroughly describes how the ECO project was implemented and the research literature related to the ECO project. We also confine some material to online appendices.

2 The Expanding College Opportunities Project

a The Origins of the Expanding College Opportunities Project

Using administrative data for the entire population of students who take any College Board or ACT exam, Hoxby and Avery (forthcoming) show that many high-achieving, low-income students fail to apply to any selective postsecondary institution. In failing to do so, they act in a manner that is typical of students with the same income (they are "income-typical," despite their unusually high achievement) rather than the manner typical of students with the same achievement ("achievement-typical"). This evidence is reinforced by studies of mid-achieving, low-income students who, it appears, are also unlikely to choose colleges for which they academically best prepared.[6] Given the mounting array of evidence, a number of leaders of postsecondary institutions decided to support research on interventions that might inform low-income students about their college opportunities.[7] Several foundations and the Institute for Education Sciences also provided support.[8] The two main college assessment organizations in the U.S., the College Board and ACT, agreed to provide data.

A consortium model of support was logical because informing students about their opportunities is a public service. If one institution made the effort to inform students on its own, many of the benefits would accrue to other colleges. That is, informing high-achieving, low-income students about their full array of college opportunities may benefit society, but it does not ensure that any particular college ends up with students whom it prefers.

Moreover, it would not make sense for one postsecondary institution to undertake the task of informing students because there are enormous economies of scale in the data gathering and database

[6] See, for instance, Bowen, Chingos and McPherson (2009), Dillon and Smith (2012), Smith, Pender, and Howell (forthcoming).

[7] See the acknowledgments.

[8] See the acknowledgments.

infrastructure that support semi-customized interventions like those of the ECO Project. By "semi-customized," we mean that each part of the interventions has a standard framework but that this framework is filled with information that is most likely to be relevant to the student. That is, given a rich database infrastructure and intervention framework, we can ensure that students see information about colleges that are local, colleges at which they will pay in-state rates, financial aid for which they would qualify, and the like. The semi-customization of the interventions is described below.

The project focuses on *high-achieving*, low-income students because these students' behavior deviates the most from the behavior of affluent students with the same achievement. The focus also made sense because high-achieving, low-income students generally pay *less* to attend a college that has higher graduation rates, richer instructional resources, and a curriculum designed for students who are highly prepared, as they are (Appendix Table 1).

The interventions were designed to meet several constraints. First, the aforementioned research had demonstrated that income-typical students could not be informed about college in a cost-effective manner via traditional recruiting methods that depend on students being geographically concentrated. This is because income-typical students are geographically dispersed. (The opposite is true of the small minority of high-achieving, low-income students who exhibit achievement-typical behavior. These students are *highly* concentrated in a small number of schools and areas.) Thus, we designed interventions that did not depend on geographic concentration for their efficacy. They did not require that students show up at a central location or be visited in person, for instance. Second, the research had demonstrated that income-typical students were extremely unlikely to have a teacher or counselor who was expert in the process of applying to selective colleges or who had time to research colleges with the rare high-achieving student. Thus, the interventions were designed to go directly to students themselves, not to teachers or counselors who would have to relay them to students. Third, the interventions were designed to be both fully scalable and semi-customized in ways that were inexpensive and yet "smart." By "smart," we mean that the interventions were intended to take advantage of the enormous economies of scale that arise when a central organization efficiently uses large databases to inform the intervention that each person encounters. It is these economies of scale that account for the interventions' low cost of about $6 per student. Fourth, the

interventions were designed to take advantage of the enormous amount of reliable information about colleges that was already available. A naive student may find it hard to determine for himself which online and other information sources are reliable, but the interventions could inform students about how to use accurate data sources such as the U.S. Department of Education's College Navigator. Fifth and perhaps most important, because informing students about their opportunities was a public service, the interventions were written in the voice of a trusted third party. The interventions are designed to help a student gather the information that he needs to make a knowledgeable decision for himself. They do *not* direct students to any particular college or group of colleges.

b Hypotheses about Income-Typical Students' Behavior and the Interventions Designed to Test Them

There are at least four prominent hypotheses about why income-typical students exhibit application behavior very different from that of high-achieving, high-income students. We designed the interventions to test each of the four hypotheses.

Hypothesis I is that income-typical students lack the advice that a expert college counselor would give a high-achieving student. An expert counselor would advise such a student to apply to eight or more colleges, most of which would be peer colleges whose median student scores within 5 percentiles of the student's own score. A student would also typically be advised to apply to a couple of colleges whose median student scores 5 to 10 percentiles above him and one or more colleges whose median student scores 5 to 10 percentiles below him. These colleges are sometimes described as "match," "reach," and "safety" colleges, but we prefer the "peer" nomenclature because it focuses us on preparation and curriculum as opposed to strategy. An expert counselor would also advise a student to obtain letters of reference; take college assessments on schedule; send verified assessment scores to colleges; write application essays; complete the Free Application for Federal Student Aid and the CSS Profile; and meet all other deadlines and requirements of selective colleges' applications.[9] Finally, an expert college counselor would advise a student to compare colleges on

[9] The CSS Profile gathers financial and tax information similar to that required by the FAFSA. It also requires some additional information. The colleges and universities that offer the most generous financial aid tend to require the CSS Profile in addition to the FAFSA. This is because they require more information to construct richer aid packages well.

the basis of their curricula, instructional resources, other resources (housing, extracurricular resources), and outcomes (such as graduation rates).

The *Application Guidance* intervention was designed to test Hypothesis I. It provides the aforementioned information and gives students timely and customized reminders about deadlines and requirements. It provides students with semi-customized tables that compare colleges' graduation rates. The student is always confronted with the graduation rates of his nearest colleges, his state's flagship public university, other in-state selective colleges, and a small number of out-of-state selective colleges. (Colleges in latter two categories are selected at random among those that qualify.) Students' secondary materials show the graduation rates of four-year colleges nationwide. Moreover, students' primary materials explain how to use tools like the College Navigator to investigate colleges' curricula, instructional resources, and housing in detail.

Hypothesis II is that income-typical students misperceive their costs of attending selective colleges. Specifically, we hypothesize that students focus unduly on colleges' "list prices" (the tuition and fees that an affluent student who received no aid would pay) and fail to understand the net costs for students like themselves. We also hypothesize that students are unaware that some colleges provide financial aid for living expenses while other colleges do not. We suspect that income-typical students do not realize that they would generally pay *less* to attend colleges that were more selective and that had richer instructional and other resources (Appendix Table 1).[10]

The *Net Cost* intervention was designed to test Hypothesis II. It provides students with information about net costs for low- to middle-income students at an array of colleges. The materials are semi-customized in that a student will always see the list prices, instructional spending, and net costs of his state's public flagship university, at least one other in-state public college, nearby colleges, a selective private college in his state, one out-of-state private liberal arts college, and one

[10] The reason why a student might especially mistake the cost of attendance at selective colleges is that institutional aid is a large part of a low-income student's financial aid package. This is especially true since 2000 because selective colleges have increased their institutional aid to low-income students (Hill, Winston and Boyd, 2005; Avery, Hoxby, Jackson, Burek, Pope, and Raman, 2006; Pallais and Turner, 2006). It is not surprising, then, that Avery and Kane (2004) find that students from economically disadvantaged backgrounds are particularly likely to err when they estimate what various colleges would cost them. Similarly, Avery and Hoxby (2004) show that, compared to their higher-income counterparts, low-income, high-achieving students are less likely to understand their actual cost of attendance and more likely to be confused by superficial variables, such as list prices and whether a grant is called a "scholarship".

out-of-state private selective university. (Institutions in the latter categories are selected at random from among those that fit the criteria.) The net cost information is shown for hypothetical families with incomes of $20,000, $40,000, and $60,000. Students' secondary materials contain net cost information for a fuller array of colleges nationwide.

The Net Cost materials are not intended to give a student precise information about his net costs but, rather, to make him recognize that list prices and net costs can differ greatly--especially at selective institutions. The materials repeatedly state that a student will not learn exactly how much a given college will cost him *unless he applies*. The Net Cost materials also explain how financial aid works, emphasize how crucial it is to complete the FAFSA and CSS Profile on time, clarify how a student's Expected Family Contribution is computed, decipher a prototypical financial aid offer, and illustrate the trade-offs between loans, grants, and working while in college.

Hypothesis III is that income-typical students are deterred from applying to college by application fees. At first glance, this hypothesis might seem unlikely because low-income students are eligible to have most application fees waived. (They are also eligible to have most college assessment fees waived.) Obtaining a fee waiver requires some paperwork, most often income verification by a counselor or similar authority. Students can also qualify for College Board fee waivers by completing the CSS Profile. None of the required paperwork is particularly onerous, and it is a modest element of the entire process of applying to a selective college. Nevertheless, Hypothesis III is plausible for a few reasons. A student may fail to realize that fee waivers are available until it is too late to qualify for them. (Details about obtaining a waiver are often on the *final* screens or pages of a college application.[11]) Or, a student who may be willing to fill out financial aid forms to be analyzed by a stranger may still balk at revealing his family's income to a counselor. Or, his counselor may be too busy to do his part of the fee waiver process. Indeed, research by Bettinger, Long, Oreopoulos and Sanbonmatsu (2009) suggests that apparently modest FAFSA paperwork deters some students from applying to college.[12]

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[11] For instance, a student who is applying to colleges online might not see detailed information on fee waivers until the very last screens of the process.

[12] However, it is not obvious that the Bettinger, Long, Oreopoulos, and Sanbonmatsu(2009) evidence is relevant to our target students. The students they evaluate tend to be marginal applicants for any college, not very

(continued...)

The *Fee Waiver* intervention is designed to test Hypothesis III. It provides students with no-paperwork fee waivers that allow them to apply to a 171 selective colleges.[13] When we recruited colleges to accept ECO fee waivers, we specifically agreed to reimburse institutions for any case in which a student utilized a fee waiver when he was, in fact, ineligible based on that institution's waiver criteria.[14] The Fee Waiver materials instruct students on how to submit an ECO fee waiver--some institutions preferred students to mail paper waivers while others preferred that students enter an ECO code on their online applications.

Hypothesis IV is that it is the *parents* of income-typical students, rather than the students themselves, who cause the divergence in application behavior by family income. Specifically, there are ethnographic studies that suggest that low-income parents fail to perceive differences among postsecondary institutions.[15] For instance, they may fail to differentiate among institutions that offer 2-year versus 4-year degrees, have low versus high graduation rates, have poor versus rich instructional resources, offer meager versus generous financial aid, and so on. Thus, parents may focus on low-list-price institutions that are very nearby, to the exclusion of all other alternatives.

The *Parent Intervention* was designed to test hypothesis IV. It consists of materials that cover the same information presented to students in the Application Guidance and Net Cost part of the intervention, but the materials are explicitly addressed to parents and the information is conveyed differently. Specifically, the materials are written to be accessible to adults who have limited education, limited familiarity with American higher education, and limited English skills. Parents who live in a neighborhood where Spanish speakers prevail received materials in both English and Spanish. In addition, the materials emphasize issues that, according to the ethnographic research,

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[12](...continued)
high-achieving students who are excellent applicants for selective colleges.

[13] 171 is the number of colleges for the ECO-C Intervention, which is mainly what we evaluate in this paper. The number of colleges was 151 for the 2010 high school graduating cohort of students, on whom we do not focus except for a subset of results.

[14] Institutions' criteria for waiving application fees differ somewhat. Since we wanted the fee waivers to be simple, we did not attempt to incorporate all of the different criteria. In addition, a small percentage of the students in the ECO evaluation would have family income above most colleges' thresholds for waiver eligibility. See the section on targeting below.

[15] See, for instance, Tornatzky, Cutler, and Lee (2002).

especially concern parents: financial returns to college, financial aid (especially loans), and differences in time-to-degree among colleges.

c Development of the ECO-C Intervention

We randomly assigned the four interventions to students in our Pilot cohort of 2009 high school seniors and in 2010 cohort of high school seniors.[16] Although the materials sent to the Pilot cohort were formulated with the help of experienced college mentors, admissions staff, financial aid staff, and student focus groups, we obtained substantial new information after the Pilot year, using focus groups drawn from the Pilot cohort itself. While much of the feedback confirmed our prior information, we learned some things worthy of note.

First, families strongly preferred to receive paper materials in the mail, as opposed to receiving electronic materials by email or other online means. Families also preferred materials that did not look like typical college recruiting brochures. We therefore adjusted our dissemination strategy and sent virtually all materials by mail (with extensive online backup, links, and secondary materials). Each intervention was sent in a tabbed, expandable file designed to help students organize their materials for *multiple* college applications. That is, the design was meant to signal that ECO intended to help them learn about their *options*, not recruit them for a specific college.

Second, families were often suspicious of the interventions (especially anything that was online) because they feared falling prey to for-profit firms selling college advice. We investigated these firms to ensure that the design of our materials was as distinct as possible from theirs. We also ensured that all ECO materials prominently stated that the project was research conducted by the principal investigators and funded by the relevant foundations and IES. We promptly answered questions about the project by email and telephone, often assuring families that it was legitimate research. While these efforts reassured some wary families, the credibility of the ECO project continued to be an issue simply because we could not give the ECO project a strong, public presence without contaminating the randomized experiment. In particular, we did not want the control group to know what the interventions were, and we did not want the students to know what hypotheses we were testing. We believe that credibility would *not* be an issue if the same interventions were

[16] Parent Intervention materials were sent only to the 2010 cohort.

conducted by a well-known non-profit organization with a public presence. We return to this issue below because we are confident that it caused the take-up rate of the experimental interventions to be substantially below that which a well-known organization would attain.

As an aside, we discovered that there was good reason for families to be suspicious of firms offering free college advice. Numerous for-profit firms offer initial advising materials for free but then charge substantial fees once a family is engaged. We found multiple firms that sell information that is inaccurate and many firms that sell information that is available for free elsewhere. Some websites that appear to offer unbiased advice are actually recruiting tools for specific, profit-making institutions. A neophyte might have considerable difficulty distinguishing between public-minded organizations that offer reliable information and firms that offer inaccurate or overpriced information.

Third, we learned that particular members of each family tended to vet incoming college-related mail, regardless of to whom it was addressed. By "vet," we mean that the person felt free to discard or read the materials before handing them to the addressee. This person was sometimes a parent, sometimes the student himself (in the case of the Parent Intervention), and sometimes another adult. In many cases, the same member of the family vetted incoming college-related email. In short, we learned that our attempts to direct interventions to particular family members were largely useless.

Fourth, we found that the Fee Waivers had a consequence that we had not foreseen. Like "earnest money," the Fee Waivers apparently made families believe that the information was provided with earnest intentions. This caused them to pay more attention to materials that accompanied the Fee Waivers.

Having learned these lessons, we created the ECO Comprehensive or "ECO-C" intervention. It combines the Application Guidance, Net Cost, and Fee Waiver interventions. It does not include the Parent Intervention because we concluded that materials directed to parents were often read by students and *vice versa*. Since the Parent Intervention simply bundled content from the Application Guidance and Net Cost interventions in a different way, we believed that it would prove repetitive if added to the ECO-C Intervention.

We randomly assigned the ECO-C Intervention, each of the four interventions, and control status to 3000 students, per treatment, in the cohort of 2011-12 high school seniors. Most of the

findings in this paper are based on the results of that randomized control trial.

The key features of the ECO-C Intervention and each intervention are summarized in Appendix Figure 1.

d Selecting Students for the Evaluation

We identified target students by combining student data from the College Board and ACT with data from an array of sources that allow us to estimate whether a student comes from a low-income family. The data combination and estimation process is described in greater detail in Hoxby and Avery (forthcoming).

Briefly, we start with data that contain a student's College Board or ACT scores, his location at the level of a Census block (the smallest unit of geography in the Census), his high school, his self-reported high school grade point average (which has been demonstrated to be quite accurate), the identity of the postsecondary institutions where he sends his scores, and a variety of information that the student reports about his high school experience and his college plans (if any). We match each student to 454 variables that describe the socio-demographics of his neighborhood (at the Census Block Group level), the socio-demographics and other characteristics of his high school, the history of college application and college attendance among former students of his high school, the scores of former students of his high school on college assessments and statewide high school exams, and income information on his zip code from the Internal Revenue Service. The variables focus on issues that summarize or predict parents' and other local adults' incomes; parents' and other local adults' educational attainment; local house values (a key measure of wealth); race; ethnicity; and the propensity to apply to postsecondary institutions, to four-year colleges, and to selective colleges. A list of these variables is available in Online Appendix Table 1. The variables come from the student's self-description at the time he or she took a college assessment, from the U.S. Department of Education's Common Core of Data (2009) and Private School Survey (2009), from the 2000 Census of Population and Housing, from Geolytics 2009 estimates for Census Block Groups, from the Internal Revenue Service, and from statistics computed by the authors for each U.S. high school

using multiple years of past College Board and ACT data.[17]

We use all of these variables to estimate students' family incomes, where the verified income variable that we use to generate our parameter estimates comes from financial aid data (which we have for about one tenth of students). We estimate students' family income rather than use the students' self-reported family income because the majority of College Board test takers do not answer the question about family income and because ACT test takers understate their incomes.[18] We are most likely to underestimate a student's income if he lives in a neighborhood and attends high school with poorer people. Symmetrically, we are most likely to overestimate a student's income if he lives in a neighborhood and attends high school with richer people. Put another way, we are better at estimating a student's family's permanent income than current income. This is desirable from a policy perspective because disadvantage is more a function of a family's permanent (lifetime) income than its current income, which can be temporarily affected by job loss, insurance benefits, and the like.

For the 2011-12 cohort of high school seniors, we used a random number generator to randomly select 18,000 students. 12,000 of these were our target students who:

(i) scored in the top decile of test-takers of the SAT I or ACT (1300 math plus verbal on the SAT, 28 on the ACT);[19]

(ii) had estimated family income in the bottom third of the income distribution for families with a twelfth grader (based on the 2007-2011 American Community Survey);

(iii) did *not* attend a "feeder" high school.

We define a feeder high school as one in which more than 30 students in each cohort typically score

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[17] Specifically, there are 48 variables based on students' self-descriptions when they took the ACT or SAT test, 36 variables from the Common Core of Data, 165 variables from the 2000 Census at the Block or Block Group level (whichever was the most disaggregated available), 82 variables from the Geolytic 2009 estimates, 24 variables based on Internal Revenue Service data, 98 variables computed for high schools by the authors using historical College Board and ACT data, and 1 variable that contains the authors' estimate of the student's family's income.

[18] See Hoxby and Avery (2013) for an explanation of the income understatement in ACT data.

[19] The 2011-12 cohort was drawn from takers of College Board tests while the 2009-10 and 2010-11 cohorts were drawn from both College Board and ACT test takers. However, the effects are very similar between the 2010-11 and 2011-12 cohorts, with one exception noted below that was due to external circumstances, not the sample.

in the top decile on college assessment exams. The test score cut-offs ensure that all the selected students have a high probability of admission at the 236 most selective colleges in the U.S. This corresponds to the set of colleges in Barron's Most Competitive, Highly Competitive, and Very Competitive Plus categories.[20]

For the 2011-12 cohort of high school seniors, we also randomly selected 6,000 students who met the same test score criteria but who had estimated family income above the bottom tertile and/or attended a feeder high school. Although these students are outside our target group, we selected some of them--at a lower sampling rate--so that we could test whether the effects of the ECO-C Intervention were different for the target students than for non-target students. Most of the results shown in this paper are for target students. It will be clear when we use data on non-target students.

For the 2010-11 cohort and 2009-10 Pilot cohorts, we selected totals of--respectively--12,500 and 9000 students in a similar manner.[21]

Once students were selected from each cohort, we randomly assigned an equal number to each intervention offered that year or to the control status. Most of the results shown in this paper are for students from the 2011-12 cohort because only they experienced the ECO-C Intervention. It will be clear when we show findings based on the interventions applied to students in the 2010-11 cohort. We do not show results for the 2009-10 Pilot cohort because--as mentioned above--the interventions changed substantially after feedback from the pilot year.[22]

e Tracking Application Behavior, Admissions, and Enrollment

To evaluate students' response to the ECO-C Intervention and interventions, we obtained two

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[20] For the 2009-10 Pilot cohort and 2010-11 cohort, we eliminated students who did not self-report a grade point average of A- or above. However, given the test score cut-offs, this criterion eliminated only a small share of students--more often because they failed to self-report *any* variables than because they actively reported a grade point average below A-. We therefore did not apply this criterion to the 2011-12 cohort, the cohort we mainly evaluate in this paper.

[21] Because we had more data with each subsequent cohort, we refined the income estimation process between each cohort. Using the 2011-12 estimation process to re-select students from the 2010-11 cohort, we can confirm that the refinement did not substantially affect the results for those two cohorts. However, we used students' self-reported family incomes to select some students in the 2009 Pilot cohort. This proved to be a mistake because the self-reports turned out to be inaccurate and systematically biased downward among ACT takers.

[22] Once we allow for the difference in selection (see previous footnote), the estimated effects of the interventions for the pilot year are largely consistent with those for the next (2010-11) cohort.

sources of data on their application behavior, admissions outcomes, and college enrollment. First, we surveyed students during each summer after they were selected for an ECO treatment or control group. In the summer after he is expected to graduate from high school, each student is asked to take a fairly comprehensive survey on his college application process, where he was admitted, what his financial aid offers were, and so on. The resulting survey data are so rich that most of the variables must be analyzed in future papers by the authors. In the summers after which the student might have completed a year of college, each student is asked to complete a shorter survey that measures college enrollment, course-taking, time allocation in college, work for pay, and degree attainment.

Our second source of outcome data is NSC data on enrollment, persistence, and progress toward a degree. These data are reported by postsecondary institutions. The NSC covers 96 percent of students enrolled in colleges and universities in the U.S.[23] Our selected students are matched to NSC data using their names and birth dates. This is a largely accurate match, but it is not perfect owing to variation in how students write their names and owing to typographical errors in students' reported their birth dates.

We report descriptive statistics for variables in the dataset in Online Appendix Table 2.

3 Randomization, Survey Response, and the Probability that ECO Materials Are Seen by the Intended Recipient

In a randomized controlled trial such as this, the econometrics entail only fairly simple comparisons between the treatment and control group so long as (i) the groups were actually selected at random and (ii) there is not differential attrition. In our case, differential attrition could take the form of students failing to respond to the survey in such a way that they bias the comparison between treatment and control groups. In this section, we explore these issues.

We also describe the extent to which students who were sent intervention materials did not actually see them. That is, we describe the extent to which students whom we "intended to treat" were actually "treated."

[23] The source is http://www.studentclearinghouse.org/about/.

Given our use of a random number generator, the large number of students in each treatment group and the cohort group (3000 in the 2011-12 cohort), and the Law of Large Numbers, we expect each group to be have observable and unobservable characteristics that are the same. Nevertheless, it makes sense to check that the groups' observable characteristics are, indeed, as similar as we expect with randomization. To do this, we check the 454 predetermined (pre-treatment) variables that we used in the process of selecting students. These variables describe the student, his family, his neighborhood, his high school, and the college-going behavior of students in his high school in previous years.[24]

We regress each of the 454 predetermined variables on indicators for a student's treatment group and his cohort. We find that 3.2 percent of the coefficients on the treatment group indicators are statistically significantly different from 0 at the 5 percent level and that less than 1 percent are statistically significantly different from 0 at the 1 percent level. These results are consistent with the randomization having worked just as intended.

66.9 percent of students answered the survey. While this is a high response rate, it is nevertheless possible that, *within the survey respondents*, the randomization fails so that the characteristics of the treatment and control groups differ. We do not find evidence of such failure, however. Using just the students who answered the survey, we again regress each of the 454 predetermined variables on treatment group and cohort indicators. We find that 1.7 percent of the coefficients on the treatment group indicators are statistically significantly different from 0 at the 5 percent level and that less than 1 percent are statistically significantly different from 0 at the 1 percent level. This evidence is consistent with there being no *differential* survey response that could bias our results.

Another way to judge whether the survey-based outcomes will generate unbiased results is to compare the institution in which the student reports enrolling (in the survey) with the institution in which the student appears to enroll in the NSC data. These institutions are the same 95.2 percent of the time. The remaining 4.8 percent of the time, the institutions are not identical but the differences are not systematic. For instance, it does *not* appear that students are overstating their true

[24] Note that the 454 variables are not independent. This is useful information for interpreting the tests that we describe.

institution in the survey. When the institutions are not identical, the survey-based institution has a lower Barrons' competitiveness ranking 2/5ths of the time, a higher Barrons' ranking 2/5ths of the time, and the same Barrons' ranking 1/5th of the time. More precisely, the Barrons' rankings of the survey-reported and NSC institutions are not statistically significantly different in a paired t-test. While we find that students who answer the survey attend institutions with slightly higher Barrons' rankings than students who do not answer the survey,[25] what matters for our results is whether the survey-NSC ranking gap differs across treatment and control groups. We find that this gap does not differ statistically significantly across the groups.[26]

Using a combination of individual inspection and cross-validation with colleges' student directories, we conclude that at least half of the survey-NSC conflicts in the enrolled institutions occur because the student has been matched to the wrong person in the NSC. (Because the match uses only names and birth dates, incorrect matches are possible although unlikely.) The remaining conflicts appear to be due to students really changing their institution of enrollment between the time they are surveyed and the time they enroll in the fall. Some of these changes are minor--for instance, changing between the Stout and Eau Claire campuses of the University of Wisconsin.

When we consider NSC-based outcomes, we adjust our estimates for the attenuation bias caused by having a small percentage of the students matched to the wrong person in the NSC data.[27]

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[25] The difference is 0.4 ranks when we convert the Barrons' (plus) groups into numerical groups based on their order. The conversion is 12=Most Competitive, 11=Highly Competitive Plus, 10=Highly Competitive, 9=Very Competitive Plus, 8=Very Competitive, 7=Competitive Plus, 6=Competitive, 5=Less Competitive, 4=Noncompetitive but still in the Barrons' *Profiles of American Colleges*. Two-year institutions and *many* four-year institutions are not listed at all in Barrons' *Profiles*. Also, specialty institutions such as culinary schools are an awkward fit for the Barrons' vertical ranking on selectivity. They have a separate category in Barrons, known as "Special," that we have explored as an outcome without producing results of much interest. The 0.4 difference in ranks is the same if we assign plausible rankings to institutions that do not appear at all in Barrons' *Profiles*. For instance, we have tried assigning non-selective, non-appearing four-year institutions the number 2 and assigning non-selective two-year institutions the number 1.

[26] In fact, the point estimates of the gaps have the "wrong" sign if one is concerned that treated students (relative to control students) are less likely to respond to the survey if they enroll in a low selectivity institution. That is, the survey-NSC gap in the enrolled institution's ranking is (very slightly) larger for control group students, but their gap is not statistically significantly different from the gap for students in any treatment group.

[27] Students being matched to the wrong person causes attenuation bias of a simple form. Some percentage of NSC outcomes are for people whom we did not, in fact, attempt to treat. Therefore, the treatment indicator is erroneously set to 1 in some percentage (we assume 2.4 percent) of cases when it ought to be set to 0. The remedy (continued...)

Specifically, we assume that 2.4 percent of the students are matched to the wrong person's outcomes.

A related issue that affects all estimates but especially NSC outcomes is undeliverable mail. We sent intervention materials to the address that each student had when he or she registered for a college assessment exam. The gap between our sending materials and the student's registration date was usually four to fourteen months, although the lag was shorter in some cases. Thus, some students had moved between the day they registered for an exam and the day we sent interventions. Also, a small share of addresses supplied by students are incomplete--most often, an apartment or unit number is missing. When such situations arise, the ECO-C Intervention materials are undeliverable. The materials are sometimes though not always returned to us. We received return-to-sender mail for 10 percent of our targeted participants, and it is likely that some additional percentage of materials was undeliverable but was not sent back to us because the people at the address did not bother to return it. In any case, households that do not receive any materials are clearly untreated by the interventions, and in a typical research design they would not even be recorded as participants whom we *intended* to treat since they could not possibly have been treated.

This leads us to two points. First, if the interventions were to be run at scale by an organization--such as the College Board, ACT, or third party--that sent intervention materials at the same time students received their test scores, most of the undeliverable mail problem would disappear because most of it is due to students who move. That is, the undeliverable mail problem arises in the experiment, which is not timed tightly with test-taking, but would occur much less in an at-scale program. Second, when we compare enrollment outcomes based on the NSC to enrollment outcomes based on our survey, we rescale the NSC outcomes for the undeliverable mail problem. This is because survey-based outcomes are relatively unaffected by the problems: a person who could not receive intervention materials owing to moving or a bad address also would not have received an invitation to take the survey. To rescale the NSC-based outcomes, we use a simple Wald (1940) Estimator that rescales the intention-to-treat by the actual probability of receiving the mail.[28]

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[27](...continued)
for such attenuation bias is a re-scaling of each coefficient estimate.

[28] Note that the Wald Estimator is the appropriate remedy, as opposed to dropping potential participants whose intervention materials were returned to us. This is because we do not send control students interventions
(continued...)

More generally, there is a significant gap between the intention-to-treat and treatment in the experiment, and we believe that a substantial share of this gap would disappear if the interventions were done at scale by a well-known, reputable organization such as the College Board, ACT, or a third party organized for the purpose. The nature of the experiment made it necessary for ECO to maintain a very low profile for fear of contaminating the control group or informing the participants of the hypotheses under consideration. This very low profile undoubtedly contributed to households' discarding the materials without the intended recipient ever seeing them. If, for instance, intervention materials were delivered in coordination with students' receipt of their college assessment scores, it is likely that few materials would be discarded out of hand.

In order to present the effects that the interventions would likely have if conducted by, say, The College Board, we show treatment-on-the-treated effects where treatment is defined very broadly so that any intended participant who could merely remember having received the materials is counted as treated. This measure of treatment is meant to show what a reputable organization could expect, not to indicate the effect of reading the materials thoroughly--a treatment whose effects we will probably never know.[29] To compute the percentage of participants who were treated (broadly defined), we conducted a very brief telephone survey of a sample random of 200 students in each of the treatment groups (not the control group) in the 2010-11 cohort.[30] We simply asked them whether they could recall having seen any materials from the Expanding College Opportunities project. Among students who were assigned to the Fee Waiver treatment, 40 percent could recall the materials. Among students who were assigned to another treatment, 28 percent could recall the materials. As described in the previous section, we believe that these low percentages reflect families' mistaking the materials for solicitations from companies engaged in for-profit college

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[28](...continued)
materials, so we naturally do not observe which of them would have such materials returned to us.

[29] We could learn the effects of such a treatment by giving students an incentive to read the materials online and monitoring the time they spent doing so. However, we do not think that such a version of the treatment is scalable, so we do not test it. The goal of the project was to test *fully* scalable interventions.

[30] We did not attempt to survey all participants on this question for fear of changing the nature of the intervention since a full-scale intervention would not include such telephone calls. Since the calls could potentially generate Hawthorne effects, we have verified that the participants who received such calls do not exhibit outcomes that differ from those who did not. The survey was conducted at the end of the students' senior year in high school.

advising and parents discarding mail addressed to their children from organizations without a well-known profile.

The bottom line is that we use the above percentages to construct Wald Estimates of the treatment-on-the-treated.[31] These estimates are our best estimate of the effects that an organization could expect to get if it were well-known and reputable (as the College Board and ACT are) and if it conducted the interventions with timing that was coordinated with students' receiving their test scores. More generally, we invite readers to interpolate between the intent-to-treat and treatment-on-the-treated estimates as they see fit, according the way they envision fully-scaled-up interventions being conducted.

In summary, all of our tests confirm that randomization worked as intended to create statistically same treatment and control groups. The randomization also worked as intended if we consider only those students who answered our survey. We are therefore confident that our estimates reflect the *causal* effect of the ECO interventions. We present both intention-to-treat results and treatment-on-the-treated results, where as student is defined as treated if he or she merely remembers having received ECO materials.

4 The Effects of the ECO-C Intervention on Students' College Applications, Admissions, and Enrollment

In this section, we describe the effect of the ECO-C Intervention on students' outcomes. Because the ECO-C Intervention was given only to students in the 2011-12 cohort, all of the results shown in this section are based on them only. In later sections, we show results for the interventions for which we have data from the 2010-11 cohort as well.

We show estimates of the intent-to-treat effect, β, from the straightforward regression.

(1) $$Outcome_i = \alpha + \beta \cdot ECOinterv_i + \varepsilon_i$$

[31] We conducted the telephone survey for a cohort in which the (combined) ECO-C Intervention was not used, but it is clear from conversation with participants that it is the fee waivers that account for the greater memorability and credibility of the Fee Waiver intervention materials. Therefore, we use 40 percent as the percentage of participants who were treated for both the Fee Waiver and (combined) ECO-C Intervention.

where *Outcome* is the relevant application, admissions, or enrollment outcome and *ECOinterv* is an indicator variable for the student's having been assigned to the ECO-C Intervention.[32] The estimate of the parameter α records the average outcome among students in the control group.

We also show estimates of the treatment-on-the-treated-effect based on the Wald Estimator

$$\frac{\hat{\beta}}{Prob(Recall\ \ Intervention)} \tag{2}$$

where *Prob(Recall Intervention)*, our measure of treatment, is equal to 40 percent for the ECO-C Intervention.

Our estimating equation (1) does not control for any predetermined covariates, such as a student's gender, race, ethnicity, and neighborhood characteristics. This is because we found that adding them, in various plausible combinations, does not affect the coefficients. This is not surprising given the balance in the covariates reported in the previous section. Estimates for regression in which covariates are included are available from the authors.

Each table in the sections that follow shows the effects in native units (for instance, the *number* of applications submitted), in percentage changes relative to the control group's mean, and in effect size (as a share of the control group's standard deviation). On the whole, we believe that the percentage changes are easiest for readers to interpret because they do not require the reader to know the mean of the outcome for himself. Indeed, we have found that readers usually have only hazy ideas of the outcomes of the high-achieving, low-income students who are targeted in this study. Thus, they often end up with misimpressions if the effects are not put into percentage changes or effect sizes for them. However, each reader is welcome to focus on whichever translation of the effects is most transparent to him.

a Effects of the ECO-C Intervention on College Application Behavior

Table 1 shows intention-to-treat effects of the ECO-C Intervention on students' application behavior. We find that the ECO-C Intervention causes students to submit 19 percent more applications and to be 27 percent more likely to submit at least five applications. The ECO-C

[32] NSC-based outcomes are slightly rescaled to account for mail that was undeliverable and for mis-matching to NSC data. Survey-based outcomes need no such rescaling.

Intervention raises their probability of applying to a peer public university by 19 percent, a peer private university by 17 percent, and a peer liberal arts college by 15 percent. Students were also more likely to apply to institutions in the range immediately below and above peer institutions. The pattern of effects clearly shows students targeting peer institutions the most, and other institutions less as their median student differs more from the student himself. (Note that, because they are so high-achieving themselves, only a small share of our students *can* apply to an institution whose median students score more than 5 percentiles higher.) The ECO-C Intervention causes students' "maximum" application to have higher median SAT scores (by 34 points), a graduation rate that is 7 percent higher, instructional spending that is 22 percent higher, and student-related spending that is 21 percent higher.[33]

If an organization like the College Board or ACT were to conduct the ECO-C Intervention, we believe that the effects would be more like the treatment-on-the-treated effects shown in Table 2. If a student could at least recall having seen ECO materials, the ECO-C Intervention caused her to submit 48 percent more applications and be 66 percent more likely to submit at least five applications. She was 48 percent more likely to apply to a peer public university, 42 percent more likely to apply to a peer private university, and 38 percent more likely to apply to a peer liberal arts college. If she could recall seeing ECO materials, the ECO-C Intervention also caused her to apply to a college with a 17 percent higher four-year graduation rate, 55 percent higher instructional spending, 52 percent higher student-related spending, and a 86 point higher median SAT score.

b Effects of the ECO-C Intervention on College Admissions Outcomes

Because the students targeted by the ECO program had high college assessment scores and grades, we expected that they would be admitted to more selective colleges if the intervention did, in fact, cause them to apply to such colleges. This expectation was correct, as shown in Tables 3 and 4. First consider the intention-to-treat effects. Students who were assigned to the ECO-C Intervention were admitted to 12 percent more colleges. They were 31 percent more likely to be admitted to a peer college and the maximum college to which they were admitted had students whose median SAT score was 21 points higher. Students were admitted to a college with a 10 percent

[33] Student-related spending is spending on instruction, student services, academic support, and institutional support. It does not include research spending or public service spending.

higher graduation rate, 14 percent higher instructional spending, and 14 percent higher student-related spending. The effects for a student who could at least recall having seen ECO materials are larger. He was admitted to 31 percent more colleges. He was 78 percent more likely to be admitted to a peer college, and the maximum college to which he was admitted had students whose median SAT score was 53 points higher. The maximum college that admitted him also had a 24 percent higher graduation rate, 34 percent higher instructional spending, and 34 percent higher student-related spending.

c Effects of the ECO-C Intervention on Fee Waiver Use and FAFSA Filing

Tables 3 and 4 show that the ECO-C Intervention increased the probability that a student used any application fee waivers and increased the number of application fee waivers she used. This is not a mechanical effect because most of the target students could have had their application fees waived at most institutions anyway. That is, receiving *low-paperwork* fee waivers did make a difference in students' use of fee waivers. This indicates that eligible students tend not to utilize all of the fee waiver opportunities normally available to them. This is not a surprising result because it accords with the evidence of other studies such as Pallais (2009).

The ECO-C Intervention did not affect a student's probability of filing the FAFSA. We suspect that this is because nearly all of our target students apply to *some* postsecondary institution, and all of them require that students who wish to be considered for financial aid file the FAFSA. In fact, there is evidence that non-selective institutions, especially those that are highly dependent on federal aid, may be especially proficient at ensuring that students file FAFSA forms (U.S. General Accountability Office, 2010).

d Effects of the ECO-C Intervention on College Enrollment Outcomes

It is not obvious that the ECO-C Intervention should have affected college enrollment outcomes simply because it affected the colleges to which students applied and were admitted. After all, a student might be willing to invest the time and effort to apply to a college in order to learn about it and the financial aid package it would offer. The same student might, upon receiving this information, decide that the college was--after all--not for him. If we find evidence that the ECO-C Intervention affected enrollment outcomes, the logical interpretation is that our target students were

initially somewhat misinformed about their college opportunities. To see this, consider a student who is not *certain* about where he will gain admission and what aid he will be offered but whose information or beliefs are right on average. When such a student receives the ECO-C Intervention, he may decide to apply to more colleges simply because the low-paperwork fee waivers reduce his (time) cost of doing so. However, when he gets his admissions letters, his prior beliefs will be confirmed (since he was right on average), and he will not change his enrollment decision much. That is, unless the target students' information is changed fairly systematically by the application and admissions experience, they should not change their enrollment decisions much.[34]

In Tables 5 and 6, we show that the ECO-C Intervention does, in fact, alter students' enrollment decisions. The intention-to-treat effects are as follows. Students who were assigned to the ECO-C Intervention enrolled in a college that was 19 percent more likely to be a peer institution. Also, students assigned to the ECO-C Intervention enrolled in colleges with graduation rates that were 6 percent higher, instructional spending that was 8.6 percent higher, and student-related spending that was 10.4 percent higher.

The treatment-on-the-treated effects, which are a better guide to what a well-reputed organization could expect, are larger. For instance, a student who *experienced* the ECO-C Intervention enrolled in a college that was 46 percent more likely to be peer institution, whose graduation rate was 15.1 percent higher, whose instructional spending was 21.5 percent higher, and whose student-related spending was 26.1 percent higher.

Tables 5 and 6 are based on the college in which students report enrolling when they take the ECO survey. Thus, it is directly comparable to Tables 1 through 4, which are also based on the survey data. However, we find that we obtain very similar results if we use NSC data on the college in which students enroll first after high school graduation or enroll the longest after high school graduation. These results are shown in Online Appendix Table 3. This is further evidence that the students who take the survey are not *differentially* selected among treatment and control status.

[34] A student's preferred college could potentially change simply because the fee waivers induced him to apply to more reach schools and one of them unexpectedly admitted him. However, if students were fully informed and making rational calculations about application costs and benefits, this effect would be trivially small.

5 Who is Most Affected by the ECO-C Intervention?

We chose to target the students we did because we hypothesized initially that they would be more affected by the ECO-C Intervention than more affluent students or students who attended a high school with a critical mass of high-achieving students. In this section, we test whether this hypothesis was accurate by examining the effects of the ECO-C Intervention for the relatively small sample of students whom we drew from outside our target group. (See Section 2.)

Tables 7 and 8 present this evidence. The second column in each table shows the intention-to-treat effect of the ECO-C Intervention (in native units) for our target group of students. The third column shows the *difference* in the intention-to-treat effect for students who are from feeder high schools (Table 7) or students whose families have incomes above our target range (Table 8). The right-hand column indicates whether the difference shown in the third column is statistically significantly distinguishable from zero.

About one-fourth of the differences shown in the third columns of the tables are statistically significant. Moreover, the pattern of the differences is consistently negative in sign. Thus, it appears that students who are from feeder high schools and students from more affluent families are indeed less affected by the ECO-C Intervention. This broadly confirms our initial hypothesis.

Of course, even within our target group of high-achieving, low-income students, students still differ on dimensions such as their family income, test scores, gender, parents' education, race, and ethnicity. We also tested whether the effects of the ECO-C Intervention differed along these dimensions. Specifically, we tested whether there were statistically significant differences in the effects that depended upon whether the student had an above versus below median SAT/ACT score (among the target students), whether the student was female versus male, whether the student had parents whose maximum educational attainment was greater or less than a baccalaureate degree, and whether the student was white, Asian, or from a underrepresented minority group (black, Latino, Hispanic, Native American, Native Pacific Islander).[35] While we lack the statistical power to cut the sample in finer slices, we have sufficient statistical power to find heterogeneous effects for three

[35] We tried cutting the students at various other points in parents' educational attainment, and we tried various other cuts of race and ethnicity. We saw little evidence of heterogeneous effects.

groups of fairly equal size. However, we not only found no statistically significant evidence of heterogeneity in the effects along the aforementioned dimensions, we did even see patterns in the point estimates that might suggest systematic heterogeneity in the effects. This suggests that the ECO-C Intervention has fairly similar effects on students in the target group.

6 Which Parts of the ECO-C Intervention Matter?

Students in the Pilot and 2010-11 cohorts did not experience the ECO-C Intervention. Instead, they could experience one of the four interventions that the ECO-C Intervention largely subsumes: Application Guidance, the Net Cost intervention, the Fee Waiver intervention, or the Parent Intervention.

As mentioned above, the ECO-C Intervention was created as a combination of the first three of the interventions because we observed a few phenomena in the Pilot and 2010-11 cohorts. First, based on our telephone survey, we observed that Fee Waivers were associated with a substantial increase in the probability that a student would recall having seen the ECO materials--that is, be "treated" in our generous terminology. Second, a large number of informal contacts with parents and students suggested that the Fee Waivers raised the credibility of the information in the materials. Third, we observed that Fee Waivers tended to have disproportionate effects on *application* behavior, relative to enrollment behavior. In contrast, the Application Guidance and Net Cost interventions tended to have disproportionate effects on *enrollment* behavior, relative to application behavior. As a result, we speculated that the Fee Waivers induced students to apply to more institutions but that students did not consistently submit their induced, marginal applications to colleges that were a good match for them. We speculated that the Application Guidance and Net Costs interventions gave students more information about how to find institutions that suited them and gave them a better sense of how colleges differed in terms of graduation rates, resources, and aid. However, these two purely informational interventions were less likely to be taken up by students.

We hoped that the ECO-C Intervention would have the take-up of the Fee Waiver intervention combined with the greater informativeness of the Application Guidance and Net Costs intervention. In this section, we investigate whether the ECO-C Intervention was, in fact, capable of inducing

students to recognize a *larger* array of postsecondary options and to recognize a *better matched* array of postsecondary options (that is, an array from which they would rather choose even if the number of institutions in the array were unchanged).[36]

For this investigation, we rely on evidence from the 2011-12 cohort, which was randomized into the control group or into the ECO-C, Application Guidance, Net Cost, Fee Waiver, or Parent intevention. Before presenting the evidence, however, we need to explain one circumstance that changed between the Pilot and 2010-11 cohorts (for whom we observed the patterns describe above) and the 2011-12 cohort (on whom we will conduct the investigation). Net cost information was difficult for the Pilot and 2010-11 cohort to obtain on their own–that is, if they did not receive the Net Cost intervention. Although a small number of institutions had readily accessible net cost calculators posted on their websites in the years that the Pilot and 2010-11 cohort applied to college, the vast majority of institutions did not post such calculators. In contrast, the 2011-12 cohort was the first to experience very widespread availability of net cost calculators, owing to the Higher Education Opportunity Act of 2008, which mandated that such calculators be posted on each college's website and linked to the U.S. Department of Education's College Navigator by October 29, 2011. We expected that this legal change would make all of the interventions *except* the Net Cost intervention more effective and would make the Net Cost intervention less effective. This is, in fact, what occurred. The Net Cost intervention went from having effects that were routinely substantially larger than those of Application Guidance to having effects that were routinely smaller.[37]

To understand why this occurred, consider the experience of a student assigned to Application Guidance before and after net cost calculators were widely posted. The intervention would advise a student on how to find colleges that counselors would consider to be a match. It would inform a student about graduation rates and application requirements for various colleges. All this might help

[36] We did not fold the Parent Intervention into the ECO-C Intervention because our numerous informal contacts with families suggested that it was not possible to target any of the interventions to a specific family member. We concluded that adding the Parent Intervention to the ECO-C Intervention would cause families to read similar information in two different forms, an experience that might prove frustrating.

[37] The Net Cost intervention's effects on enrollment outcomes were, on average, twice those of Application Guidance for the Pilot and 2010-11 cohorts. As shown below, this is not the case for the 2011-12 cohort.

a student choose a portfolio of colleges that were better suited to him *academically*. However, before the net cost calculators were posted, the student might still have substantial difficulty learning which of the colleges for which he was academically suited were likely to offer him sufficient aid so that he could attend. In contrast, once the net cost calculators were posted, a student who had found his way to an academically suitable college using the College Navigator could easily determine what net cost he was likely to face with a link on the same page.

Now consider the experience of a student assigned to the Net Cost intervention which--recall--did not give students information on how to find colleges that were *academic* matches. Rather, it helped them find colleges that were attractive in terms of aid. Once the student had found these colleges, he still had figure out which of them was academically suited to him. This task was made no easier by the posting of the net cost calculators. Indeed, one might even argue that, owing to the media's and U.S. Department of Education's focus on the net cost calculators (which was natural because they were new), students were distracted from learning which colleges suited them *academically*. Such distraction might be a short-term phenomenon since net cost calculators will not have so much news value in future years.

With this important caveat about the changing environment for the Net Cost and other interventions for the 2011-12 cohort, let us examine how the four "partial" interventions compared to the ECO-C Intervention. Table 9 presents this comparison. Each row shows an outcome that was affected by the ECO-C Intervention. Each column shows how a intervention affected the same outcome *relative* to the ECO-C Intervention. An number less (greater) than one indicates that the intervention had a smaller (greater) effect than the ECO-C Intervention. For instance, a 0.7 for Application Guidance would indicate that the Application Guidance intervention had 0.7 of the effect on the same outcome that the ECO-C Intervention had. A 1.2 would indicate that the Application Guidance intervention had 1.2 times the effect on the same outcome that the ECO-C Intervention had. The asterisks in the table indicate that a intervention had an effect that was statistically significantly different from the randomized control group.[38]

The first thing to observe about Table 9 is that the vast majority of numbers in it are less than

[38] That is, the asterisks do *not* indicate that the intervention had an effect that was statistically significant different from that of the ECO-C Intervention or another intervention.

1, suggesting that the ECO-C Intervention tends to have larger effects than any one of its parts The second thing to observe is that the Fee Waiver intervention tends to have effects that are close in size to those of the ECO-C Intervention when the outcome is an *application* behavior. Its effects are, however, less commensurate in size when the outcome is an *enrollment* outcome. In contrast, the Application Guidance intervention tends to have effects that are close in size to the those of the ECO-C Intervention when the outcome is an *enrollment* outcome. Its effects are less commensurate in size when the outcome is an *application* behavior.

Summing up, we find support for both of our hypotheses: the ECO-C Intervention is more effective than any of its parts and it appears to combine the strengths of the Fee Waiver intervention and the strengths of the Application Guidance and Net Cost interventions.

7 The Effects of the ECO-C Intervention on Freshman Year Grades and Persistence through the Middle of the Sophomore Year?

The interventions induce students to attend colleges where their peers are higher-achieving but also *more like them* in terms of incoming test scores and high school grade point averages. Thus, one can form a variety of hypotheses about how the interventions will affect students' grades and persistence in college. On the one hand, if we hypothesize that students study more if they are surrounded by peers who also study and if they take courses more attuned to their level of incoming achievement, then the interventions may improve students' learning. On the other hand, colleges tend to grade students "on a curve" and promote them according to their "curved" grades. Thus, the interventions will systematically put downward pressure on a student's grades and (therefore) persistence simply because he is more likely to be attending an institution where other students tend to be high-achieving too. Note that this "on the one hand" and "on the other" is *not* symmetric. In the first case, the student is learning more. In the second case, the student could still be learning more but might earn lower grades nonetheless. Until our target students have outcomes such as earnings which are on a fairly absolute standard, we can only compare students' in-college outcomes, which are measured in relative terms and are therefore biased in favor of students who attend less

selective colleges.

Students in the 2011-12 cohort are still freshman for whom we do not yet have grades or measures of persistence. We can, however, examine students in the 2010-11 cohort who were affected by the interventions. We could presents the results as reduced-form effects--for instance, the effect of the intention-to-treat for a specific intervention on the student's freshman grades. In our experience, though, readers find such effects hard to interpret because readers are required to remember each intervention's effects on enrollment outcomes and then multiply through in order to obtain useful and comparable magnitudes. Therefore, we present the effects on grades/persistence of being induced, by a intervention, to attend a more selective college. These results are from an instrumental variables estimation where our measure of selectivity is the most continuous one available to us: the median SAT score of the students at the college where the student enrolls.[39]

Table 10 shows, first, that the indicators for the interventions have a statistically significant effect on the selectivity of the college attended by students in the 2010-11 cohort. That is, the first stage of the instrumental variables procedure has power: the F-statistic is 3.05. Second, if a student was induced by the interventions to enroll in a more selective college, his grades and persistence into sophomore year were not statistically significantly affected. (Both point estimates are positive and have p-values around 0.3.) This evidence suggests that students induced to attend more selective colleges are earning similar grades and persisting with similar probabilities as they would if they had attended less selective colleges. Because grading and promotion standards are higher in more selective colleges, this evidence hints that the students induced to attend more selective colleges are learning more. We will have more evidence on this question in future years as the 2011-12 cohort ages.

8 Cost-Benefit Analyses for the ECO-C Intervention

In this section, we compare the costs and benefits of the ECO-C Intervention. The costs of the intervention are simple: approximately $6 per student whom we intended to treat. We can scale this

[39] Our alternative measures of selectivity produce results that are similar in spirit but harder to interpret because they are categorical.

up to generate a cost of actually *treating* a student. The upper bound on this cost of treatment is $15 ($6 divided by 0.4, the probability of treatment). We believe, however, that a highly reputable organization like the College Board or ACT could achieve a cost of treatment of approximately $6 simply because mail from such an organization would likely be opened and at least cursorily reviewed (our definition of treatment). Such an organization would presumably also have lower mailing and in-house printing costs than our small experimental organization had.

Some useful are statistics are the following. Per 10 dollars of cost, the ECO-C Intervention caused target students to apply to 4 more colleges and to be 50.5 percentage points more likely to apply to a peer college. Per 10 dollars of cost, the ECO-C Intervention caused target students to enroll in colleges where graduation rates were 13 percentage points higher, where instructional spending was $5906 greater, where the median student had college assessment scores that were 65 points higher, and that were 22.2 percentage points more likely to be peer colleges.

a Comparing ECO Benefit-to-Cost to that of In-Person Counseling Interventions

The most comparable alternative intervention is a counseling intervention also directed to high-achieving, low-income students: Avery (2010). Students in the target population were asked whether they were willing to experience expert college counseling. If they agreed that they were, they were randomly selected to a control status or to receive ten hours of individualized college advising from a experienced counselor normally employed in full-time college counseling at high school with a critical mass of high achievers. The cost of the intervention was approximately $600 per student. This counseling intervention did not have statistically significant effects on most college application or enrollment outcomes, but this was partly due to the experiment's low statistical power. If we take the *most optimistic* point estimates from the study, however, we find that, per 10 dollars of cost, the counseling intervention caused high-achieving, low-income students to apply to 0.006 more colleges and to be 0.18 percent (18 one-hundredths of 1 percent) more likely to enroll in highly selective colleges (Barron's "most competitive" category). These per-dollar effects are clearly very

small compared to those of the ECO-C Intervention.[40]

Most other related studies have evaluated counseling interventions targeted to much less high-achieving students. Thus, they typically examine whether a student attends a postsecondary institution *at all* as the main outcome. Since our target students nearly always attend some postsecondary institution even with no intervention, comparing our benefit-cost ratio to their benefit-cost ratio is not possible. However, we can nevertheless learn about the cost of an in-person counseling intervention from these studies. Carroll and Sacerdote (2012) study a counseling intervention randomly assigned to about 500 New Hampshire high school seniors. The intervention would probably cost between $600 and $900 per student to replicate at scale because it paid each student $100 for participating, paid all of a student's application and College Board/ACT assessment fees, and paid Dartmouth college students to mentor each student through the application process.[41] Cuhna and Miller (2009) study Texas' GO Centers, which are centers placed in high schools, designed to encourage college attendance. Each GO Center costs about $80,000, is staffed, has computer facilities and information to make applying online easy, provides a marketing campaign that emphasizes peer-to-peer persuasion about the importance of college, and links students with local colleges and universities. The number of students in each school averages 197, no more than half of whom use the GO Center. Thus, the cost per student is about $812 per student.[42]

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[40] The most direct comparison we can make is based on the probability of applying to a Barron's Most Competitive institution. The treatment-of-the-treated effect of the ECO-C intervention is 30.8 percentage points or 51.2 percentage points per $10 of cost. Per dollar of cost, the ECO-C intervention is thus 285 times more "productive" (on this measure) than the counseling intervention reported by Avery (2010).

[41] Carroll and Sacerdote report that they paid 20 Dartmouth students to work full-time for about 2.5 months. If we figure that Dartmouth students' full-time earnings would be at least $40,000 per year (which is much less per hour than the counselors were paid in the Avery (2010) interventions), then the cost of the mentoring was $333 per student. Application and assessment fees would typically total between $100 and $400. There were also costs associated with arranging the mentoring times, matching mentors with the students, and the like.

[42] Among those that have been studied rigorously, the least expensive intervention with some in-person elements is investigated by Castleman and Page (2012). This summer-after-senior-year intervention used email, text-messaging, and Facebook along with in-person counseling and cost only about $200 per student. However, it is not comparable to the ECO-C Intervention or the in-person interventions described above because it was directed to students who were attending non-selective colleges (mainly community colleges). These colleges have only a small fraction of the application requirements associated with selective four-year colleges: test scores, letters of reference, mid-senior year transcripts, essays, applications submitted by specific mid-senior-year deadlines. Given that the summer-after-senior-year intervention was not attempting to advise students on any of these dimensions, it is not

(continued...)

In short, it seems reasonable to conclude that alternative, in-person counseling interventions typically cost upwards of $600. Thus, in order to achieve the same benefit-to-cost ratio as the ECO-C Intervention, such interventions would need to have effects that are at least 100 times as large as those of the ECO-C Intervention.

It is noteworthy that each of the in-person counseling interventions described above is reported by its evaluators to be a *much* more cost efficient way of changing students' college-going behavior than reducing the cost of college through tuition reductions, grants, and other forms of aid. That is, in-person counseling has high benefits to costs relative to many alternative policies that are intended to increase college-going.

Some other low-cost interventions have been shown to change college application and/or enrollment behavior. These tend to have something of the same character as the ECO interventions insofar as they are not only primarily informational but are driven by large-scale databases (as opposed to information conveyed by individual human beings). We especially note Bettinger, Long, Oreopoulos, and Sanbonmatsu's (2009) of how H&R Block's automatically filling out FAFSA forms affected college-going, Pallais' (2009) study of how college applications rose when ACT made it free to send scores to additional colleges, and Bulman's (2012) study of how a high school's college-going rises when it allows the SAT to be administered on school premises on at least one Saturday morning.

All of the above interventions are inexpensive. However, because all of them target much lower-achieving students than the ECO-C Intervention, their main outcomes are whether a student applies to or attends college at all (or applies to or attends a four-year college). This makes it difficult to compare their benefits-to-cost ratios to those of the ECO-C Intervention.

b The ECO-C Intervention's Long-Run Benefits Relative to its Costs

The ECO-C Intervention causes students to attend colleges that have higher graduation rates, have richer resources devoted to instruction and other student-related activities, and are more selective. Whether such colleges improve students' long-run outcomes, especially their earnings, has

[42](...continued)
surprising that it cost less than the interventions studied by Avery, Carroll and Sacerdote, and Cuhna and Miller.

in the past been difficult to assess owing to the difficulty of controlling adequately for selection.[43] However, there are recent studies that deliver highly credible estimates by comparing people who were just above and just below an admissions cut-off. This approach, the regression discontinuity approach, produces causal estimates because the people just to one and the other side of the cut-off are alike in aptitude and achievement for all intents and purposes. Regression discontinuity estimates of attending a more selective college have been produced by Hoekstra (2009), Saavedra (2009), Cohodes and Goodman (2012), Hastings, Neilson, and Zimmerman (2012), and Kaufmann, Messner, and Solis (2012).[44] All of these studies find substantial positive effects of attending a more selective college, and they examine a variety of outcomes: earnings, graduating on time, even the qualities of the person the student marries. Moreover, no study that uses the convincing regression discontinuity method has found negligible or even small effects of attending a more selective college.

Hoekstra's study is the most useful for our purposes because it focuses on U.S. students who are choosing between their state's most selective public university and colleges that are less selective by about 65 SAT points. He shows that the students who attend the more selective university have earnings that are 18 to 28 percent higher each year than those of students who attend the less selective colleges. Moreover, people may enjoy such higher earnings for 40 or more years.[45]

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[43] Until recently, the two main methods of controlling for selection were (i) controlling for a very full array of students' observable characteristics, sometimes an even fuller array than would plausibly be seen in a college application and (ii) examining students who were admitted to comparable portfolios of colleges but who chose to enroll in colleges of widely differing selectivity. The first approach is nicely exemplified by Black and Smith (2006). The weakness of the first approach is that students may have unobservable characteristics, such as motivation, that affect their college choices and their later outcomes. If the first approach works, it is because students with similar characteristics make different college decisions for reasons that are (conditionally) random--for instance, because they happen to receive a brochure from one college and not another. The weakness of the second approach is more serious because it relies upon comparing people whose college choices could *not* differ for a random reason. By design, the people being compared are people who have deliberately expressed interest in and made the effort to apply to the same set of colleges. Therefore, if they make widely different choices, it must be because they have some unobserved variable that is important for that choice. Thus, the method *exacerbates* the problem associated with unobserved variables: whatever unobserved variables are strong enough to force people into very different choices from the same choice set are probably strong enough to affect their earnings and other outcomes.

[44] Cohodes and Goodman actually use a scholarship cut-off, but the regression discontinuity method otherwise works similarly.

[45] In Hoekstra's study, the earnings difference vastly swamps the difference in the expenditures between the more and less selective colleges in his study (about 6 percent).

Recall that, per 10 dollars of cost, the ECO-C Intervention caused students to enroll in colleges where their median peer had scores that were 65 points higher. Thus, we can apply the Hoekstra estimates quite easily. Data from the Beginning Postsecondary Student Longitudinal Survey (2009) suggests that our target students would initially earn about $34,000 if they did *not* attend selective colleges but instead attended colleges categorized by Barron's as Less Competitive.[46] An 18 to 28 percent increase in this level of earnings gives us $6,120 to $9,520 per year. If we apply a 3 percent real discount rate and assume 5 percent real earnings growth over a 40-year career (a conservative assumption based on the actual earnings growth of people with similar aptitude in the National Longitudinal Survey of Youth 1979), we get a lifetime earnings difference of $365,028 to $567,821. Even if we assume a real earnings growth rate of only 2.5 percent, we still get a lifetime earnings difference of $222,990 to $346,874. These are clearly imprecise calculations but the imprecision does not matter much because the numbers are obviously much larger than $10.

So far, we have considered only *private* benefits that could potentially be attributed to the ECO-C Intervention. There are also social costs and social benefits. Among the social costs are the costs of providing the student with a more expensive education. (Recall that, given our target students' achievement, they themselves tend to pay less when they attend a more selective college. However, the college spends more.) Our estimates suggest that, per $10, the ECO-C Intervention might increase this social cost by no more than $50,613 for all four years of college.[47] Thus, before counting any social benefits, the benefit-to-cost ratio is high--always above 4.45.

The social benefits of the ECO-C Intervention are harder to assess, but they are the benefits associated with having high-achieving students from low-income families achieve considerable income mobility and socio-demographic mobility. For instance, such students may "pave the way" to selective colleges for other students from their high schools or neighborhoods. Or, such students may inspire other low-income students to study more because their experience makes the benefits of high achievement more salient.

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[46] Authors' calculations using students with positive earnings as of 2009 from the Beginning Postsecondary Student Longitudinal Survey. We apply the same test score and family income cut-offs that we used to find our target students.

[47] Multiply the treated-on-treated effect for student-related costs by $10/$6 and then multiply by four years of college.

8 Conclusions

Using random assignment on thousands of students, we demonstrate that a low-cost, fully scalable intervention can help many high-achieving, low-income students recognize their full array of college opportunities. The ECO-C Intervention causes students to apply to and enroll in colleges with higher graduation rates, greater instructional resources, and curriculum that is more geared toward students with very strong preparation like their own. Put another way, the ECO-C Intervention closes part of the college behavior "gap" between low-income and high-income students with the same level of achievement. The high-achieving, low-income students who are induced to attend more selective colleges do not earn grades that are lower than they would if they had enrolled at the less selective colleges attended by the control students.

Under any reasonable assumptions, the ECO-C Intervention has a high ratio of benefits to costs. For instance, its benefit-to-cost ratio appears to be high relative to in-person college counseling for the same target group of students. Since the in-person counseling interventions already exhibit benefit-to-cost ratios that are substantially higher than policies that reduce tuition or increase grants, it appears that the ECO-C Intervention has a benefit-to-cost ratio many times that of competing policies intended to improve college going.

One interesting implication of this study (and some others mentioned above) is that interventions that exploit the power of large scale databases may be cost efficient and somewhat customized at the same time.

We are often asked why some intervention akin to the ECO-C Intervention does not already exist at a large scale. Our answer is twofold. First, the database capabilities that power the intervention (but are extremely inexpensive per student) did not always exist. Second, no one postsecondary institution would have the incentive to conduct such an intervention since many of the benefits would accrue to other institutions. That is, the ECO-C Intervention produces benefits that are largely *public*. Thus, a natural host for such an intervention would be a pan-collegiate organization or other organization with social goals.

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Table 1

Intention-to-Treat Effects of the ECO Intervention on Application Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Number of Applications Submitted	0.888***	19.0%	0.247
	(0.182)		
Submitted at least Five Applications	0.108***	26.5%	0.220
	(0.023)		
Applied to a "Peer" Public University	0.045**	19.1%	0.106
	(0.021)		
Applied to a "Peer" Private University	0.088***	16.9%	0.176
	(0.023)		
Applied to a "Peer" Liberal Arts College	0.046**	15.1%	0.100
	(0.023)		
Applied to a "Peer" Institution of any Type	0.122***	22.3%	0.245
	(0.023)		
Applied to an Institution that was at least "Peer" minus about 10 percentiles	0.065***	9.4%	0.141
	(0.021)		
Applied to an Institution that was at least "Peer" minus about 20 percentiles	0.046***	6.2%	0.105
	(0.020)		
Applied to an Institution that was at least "Peer" minus about 30 percentiles	0.024*	2.7%	0.074
	(0.014)		
Applied to an Institution that was "Peer" plus 5 percentiles	0.161**	31.0%	0.121
	(0.068)		
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	4.475***	6.6%	0.204
	(1.022)		
Instructional Spending, Maximum Among Colleges to which Applied	7760.219***	22.2%	0.253
	(1520.598)		
Student-Related Spending, Maximum Among Colleges to which Applied	12232.660***	20.8%	0.259
	(2340.458)		
Median SAT Score of Students, Maximum Among Colleges to which Applied	34.301***		
	(7.259)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects as a percentage of the mean in the control group. The fourth column shows effects as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 2
Treatment-on-the-Treated Effects of the ECO Intervention on Application Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Number of Applications Submitted	2.220***	47.6%	0.616
	(0.455)		
Submitted at least Five Applications	0.270***	66.2%	0.549
	(0.058)		
Applied to a "Peer" Public University	0.113**	47.8%	0.265
	(0.052)		
Applied to a "Peer" Private University	0.220***	42.2%	0.440
	(0.058)		
Applied to a "Peer" Liberal Arts College	0.115**	37.8%	0.250
	(0.058)		
Applied to a "Peer" Institution of any type	0.305	55.8%	0.612
	(0.058)		
Applied to an Institution that was at least "Peer" minus about 10 percentiles	0.163***	23.5%	0.353
	(0.053)		
Applied to an Institution that was at least "Peer" minus about 20 percentiles	0.115***	15.5%	0.263
	(0.050)		
Applied to an Institution that was at least "Peer" minus about 30 percentiles	0.060*	6.8%	0.185
	(0.035)		
Applied to an Institution that was "Peer" plus 5 percentiles	0.403**	77.5%	0.302
	(0.170)		
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	11.188***	16.6%	0.510
	(2.555)		
Instructional Spending, Maximum Among Colleges to which Applied	19400.548***	55.4%	0.632
	(3801.495)		
Student-Related Spending, Maximum Among Colleges to which Applied	30581.650***	52.1%	0.648
	(5851.145)		
Median SAT Score of Students, Maximum Among Colleges to which Applied	85.753***		
	(18.148)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group, scaled by the share of intended participants who recognized that they had received ECO materials. This is as a Wald Estimate of the treatment-on-the-treated effects. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects that are statistically significant (at the 10 percent level at least) as a percentage of the mean in the control group. The fourth column shows effects that are statistically significant (at the 10 percent level at least) as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 3
Intention-to-Treat Effects of the ECO Intervention
on Admissions and Other Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Admissions Outcomes			
Number of Colleges to which Admitted	0.253***	12.3%	0.184
	(0.071)		
Admitted to a "Peer" Institution	0.093***	31.0%	0.203
	(0.023)		
Admitted to an Institution that was at least "Peer" minus about 10 percentiles	0.076***	15.4%	0.152
	(0.024)		
Admitted to an Institution that was at least "Peer" minus about 20 percentiles	0.077***	13.9%	0.155
	(0.024)		
Admitted to an Institution that was at least "Peer" minus about 30 percentiles	0.055***	7.3%	0.128
	(0.020)		
Admitted to an Institution that was "Peer" plus 5 percentiles	0.155**	31.5%	1.263
	(0.061)		
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	4.430***	9.5%	0.240
	(1.048)		
Instructional Spending, Maximum Among Colleges to which Admitted	2265.441***	13.6%	0.163
	(727.016)		
Student-Related Spending, Maximum Among Colleges to which Admitted	4068.322***	13.8%	0.181
	(1151.795)		
Median SAT Score of Students, Maximum Among Colleges to which Admitted	21.097***		
	(6.354)		
Other Outcomes			
Filed a Free Application for Federal Student Aid (FAFSA)	-0.020	-2.2%	-0.069
	(0.014)		
Used Any Application Fee Waivers	0.153***	34.0%	0.307
	(0.023)		
Number of Application Fee Waivers Used	1.794***	50.0%	0.551
	(0.249)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects that are statistically significant (at the 10 percent level at least) as a percentage of the mean in the control group. The fourth column shows effects that are statistically significant (at the 10 percent level at least) as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 4
Treatment-on-the-Treated Effects of the ECO Intervention
on Admissions and Other Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Admissions Outcomes			
Number of Colleges to which Admitted	0.633***	30.8%	0.461
	(0.178)		
Admitted to a "Peer" Institution	0.233***	77.5%	0.508
	(0.058)		
Admitted to an Institution that was at least "Peer" minus about 10 percentiles	0.190***	38.6%	0.380
	(0.060)		
Admitted to an Institution that was at least "Peer" minus about 20 percentiles	0.193***	34.7%	0.387
	(0.060)		
Admitted to an Institution that was at least "Peer" minus about 30 percentiles	0.138***	18.2%	0.319
	(0.050)		
Admitted to an Institution that was "Peer" plus 5 percentiles	0.388**	78.8%	3.158
	(0.153)		
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	11.075***	23.9%	0.599
	(2.620)		
Instructional Spending, Maximum Among Colleges to which Admitted	5663.603***	34.1%	0.407
	(1817.540)		
Student-Related Spending, Maximum Among Colleges to which Admitted	10170.805***	34.4%	0.453
	(2879.488)		
Median SAT Score of Students, Maximum Among Colleges to which Admitted	52.743***		
	(15.885)		
Other Outcomes			
Filed a Free Application for Federal Student Aid (FAFSA)	-0.050	-5.5%	-0.173
	(0.035)		
Used Any Application Fee Waivers	0.383***	85.0%	0.768
	(0.058)		
Number of Application Fee Waivers Used	4.485***	124.9%	1.377
	(0.623)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group, scaled by the share of intended participants who recognized that they had received ECO materials. This is as a Wald Estimate of the treatment-on-the-treated effects. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects that are statistically significant (at the 10 percent level at least) as a percentage of the mean in the control group. The fourth column shows effects that are statistically significant (at the 10 percent level at least) as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 5
Intention-to-Treat Effects of the ECO Intervention
on Enrollment Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Enrolled in a "Peer" Institution	0.053**	18.5%	0.117
	(0.023)		
Enrolled in an Institution that was at least "Peer" minus about 10 percentiles	0.043*	9.5%	0.086
	(0.024)		
Enrolled in an Institution that was at least "Peer" minus about 20 percentiles	0.031	6.0%	0.062
	(0.024)		
Enrolled in an Institution that was at least "Peer" minus about 30 percentiles	0.011	1.5%	0.024
	(0.022)		
Enrolled in an Institution that was "Peer" plus 5 percentiles	0.021**	60.3%	0.114
	(0.010)		
Four-Year Graduation Rate of College where Enrolled	3.116***	6.0%	0.138
	(1.138)		
Instructional Spending of College where Enrolled	1417.624*	8.6%	0.101
	(762.052)		
Student-Related Spending of College where Enrolled	3037.126**	10.4%	0.129
	(1267.838)		
Median SAT Score of Students at College where Enrolled	15.472**		
	(7.104)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects that are statistically significant (at the 10 percent level at least) as a percentage of the mean in the control group. The fourth column shows effects that are statistically significant (at the 10 percent level at least) as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 6
Treatment-on-the-Treated Effects of the ECO Intervention
on Enrollment Outcomes

dependent variable:	Effect in native units	Effect in percentage change	Effect in effect size
Enrolled in a "Peer" Institution	0.133**	46.3%	0.293
	(0.057)		
Enrolled in an Institution that was at least "Peer" minus about 10 percentiles	0.108*	23.8%	0.216
	(0.060)		
Enrolled in an Institution that was at least "Peer" minus about 20 percentiles	0.078	14.9%	0.155
	(0.060)		
Enrolled in an Institution that was at least "Peer" minus about 30 percentiles	0.028	3.8%	0.061
	(0.055)		
Enrolled in an Institution that was "Peer" plus 5 percentiles	0.053**	150.8%	0.286
	(0.025)		
Four-Year Graduation Rate of College where Enrolled	7.790***	15.1%	0.345
	(2.845)		
Instructional Spending of College where Enrolled	3544.060*	21.5%	0.253
	(1905.130)		
Student-Related Spending of College where Enrolled	7592.815**	26.1%	0.323
	(3169.595)		
Median SAT Score of Students at College where Enrolled	38.680**		
	(17.760)		

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable, relative to the randomized control group, scaled by the share of intended participants who recognized that they had received ECO materials. This is as a Wald Estimate of the treatment-on-the-treated effects. Estimates are for the 2011-2012 cohort, which is the cohort that experienced the ECO intervention (see text for a description of the intervention). Standard errors are in parentheses. A single, double, and triple asterisk indicate--respectively--a coefficient that is statistically significantly different from zero at the 10, 5, and 1 percent level. The third column shows effects that are statistically significant (at the 10 percent level at least) as a percentage of the mean in the control group. The fourth column shows effects that are statistically significant (at the 10 percent level at least) as a share of the standard deviation in the control group. The data source is the Expanding College Opportunities survey.

Table 7
Intention-to-Treat Effects of the ECO Intervention:
Target Students Versus Students from Feeder High Schools

dependent variable:	Effect in native units for target students	Difference in effect for students from feeder high schools	Indicator of statistically significant difference
Number of Applications Submitted	0.888***	-0.248	
	(0.182)	(0.321)	
Median SAT Score of Students, Maximum Among Colleges to which Applied	34.301***	-20.768	*
	(7.259)	(11.963)	
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	4.475***	-1.897	
	(1.022)	(1.703)	
Instructional Spending, Maximum Among Colleges to which Applied	7760.219***	-2351.120	
	(1520.598)	(2646.691)	
Student-Related Spending, Maximum Among Colleges to which Applied	12232.660***	-4987.290	
	(2340.458)	(4016.074)	
Number of Colleges to which Admitted	0.253***	-0.114	
	(0.071)	(0.126)	
Median SAT Score of Students, Maximum Among Colleges to which Admitted	21.097***	-23.070	**
	(6.354)	(10.737)	
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	4.430***	-3.275	*
	(1.048)	(1.795)	
Instructional Spending, Maximum Among Colleges to which Admitted	2265.441***	-1757.070	
	(727.016)	(1343.138)	
Student-Related Spending, Maximum Among Colleges to which Admitted	4068.322***	-2028.33	
	(1151.795)	(2086.787)	
Median SAT Score of Students at College where Enrolled	15.472**	-15.366	**
	(7.104)	(11.993)	
Four-Year Graduation Rate of College where Enrolled	3.116***	-2.475	
	(1.138)	(1.981)	
Instructional Spending of College where Enrolled	1417.624*	-2193.140	§
	(762.052)	(1379.380)	
Student-Related Spending of College where Enrolled	3037.126**	-2788.310	
	(1267.838)	(2265.388)	

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable for the target students relative to the randomized control group. The third column shows the difference in the coefficient for students from feeder high schools (see text). Standard errors are in parentheses. In the right-hand-column, ***, **, *, and § indicate--respectively--a difference in the third column that is statistically significantly different from zero at the 1, 5, 10, and 15 percent level. The data source is the Expanding College Opportunities survey.

Table 8
Intention-to-Treat Effects of the ECO Intervention:
Target Students Versus Students from More Affluent Families

dependent variable:	Effect in native units for target students	Difference in effect for students from more affluent families	Indicator of statistically significant difference
Number of Applications Submitted	0.888***	-0.293	
	(0.182)	(0.293)	
Median SAT Score of Students, Maximum Among Colleges to which Applied	34.301***	-18.632	*
	(7.259)	(10.885)	
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	4.475***	-2.168	**
	(1.022)	(1.543)	
Instructional Spending, Maximum Among Colleges to which Applied	7760.219***	-5613.200	**
	(1520.598)	(2394.179)	
Student-Related Spending, Maximum Among Colleges to which Applied	12232.660***	-7496.160	**
	(2340.458)	(3625.932)	
Number of Colleges to which Admitted	0.253***	-0.018	
	(0.071)	(0.114)	
Median SAT Score of Students, Maximum Among Colleges to which Admitted	21.097***	-3.322	
	(6.354)	(9.754)	
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	4.430***	-0.568	
	(1.048)	(1.622)	
Instructional Spending, Maximum Among Colleges to which Admitted	2265.441***	-493.564	
	(727.016)	(1211.017)	
Student-Related Spending, Maximum Among Colleges to which Admitted	4068.322***	12.845	
	(1151.795)	(1879.842)	
Median SAT Score of Students at College where Enrolled	15.472**	-4.533	
	(7.104)	(10.913)	
Four-Year Graduation Rate of College where Enrolled	3.116***	-0.982	
	(1.138)	(1.785)	
Instructional Spending of College where Enrolled	1417.624*	-1504.030	
	(762.052)	(1240.380)	
Student-Related Spending of College where Enrolled	3037.126**	-1677.400	
	(1267.838)	(2037.945)	

Notes: The second column of the table shows estimated regression coefficients on the ECO intervention indicator variable for the target students relative to the randomized control group. The third column shows the difference in the coefficient for students whose family incomes are above the third tercile. (see text). Standard errors are in parentheses. In the right-hand-column, ***, **, *, and § indicate--respectively--a difference in the third column that is statistically significantly different from zero at the 1, 5, 10, and 15 percent level. The data source is the Expanding College Opportunities survey.

Table 9

Effects of the Sub Interventions as a Share of the Effects of the ECO Intervention

dependent variable:	Application Guidance effect as a share of the ECO intervention effect	Net Cost intervention effect as a share of the ECO intervention effect	Fee Waiver effect as a share of the ECO intervention effect	Parent Intervention effect as a share of the ECO intervention effect
Number of Applications Submitted	0.766 ***	0.698***	0.938***	0.707***
Applied to a "Peer" Institution	0.623***	0.656***	0.959***	0.680***
Median SAT Score of Students, Maximum Among Colleges to which Applied	0.608***	0.561***	0.964***	0.828***
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	0.789***	0.713***	1.091***	0.959***
Instructional Spending, Maximum Among Colleges to which Applied	0.596***	0.494**	0.922***	0.770***
Student-Related Spending, Maximum Among Colleges to which Applied	0.595***	0.507***	0.909***	0.766***
Number of Colleges to which Admitted	0.941***	0.838***	0.866***	0.759***
Admitted to a "Peer" Institution	0.419*	0.462*	0.785***	0.656***
Median SAT Score of Students, Maximum Among Colleges to which Admitted	0.388	0.291	0.699**	0.851***

Note: Table continues on next page. See notes at the bottom of the continuation table.

Table 9, continued

Effects of the Sub Interventions as a Share of the Effects of the ECO Intervention

dependent variable:	Application Guidance effect as a share of the ECO intervention effect	Net Cost intervention effect as a share of the ECO intervention effect	Fee Waiver effect as a share of the ECO intervention effect	Parent Intervention effect as a share of the ECO intervention effect
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	0.651***	0.634***	0.763***	0.740***
Instructional Spending, Maximum Among Colleges to which Admitted	0.890***	0.610*	0.740**	0.881***
Student-Related Spending, Maximum Among Colleges to which Admitted	0.570**	0.636**	0.520*	0.754***
Median SAT Score of Students at College where Enrolled	0.971**	0.010	0.849*	1.043**
Four-Year Graduation Rate of College where Enrolled	0.990***	0.441	0.666*	0.939**
Instructional Spending of College where Enrolled	1.576***	0.133	1.168**	0.597
Student-Related Spending of College where Enrolled	1.217***	0.214	0.844**	0.561**

Notes: The columns of the table shows estimated effects of each of the sub interventions as a share of the estimated effect of the the ECO intervention. ***, **, and * indicate--respectively--that the sub intervention's effect is significantly different from zero (that is, from the randomized control group) at the 1, 5, and 10 percent level. The data source is the Expanding College Opportunities survey.

Table 10
The Effect on Grades and Persistence of Being Induced to Attend a More Selective College by an Expanding College Opportunities Sub Intervention
instrumental variables estimates based on the 2010-11 cohort

Instrumental variables (second stage) regression:	dependent variable:	
	Freshman year grade point average	Persist in college through autumn term of sophomore year
independent variable:		
Median SAT Score of Students at College where Enrolled	0.003	0.0015
	(0.003)	(0.0016)

First stage regression:	dependent variable:
	Median SAT Score of College where Enrolled
independent variables (the instruments):	
Application Guidance intervention	27.700
	(25.652)
Net Cost intervention	49.120**
	(25.837)
Fee Waiver intervention	73.828***
	(25.408)
Parent intervention	15.790
	(25.597)
F-statistic on joint statistical significance of the instruments	3.05

Notes: The upper panel of the table shows instrumental variables estimates of the effect of being induced to attend a more selective college by an Expanding College Opportunities sub intervention. Freshman year grade point average is on a 4.0 scale where an A is 4.0, a B is 3.0, and so on. The measure of persistence in college through the autumn term of the sophomore year is a 0/1 variable, and the model is a linear probability model. The bottom panel of the table shows the first stage regression of the instrumental variables estimation. Specifically, it shows the estimated effect of each of the sub interventions on the median SAT score at the college where the student enrolled. The 2010-11 cohort, on whom the estimates are based, experienced sub interventions but not the ECO (combined) intervention. ***, **, and * indicate--respectively--that the effect is significantly different from zero at the 1, 5, and 10 percent level. The data sources are the Expanding College Opportunities survey and NSC.

Appendix Table 1
College Costs and Resources by Selectivity

Selectivity (Barron's)	Out-of-Pocket Cost for a Student at the 20th Percentile of Family Income (includes room and board)	Comprehensive Cost (includes room and board)	Instructional Expenditure per Student
most competitive	6,754	45,540	27,001
highly competitive plus	13,755	38,603	13,732
highly competitive	17,437	35,811	12,163
very competitive plus	15,977	31,591	9,605
very competitive	23,813	29,173	8,300
competitive plus	23,552	27,436	6,970
competitive	19,400	24,166	6,542
less competitive	26,335	21,262	5,359
some or no selection, 4-year	18,981	16,638	5,119
private 2-year	14,852	17,822	6,796
public 2-year	7,573	10,543	4,991
for-profit 2-year	18,486	21,456	3,257

Notes: The sources are colleges' net cost calculators for the out-of-pocket cost column and IPEDS for the remaining columns. The net cost data were gathered for the 2009-10 school year by the authors, for the institutions at the very competitive and more selective levels. For the institutions of lower selectivity, net cost estimates are based on the institution's published net cost calculator for the year closest to 2009-10--never later than 2011-12. Net costs are then reduced to approximate 2009-10 levels using the institution's own room and board and tuition net of aid numbers from IPEDS, for the relevant years.

Appendix Figure 1
Primary Elements of the ECO Interventions

Application Strategies	*Net Cost*	*Fee Waiver*	*ECO-C Intervention (Comprehensive)*	*Parent Intervention*
• Personalized letter of introduction • Application Strategies guide • Brochure with graduation rates for all four-year institutions • College deadline chart request form, example, and business reply envelope • Blank Common Application • Intervention FAQ document • Reminder magnet	• Personalized letter of introduction • Financial Aid guide • State-specific net cost handout, with predicted net cost for three income levels: $25k, $40k, and $60k. • Handout of net costs for selective colleges nationally. • List of colleges that meet 100% of a student's need. • List of state merit and need aid opportunities • Intervention FAQ document • Reminder magnet	• Personalized letter of introduction • Fee waiver guide • 8 ECO Fee Waiver coupons, personalized with participant's name • Fee waiver instructions and list of participating institutions • Intervention FAQ document • Reminder magnet	*Packet One:* • Personalized letter of introduction • Application strategies guide • All supplemental materials (graduation rates, net costs, etc.) from AS & FA interventions *Packet Two*: • Personalized letter of introduction • Fee Waiver guide • 8 ECO Fee Waiver coupons, personalized with participant's name • Fee waiver instructions and list of participating institutions.	• Personalized letter of introduction • Parent Guide #1 (AS): Content of Application Strategies modified for parents • Parent Guide #2 (FA): Content of Financial Aid modified for parents • Parent Guide Glossary • All supplemental materials (graduation rates, net costs, etc.) from AS & FA interventions *April mailing* Parents receive a guide about how to help their child(ren) in making college decisions in the spring.

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	all (obs = 9341)		control (obs = 1536)		ECO-C (obs = 1569)	
variable	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1363	59	1362	59	1364	59
estimated family income	33875	10929	33633	10984	34326	10700
female	0.414	0.493	0.403	0.491	0.403	0.491
Asian	0.053	0.225	0.054	0.227	0.061	0.240
white	0.358	0.480	0.333	0.471	0.351	0.477
underrepresented minority	0.181	0.385	0.202	0.402	0.175	0.380
population density is low	0.420	0.494	0.437	0.496	0.418	0.493
population density is medium	0.299	0.458	0.298	0.458	0.290	0.454
maximum of parents' education is high school	0.656	0.475	0.664	0.473	0.657	0.475
number of high achievers per cohort in high school (including student himself)	7.193	7.239	6.846	7.049	7.420	7.345
high school was public	0.804	0.397	0.804	0.397	0.780	0.414
high school was independent non-religious	0.034	0.180	0.033	0.179	0.038	0.192
high school was Catholic	0.060	0.237	0.047	0.212	0.077	0.266
high school was other relig affil	0.055	0.229	0.065	0.246	0.053	0.224
high school was home schooling	0.004	0.060	0.004	0.065	0.001	0.026
high school was charter	0.015	0.120	0.012	0.109	0.016	0.127
high school was magnet	0.029	0.167	0.035	0.184	0.036	0.185

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	all (obs = 9341)		control (obs = 1536)		ECO-C (obs = 1569)	
variable	mean	std dev	mean	std dev	mean	std dev
number of student in high school's of graduating cohort	224.635	169.128	224.924	167.002	223.691	165.626
% of students in high school Native American	1.125	3.880	1.227	4.976	1.037	3.679
% of students in high school Asian	3.623	7.975	3.595	7.897	3.887	8.277
% of students in high school Hispanic	12.510	20.172	13.312	21.523	12.963	20.128
% of students in high school black	9.778	14.886	9.738	14.724	9.745	14.562
% of students in high school white	72.963	27.369	72.127	28.019	72.368	27.571
pupil-teacher ratio of high school	16.275	12.995	16.707	18.279	15.708	4.367
inside urban area & inside principal city w pop of 250k+	0.098	0.297	0.085	0.278	0.100	0.300
inside urban area & inside principal city w pop of 100-250k	0.059	0.236	0.062	0.241	0.075	0.264
inside urban area & inside principal city w pop of <100k	0.089	0.285	0.078	0.268	0.096	0.294
outside principal city & inside urban area w pop of 250k+	0.150	0.357	0.146	0.353	0.156	0.363
outsid principal city & inside urban area w pop of 100-250k	0.030	0.171	0.031	0.173	0.029	0.169
outsid principal city & inside urban area w pop <100k	0.025	0.156	0.027	0.163	0.024	0.152
inside urban cluster that <=10 miles from urban area	0.054	0.225	0.057	0.231	0.041	0.199

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	all (obs = 9341)		control (obs = 1536)		ECO-C (obs = 1569)	
variable	mean	std dev	mean	std dev	mean	std dev
inside urban cluster that >10 & <=35 miles from urban area	0.093	0.291	0.101	0.301	0.096	0.295
inside urban cluster that 35+miles from urban area	0.084	0.278	0.085	0.278	0.088	0.283
<=5miles frm urban area <=2.5miles frm urb cluster	0.144	0.351	0.145	0.353	0.141	0.348
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.116	0.320	0.123	0.329	0.104	0.305
>25miles frm urban area & >10miles frm urb cluster	0.057	0.232	0.061	0.239	0.050	0.218
population in student's block group in 2000 Census	1729.170	1185.716	1750.717	1199.885	1736.642	1087.730
% of population was white in 2000 Census, student's block group	80.809	21.804	81.160	21.241	80.628	21.915
% of population was black in 2000 Census, student's block group	7.891	14.801	7.446	13.682	7.789	14.588
% of population was Asian in 2000 Census, student's block group	3.094	8.735	2.900	7.938	3.202	8.820
% of adult without high school degree, 2000 Census, student's block group	17.586	10.164	17.772	10.037	17.504	10.023

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	all (obs = 9341)		control (obs = 1536)		ECO-C (obs = 1569)	
variable	mean	std dev	mean	std dev	mean	std dev
% of adult with high school degree only, 2000 Census, student's block group	44.369	10.463	44.959	10.215	44.222	10.326

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	all (obs = 7931)		control (obs = 1323)		ECO-C (obs = 1296)	
variable	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1363.5	58.9	1362.0	59.5	1364.0	59.1
estimated family income	34076	10824	34019	10871	34522	10662
female	0.421	0.494	0.408	0.492	0.410	0.492
Asian	0.047	0.211	0.045	0.207	0.046	0.209
white	0.357	0.479	0.330	0.471	0.355	0.479
underrepresented minority	0.177	0.382	0.195	0.397	0.171	0.377
population density is low	0.429	0.495	0.445	0.497	0.430	0.495
population density is medium	0.299	0.458	0.296	0.457	0.296	0.457
maximum of parents' education is high school	0.660	0.474	0.675	0.469	0.662	0.473
number of high achievers per cohort in high school (including student himself)	7.132	7.199	6.763	7.015	7.337	7.304
high school was public	0.812	0.390	0.815	0.388	0.794	0.405
high school was independent non-religious	0.030	0.169	0.029	0.167	0.026	0.158

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	all (obs = 7931)		control (obs = 1323)		ECO-C (obs = 1296)	
variable	mean	std dev	mean	std dev	mean	std dev
high school was Catholic	0.060	0.238	0.047	0.213	0.081	0.273
high school was other relig affil	0.052	0.223	0.060	0.237	0.048	0.214
high school was home schooling	0.003	0.057	0.003	0.057	0.001	0.029
high school was charter	0.014	0.117	0.012	0.110	0.015	0.121
high school was magnet	0.028	0.165	0.034	0.180	0.036	0.187
number of student in high school's of graduating cohort	223.336	166.137	225.759	164.804	223.871	161.686
% of students in high school Native American	1.115	3.809	1.186	4.861	1.070	3.947
% of students in high school Asian	3.463	7.693	3.451	7.922	3.599	7.825
% of students in high school Hispanic	12.232	19.893	13.103	21.289	12.661	19.818
% of students in high school black	9.685	14.708	9.449	14.313	9.744	14.538
% of students in high school white	73.505	26.963	72.812	27.664	72.927	27.104
pupil-teacher ratio of high school	16.339	13.800	16.954	19.612	15.805	4.298
inside urban area & inside principal city w pop of 250k+	0.091	0.287	0.076	0.265	0.093	0.291
inside urban area & inside principal city w pop of 100-250k	0.057	0.232	0.057	0.231	0.069	0.253
inside urban area & inside principal city w pop of <100k	0.092	0.289	0.082	0.275	0.102	0.302
outside principal city & inside urban area w pop of 250k+	0.146	0.353	0.143	0.350	0.153	0.360

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	all (obs = 7931)		control (obs = 1323)		ECO-C (obs = 1296)	
variable	mean	std dev	mean	std dev	mean	std dev
outsid principal city & inside urban area w pop of 100-250k	0.031	0.173	0.032	0.175	0.034	0.180
outsid principal city & inside urban area w pop <100k	0.025	0.158	0.028	0.166	0.024	0.154
inside urban cluster that <=10 miles from urban area	0.052	0.222	0.053	0.225	0.041	0.199
inside urban cluster that >10 & <=35 miles from urban area	0.097	0.297	0.107	0.310	0.101	0.301
inside urban cluster that 35+miles from urban area	0.084	0.277	0.084	0.278	0.085	0.279
<=5miles frm urban area <=2.5miles frm urb cluster	0.147	0.354	0.149	0.356	0.144	0.351
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.120	0.325	0.124	0.330	0.104	0.306
>25miles frm urban area & >10miles frm urb cluster	0.058	0.233	0.065	0.246	0.051	0.221
population in student's block group in 2000 Census	1729.530	1171.720	1761.450	1185.710	1743.520	1067.360
% of population was white in 2000 Census, student's block group	81.356	21.347	81.613	21.068	81.624	21.063
% of population was black in 2000 Census, student's block group	7.788	14.659	7.306	13.606	7.608	14.213
% of population was Asian in 2000 Census, student's block group	2.915	8.382	2.803	7.868	2.956	8.630

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	all (obs = 7931)		control (obs = 1323)		ECO-C (obs = 1296)	
variable	mean	std dev	mean	std dev	mean	std dev
% of adult without high school degree, 2000 Census, student's block group	17.596	9.999	17.887	9.936	17.176	9.604
% of adult with high school degree only, 2000 Census, student's block group	44.604	10.330	45.173	10.008	44.702	10.009

Part C: Students who completed ECO survey

	all (obs = 5367)		control (917)		ECO-C (918)	
variable	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1368.6	61.7	1367.1	61.4	1368.1	62.9
estimated family income	33737	11014	33339	11070	34050	10639
female	0.457	0.498	0.449	0.498	0.453	0.498
Asian	0.028	0.166	0.029	0.169	0.034	0.181
white	0.048	0.213	0.044	0.204	0.052	0.223
underrepresented minority	0.517	0.500	0.569	0.498	0.500	0.502
population density is low	0.408	0.492	0.433	0.496	0.394	0.489
population density is medium	0.298	0.457	0.301	0.459	0.284	0.451
maximum of parents' education is high school	0.656	0.475	0.664	0.473	0.657	0.475
number of high achievers per cohort in high school (including student himself)	7.146	7.265	6.607	6.853	7.418	7.342
high school was public	0.814	0.389	0.808	0.394	0.786	0.410

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part C: Students who completed ECO survey

	all (obs = 5367)		control (917)		ECO-C (918)	
variable	mean	std dev	mean	std dev	mean	std dev
high school was independent non-religious	0.031	0.173	0.031	0.173	0.038	0.192
high school was Catholic	0.054	0.226	0.041	0.197	0.079	0.270
high school was other relig affil	0.051	0.220	0.068	0.252	0.043	0.203
high school was home schooling	0.004	0.060	0.004	0.060	0.000	0.000
high school was charter	0.014	0.118	0.010	0.097	0.014	0.117
high school was magnet	0.032	0.177	0.039	0.195	0.039	0.195
number of student in high school's of graduating cohort	226.855	170.598	222.978	169.748	226.991	169.009
% of students in high school Native American	1.136	3.939	1.225	5.132	1.123	3.992
% of students in high school Asian	3.706	7.886	3.649	8.089	4.216	8.739
% of students in high school Hispanic	12.774	20.558	13.154	21.570	13.313	20.363
% of students in high school black	9.675	15.085	9.472	15.080	9.379	14.449
% of students in high school white	72.709	27.897	72.500	28.248	71.969	28.377
pupil-teacher ratio of high school	16.239	7.552	16.581	11.224	15.864	4.202
inside urban area & inside principal city w pop of 250k+	0.099	0.299	0.086	0.281	0.107	0.310
inside urban area & inside principal city w pop of 100-250k	0.063	0.243	0.068	0.252	0.078	0.268
inside urban area & inside principal city w pop of <100k	0.097	0.296	0.085	0.279	0.097	0.296

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part C: Students who completed ECO survey

	all (obs = 5367)		control (917)		ECO-C (918)	
variable	mean	std dev	mean	std dev	mean	std dev
outside principal city & inside urban area w pop of 250k+	0.142	0.349	0.130	0.336	0.148	0.355
outsid principal city & inside urban area w pop of 100-250k	0.029	0.168	0.032	0.175	0.028	0.166
outsid principal city & inside urban area w pop <100k	0.023	0.150	0.028	0.165	0.024	0.152
inside urban cluster that <=10 miles from urban area	0.052	0.222	0.052	0.223	0.047	0.212
inside urban cluster that >10 & <=35 miles from urban area	0.089	0.285	0.097	0.296	0.090	0.286
inside urban cluster that 35+miles from urban area	0.089	0.285	0.098	0.298	0.092	0.289
<=5miles frm urban area <=2.5miles frm urb cluster	0.140	0.347	0.136	0.343	0.130	0.336
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.114	0.318	0.124	0.330	0.102	0.302
>25miles frm urban area & >10miles frm urb cluster	0.063	0.243	0.064	0.245	0.058	0.234
population in student's block group in 2000 Census	1703.780	1089.070	1728.530	1091.960	1758.710	1162.040
% of population was white in 2000 Census, student's block group	80.393	22.384	80.776	22.262	79.778	22.870
% of population was black in 2000 Census, student's block group	7.824	14.886	7.344	14.101	7.544	14.649

Table A1
Selected Predetermined Variables for All, Control, and ECO-C Target Students in 2011-12 Cohort

Part C: Students who completed ECO survey

	all (obs = 5367)		control (917)		ECO-C (918)	
variable	mean	std dev	mean	std dev	mean	std dev
% of population was Asian in 2000 Census, student's block group	3.293	9.309	3.083	8.668	3.670	9.975
% of adult without high school degree, 2000 Census, student's block group	17.627	10.308	17.841	10.107	17.794	10.308
% of adult with high school degree only, 2000 Census, student's block group	44.302	10.548	44.702	10.560	43.865	10.660

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 1 through 6.

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data (see note)

	control feeder (obs = 683)		ECO-C feeder (obs = 641)		control affluent (obs = 972)		ECO-C affluent (obs = 984)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1386	70	1383	68	1374	67	1373	65
estimated family income	58201	29200	58474	29036	76671	19971	77098	19606
female	0.419	0.494	0.421	0.494	0.406	0.491	0.429	0.495
Asian	0.126	0.332	0.129	0.336	0.052	0.222	0.063	0.243
white	0.300	0.458	0.267	0.443	0.376	0.485	0.366	0.482
underrepresented minority	0.182	0.386	0.224	0.418	0.135	0.342	0.143	0.350
population density is low	0.103	0.304	0.112	0.315	0.332	0.471	0.328	0.470
population density is medium	0.366	0.482	0.361	0.481	0.412	0.493	0.428	0.495
maximum of parents' education is high school	0.198	0.399	0.187	0.390	0.178	0.383	0.161	0.368
number of high achievers per cohort in high school (including student himself)	98.419	116.665	92.877	111.905	32.155	65.865	27.004	52.555
high school was public	0.769	0.422	0.774	0.418	0.771	0.420	0.763	0.425
high school was independent non-religious	0.022	0.148	0.019	0.137	0.030	0.171	0.024	0.153
high school was Catholic	0.066	0.248	0.070	0.255	0.079	0.270	0.086	0.281
high school was other relig affil	0.009	0.094	0.011	0.105	0.058	0.234	0.066	0.248
high school was home schooling	0.000	0.000	0.000	0.000	0.007	0.082	0.001	0.033
high school was charter	0.010	0.102	0.010	0.097	0.014	0.120	0.019	0.135
high school was magnet	0.124	0.330	0.116	0.321	0.041	0.199	0.041	0.200

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data (see note)

	control feeder (obs = 683)		ECO-C feeder (obs = 641)		control affluent (obs = 972)		ECO-C affluent (obs = 984)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
number of student in high school's of graduating cohort	437.360	203.106	437.445	204.021	291.698	206.629	287.527	190.007
% of students in high school Native American	0.667	1.577	0.559	1.161	0.923	3.096	0.815	2.587
% of students in high school Asian	13.091	14.972	13.083	15.681	5.842	10.274	5.059	8.520
% of students in high school Hispanic	11.589	12.071	12.679	14.016	10.358	14.985	11.371	15.862
% of students in high school black	12.920	13.018	12.685	12.621	9.831	13.632	11.649	15.355
% of students in high school white	61.733	22.091	60.994	22.646	73.046	23.568	71.106	23.939
pupil-teacher ratio of high school	18.229	4.544	18.155	4.459	16.715	7.995	16.393	4.173
inside urban area & inside principal city w pop of 250k+	0.371	0.484	0.371	0.484	0.149	0.356	0.141	0.349
inside urban area & inside principal city w pop of 100-250k	0.104	0.305	0.124	0.330	0.088	0.284	0.092	0.289
inside urban area & inside principal city w pop of <100k	0.137	0.344	0.143	0.351	0.109	0.312	0.136	0.343
outside principal city & inside urban area w pop of 250k+	0.292	0.455	0.261	0.439	0.237	0.426	0.247	0.432
outsid principal city & inside urban area w pop of 100-250k	0.020	0.139	0.018	0.133	0.033	0.178	0.032	0.176
outsid principal city & inside urban area w pop <100k	0.003	0.055	0.003	0.057	0.020	0.141	0.021	0.143
inside urban cluster that <=10 miles from urban area	0.018	0.134	0.018	0.133	0.052	0.222	0.045	0.208
inside urban cluster that >10 & <=35 miles from urban area	0.008	0.087	0.002	0.040	0.076	0.265	0.054	0.226

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data (see note)

	control feeder (obs = 683)		ECO-C feeder (obs = 641)		control affluent (obs = 972)		ECO-C affluent (obs = 984)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
inside urban cluster that 35+miles from urban area	0.008	0.087	0.007	0.081	0.032	0.175	0.038	0.190
<=5miles frm urban area <=2.5miles frm urb cluster	0.038	0.191	0.047	0.212	0.134	0.341	0.129	0.336
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.002	0.039	0.007	0.081	0.062	0.241	0.057	0.233
>25miles frm urban area & >10miles frm urb cluster	0.000	0.000	0.000	0.000	0.008	0.089	0.008	0.088
population in student's block group in 2000 Census	1860.273	1326.905	1942.554	1461.976	1910.049	1413.443	1947.292	1467.305
% of population was white in 2000 Census, student's block group	70.663	24.949	70.428	25.840	83.622	17.599	84.043	16.410
% of population was black in 2000 Census, student's block group	10.604	17.462	10.740	18.360	6.171	11.684	6.471	11.454
% of population was Asian in 2000 Census, student's block group	9.144	14.444	8.731	14.734	4.437	8.482	3.752	7.147
% of adult without high school degree, 2000 Census, student's block group	13.834	12.571	13.916	12.672	10.710	8.133	10.323	7.457
% of adult with high school degree only, 2000 Census, student's block group	33.939	11.625	33.460	11.818	39.190	12.141	39.055	12.043

Note: We attempted to select 1000 students for each intervention and for the control group from the pool of students who fit our score criterion but who were excluded from our target group because they were too affluent, attended a feeder high school, or both. It is important to recognize that the "more affluent" and "feeder" groups of students are not mutually exclusive. It is common for affluent high-scoring

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

students to attend feeder high schools simply because they tend to live in affluent areas with public schools that contain students like them. It is only among low-income students that feeder schools tend to be selective, magnet, or otherwise unusual schools.

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control feeder (obs = 587)		ECO-C feeder (obs = 551)		control affluent (obs = 817)		ECO-C affluent (obs = 827)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1384.7	70.0	1382.9	67.3	1373.0	66.4	1372.5	65.2
estimated family income	56869	28020	58536	28604	76015	18588	77058	19591
female	0.431	0.496	0.417	0.494	0.415	0.493	0.438	0.496
Asian	0.123	0.329	0.125	0.331	0.047	0.211	0.062	0.241
white	0.288	0.453	0.265	0.442	0.373	0.484	0.359	0.480
underrepresented minority	0.188	0.391	0.219	0.414	0.137	0.344	0.150	0.357
population density is low	0.101	0.302	0.109	0.312	0.346	0.476	0.340	0.474
population density is medium	0.366	0.482	0.364	0.482	0.411	0.492	0.425	0.495
maximum of parents' education is high school	0.188	0.391	0.185	0.389	0.181	0.385	0.162	0.368
number of high achievers per cohort in high school (including student himself)	99.282	118.821	92.702	114.315	31.665	68.220	26.550	48.343
high school was public	0.763	0.425	0.780	0.415	0.774	0.419	0.785	0.411
high school was independent non-religious	0.023	0.149	0.013	0.113	0.029	0.168	0.018	0.133
high school was Catholic	0.068	0.252	0.067	0.249	0.079	0.271	0.079	0.269
high school was other relig affil	0.010	0.102	0.013	0.113	0.056	0.229	0.057	0.232
high school was home schooling	0.000	0.000	0.000	0.000	0.008	0.089	0.001	0.036
high school was charter	0.012	0.110	0.009	0.096	0.015	0.120	0.018	0.133

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control feeder (obs = 587)		ECO-C feeder (obs = 551)		control affluent (obs = 817)		ECO-C affluent (obs = 827)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
high school was magnet	0.123	0.329	0.118	0.323	0.041	0.199	0.043	0.202
number of student in high school's of graduating cohort	439.932	207.540	436.063	202.299	289.200	206.916	293.705	190.708
% of students in high school Native American	0.643	1.483	0.569	1.197	0.875	3.057	0.779	2.396
% of students in high school Asian	13.204	15.045	12.704	15.331	5.693	10.179	4.923	8.301
% of students in high school Hispanic	11.370	11.650	12.712	13.907	10.324	15.294	11.697	16.048
% of students in high school black	13.011	12.873	13.204	13.006	9.955	13.804	11.786	15.410
% of students in high school white	61.771	22.167	60.812	22.455	73.153	23.835	70.815	24.157
pupil-teacher ratio of high school	18.139	4.382	18.189	4.385	16.731	8.468	16.540	4.169
inside urban area & inside principal city w pop of 250k+	0.378	0.485	0.375	0.485	0.141	0.348	0.139	0.346
inside urban area & inside principal city w pop of 100-250k	0.099	0.300	0.127	0.333	0.084	0.278	0.092	0.290
inside urban area & inside principal city w pop of <100k	0.130	0.336	0.140	0.347	0.114	0.318	0.140	0.347
outside principal city & inside urban area w pop of 250k+	0.302	0.460	0.258	0.438	0.233	0.423	0.238	0.426
outsid principal city & inside urban area w pop of 100-250k	0.016	0.126	0.015	0.122	0.032	0.176	0.031	0.174
outsid principal city & inside urban area w pop <100k	0.002	0.042	0.004	0.061	0.020	0.140	0.019	0.138
inside urban cluster that <=10 miles from urban area	0.018	0.132	0.021	0.143	0.055	0.228	0.047	0.211

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control feeder (obs = 587)		ECO-C feeder (obs = 551)		control affluent (obs = 817)		ECO-C affluent (obs = 827)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
inside urban cluster that >10 & <=35 miles from urban area	0.007	0.084	0.002	0.044	0.076	0.266	0.052	0.222
inside urban cluster that 35+miles from urban area	0.005	0.073	0.006	0.075	0.028	0.165	0.038	0.191
<=5miles frm urban area <=2.5miles frm urb cluster	0.041	0.198	0.045	0.209	0.141	0.348	0.136	0.343
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.002	0.042	0.008	0.087	0.067	0.250	0.061	0.240
>25miles frm urban area & >10miles frm urb cluster	0.000	0.000	0.000	0.000	0.009	0.096	0.006	0.080
population in student's block group in 2000 Census	1849.350	1233.190	1940.850	1397.910	1915.310	1386.900	1958.380	1476.030
% of population was white in 2000 Census, student's block group	70.473	25.466	70.540	25.467	83.738	17.692	84.225	16.477
% of population was black in 2000 Census, student's block group	10.580	17.909	10.696	17.806	6.175	11.843	6.508	11.636
% of population was Asian in 2000 Census, student's block group	9.339	14.874	8.645	14.784	4.361	8.552	3.603	7.133
% of adult without high school degree, 2000 Census, student's block group	13.929	12.697	13.950	12.728	10.799	7.967	10.437	7.477
% of adult with high school degree only, 2000 Census, student's block group	34.176	11.699	33.412	11.801	39.904	11.997	39.176	11.963

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part C: Students who completed ECO survey

	control feeder (obs = 399)		ECO-C feeder (obs = 392)		control affluent (obs = 547)		ECO-C affluent (obs = 557)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1392.3	72.0	1393.9	72.5	1379.9	69.5	1381.9	70.6
estimated family income	56293	28139	56956	27077	75578	18804	76525	18052
female	0.471	0.500	0.449	0.498	0.453	0.498	0.461	0.499
Asian	0.065	0.247	0.074	0.262	0.022	0.147	0.034	0.182
white	0.063	0.243	0.069	0.254	0.046	0.209	0.045	0.207
underrepresented minority	0.354	0.483	0.315	0.469	0.417	0.498	0.392	0.493
population density is low	0.114	0.319	0.109	0.312	0.349	0.477	0.340	0.474
population density is medium	0.338	0.474	0.339	0.474	0.400	0.490	0.420	0.494
maximum of parents' education is high school	0.198	0.399	0.187	0.390	0.178	0.383	0.161	0.368
number of high achievers per cohort in high school (including student himself)	100.396	118.262	96.569	117.173	33.846	76.184	28.300	54.301
high school was public	0.779	0.415	0.770	0.421	0.788	0.409	0.776	0.417
high school was independent non-religious	0.015	0.123	0.013	0.113	0.020	0.141	0.019	0.138
high school was Catholic	0.051	0.221	0.067	0.251	0.081	0.273	0.088	0.283
high school was other relig affil	0.003	0.051	0.010	0.101	0.052	0.223	0.051	0.219
high school was home schooling	0.000	0.000	0.000	0.000	0.008	0.090	0.002	0.044
high school was charter	0.015	0.123	0.010	0.101	0.016	0.126	0.025	0.157
high school was magnet	0.136	0.343	0.129	0.336	0.036	0.187	0.039	0.194
number of student in high school's of graduating cohort	438.716	189.833	436.545	202.732	290.657	197.066	281.480	180.324

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part C: Students who completed ECO survey

	control feeder (obs = 399)		ECO-C feeder (obs = 392)		control affluent (obs = 547)		ECO-C affluent (obs = 557)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
% of students in high school Native American	0.721	1.634	0.504	0.933	0.930	2.799	0.783	2.393
% of students in high school Asian	13.696	15.132	13.467	15.527	5.910	10.643	5.689	9.702
% of students in high school Hispanic	11.320	11.417	12.490	14.026	10.670	15.454	11.204	15.507
% of students in high school black	13.475	13.292	12.799	12.142	9.173	12.386	10.993	14.527
% of students in high school white	60.789	22.778	60.740	22.554	73.317	23.407	71.332	23.609
pupil-teacher ratio of high school	18.631	4.517	18.016	4.325	16.923	8.322	16.490	4.196
inside urban area & inside principal city w pop of 250k+	0.387	0.488	0.384	0.487	0.124	0.330	0.148	0.355
inside urban area & inside principal city w pop of 100-250k	0.110	0.313	0.121	0.327	0.096	0.295	0.077	0.266
inside urban area & inside principal city w pop of <100k	0.152	0.359	0.134	0.341	0.106	0.308	0.140	0.347
outside principal city & inside urban area w pop of 250k+	0.251	0.434	0.250	0.434	0.228	0.420	0.232	0.423
outsid principal city & inside urban area w pop of 100-250k	0.024	0.152	0.024	0.152	0.043	0.203	0.043	0.204
outsid principal city & inside urban area w pop <100k	0.005	0.072	0.005	0.072	0.029	0.167	0.020	0.139
inside urban cluster that <=10 miles from urban area	0.013	0.114	0.024	0.152	0.059	0.236	0.053	0.225
inside urban cluster that >10 & <=35 miles from urban area	0.008	0.088	0.000	0.000	0.079	0.271	0.053	0.225
inside urban cluster that 35+miles from urban area	0.003	0.051	0.005	0.072	0.031	0.172	0.041	0.199

Table A2
Predetermined Variables for Nontarget Control and ECO-C Students

Part C: Students who completed ECO survey

	control feeder (obs = 399)		ECO-C feeder (obs = 392)		control affluent (obs = 547)		ECO-C affluent (obs = 557)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev
<=5miles frm urban area <=2.5miles frm urb cluster	0.045	0.206	0.047	0.213	0.124	0.330	0.134	0.341
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.003	0.051	0.005	0.072	0.069	0.254	0.051	0.221
>25miles frm urban area & >10miles frm urb cluster	0.000	0.000	0.000	0.000	0.012	0.110	0.008	0.088
population in student's block group in 2000 Census	1825.350	1132.840	1888.810	1445.730	1826.780	1275.020	2020.840	1520.930
% of population was white in 2000 Census, student's block group	69.803	25.716	69.573	26.448	83.608	17.614	83.975	16.767
% of population was black in 2000 Census, student's block group	10.965	17.958	11.493	19.484	5.969	10.949	6.324	11.552
% of population was Asian in 2000 Census, student's block group	9.269	14.974	8.880	15.125	4.566	9.339	3.902	7.470
% of adult without high school degree, 2000 Census, student's block group	14.481	13.203	14.471	13.230	10.856	7.926	10.370	7.656
% of adult with high school degree only, 2000 Census, student's block group	33.618	11.687	33.251	11.957	39.963	11.897	38.994	11.642

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 7 and 8.

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	control (obs = 3395)		application guidance (obs = 3421)		net cost (obs = 3422)		fee waiver (obs = 3417)		parent intervention (obs = 3392)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1345	62	1345	62	1344	61	1348	65	1346	62
estimated family income	33536	10900	33433	10903	33960	10752	33642	11055	33513	11220
female	0.471	0.499	0.481	0.500	0.474	0.499	0.464	0.499	0.483	0.500
Asian	0.074	0.263	0.078	0.268	0.068	0.252	0.066	0.248	0.070	0.254
white	0.309	0.462	0.343	0.475	0.329	0.470	0.318	0.466	0.342	0.474
underrepresented minority	0.327	0.469	0.306	0.461	0.329	0.470	0.316	0.465	0.322	0.468
population density is low	0.377	0.485	0.370	0.483	0.372	0.483	0.365	0.482	0.359	0.480
population density is medium	0.305	0.460	0.319	0.466	0.308	0.462	0.321	0.467	0.322	0.467
maximum of parents' education is high school	0.708	0.455	0.672	0.470	0.722	0.448	0.708	0.455	0.716	0.451
number of high achievers per cohort in high school (including student himself)	6.787	7.205	6.854	7.429	6.785	7.137	6.912	7.198	6.773	7.201
high school was public	0.841	0.366	0.848	0.359	0.853	0.354	0.849	0.358	0.840	0.367
high school was independent non-religious	0.027	0.161	0.024	0.154	0.026	0.159	0.023	0.151	0.028	0.165
high school was Catholic	0.036	0.186	0.043	0.202	0.043	0.202	0.044	0.204	0.040	0.196
high school was other relig affil	0.041	0.198	0.036	0.186	0.030	0.169	0.035	0.184	0.043	0.202
high school was home schooling	0.002	0.043	0.003	0.053	0.002	0.047	0.003	0.053	0.002	0.040
high school was charter	0.012	0.110	0.015	0.123	0.015	0.123	0.012	0.107	0.012	0.110

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	control (obs = 3395)		application guidance (obs = 3421)		net cost (obs = 3422)		fee waiver (obs = 3417)		parent intervention (obs = 3392)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
high school was magnet	0.042	0.200	0.030	0.171	0.031	0.175	0.035	0.184	0.035	0.184
number of student in high school's of graduating cohort	246.955	163.289	240.033	162.720	247.137	164.392	247.609	167.202	243.162	167.704
% of students in high school Native American	1.354	4.529	1.347	4.365	1.314	4.555	1.413	4.826	1.286	4.136
% of students in high school Asian	3.407	7.397	3.263	7.533	3.238	6.958	3.276	6.939	3.329	7.733
% of students in high school Hispanic	14.232	22.494	13.985	22.490	13.951	22.218	13.817	22.001	13.393	21.194
% of students in high school black	14.872	22.066	14.453	21.811	14.638	22.122	14.528	21.750	15.108	22.671
% of students in high school white	66.135	30.735	66.951	31.016	66.860	30.686	66.967	30.555	66.885	30.907
pupil-teacher ratio of high school	16.776	12.698	16.764	13.999	16.656	12.251	16.646	13.114	16.660	11.611
inside urban area & inside principal city w pop of 250k+	0.116	0.321	0.122	0.327	0.120	0.325	0.111	0.314	0.133	0.339
inside urban area & inside principal city w pop of 100-250k	0.073	0.260	0.065	0.246	0.064	0.245	0.065	0.247	0.060	0.237
inside urban area & inside principal city w pop of <100k	0.104	0.306	0.113	0.316	0.113	0.317	0.113	0.317	0.113	0.317
outside principal city & inside urban area w pop of 250k+	0.157	0.364	0.159	0.366	0.161	0.367	0.164	0.371	0.148	0.355
outsid principal city & inside urban area w pop of 100-250k	0.028	0.164	0.025	0.156	0.030	0.170	0.026	0.159	0.028	0.164

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	control (obs = 3395)		application guidance (obs = 3421)		net cost (obs = 3422)		fee waiver (obs = 3417)		parent intervention (obs = 3392)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
outsid principal city & inside urban area w pop <100k	0.023	0.151	0.024	0.152	0.021	0.144	0.022	0.147	0.026	0.159
inside urban cluster that <=10 miles from urban area	0.051	0.221	0.051	0.221	0.049	0.215	0.045	0.208	0.043	0.203
inside urban cluster that >10 & <=35 miles from urban area	0.080	0.272	0.078	0.268	0.086	0.281	0.093	0.291	0.086	0.280
inside urban cluster that 35+miles from urban area	0.092	0.290	0.098	0.297	0.088	0.283	0.097	0.296	0.090	0.286
<=5miles frm urban area <=2.5miles frm urb cluster	0.140	0.347	0.129	0.336	0.145	0.352	0.132	0.339	0.142	0.350
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.090	0.286	0.086	0.281	0.086	0.281	0.083	0.275	0.091	0.288
>25miles frm urban area & >10miles frm urb cluster	0.044	0.205	0.051	0.219	0.038	0.191	0.047	0.213	0.040	0.197
population in student's block group in 2000 Census	1639.924	1071.925	1611.845	1201.293	1628.236	1058.997	1640.562	1121.603	1595.102	1019.650
% of population was white in 2000 Census, student's block group	75.873	25.611	75.611	25.971	75.440	26.173	75.936	25.518	75.039	26.710
% of population was black in 2000 Census, student's block group	12.127	21.802	12.370	22.311	12.479	22.410	12.027	21.727	13.048	23.112
% of population was Asian in 2000 Census, student's block group	2.459	7.075	2.566	7.503	2.429	6.689	2.515	7.034	2.553	7.859

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part A: Students for whom we had sufficiently good contact information and predetermined data to survey them and potentially match them to NSC data

	control (obs = 3395)		application guidance (obs = 3421)		net cost (obs = 3422)		fee waiver (obs = 3417)		parent intervention (obs = 3392)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
% of adult without high school degree, 2000 Census, student's block group	19.784	10.902	19.977	11.150	19.962	11.162	19.677	11.018	19.874	11.073
% of adult with high school degree only, 2000 Census, student's block group	44.280	10.409	43.750	10.988	43.576	10.570	43.819	10.482	43.928	10.766

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control (obs = 2732)		application guidance (obs = 2713)		net cost (obs = 2748)		fee waiver (obs = 2764)		parent intervention (obs = 2676)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1349.4	64.2	1348.9	63.4	1349.4	63.0	1352.8	66.5	1350.8	63.9
estimated family income	34097	10894	33976	10774	34452	10781	34059	10991	34129	11110
female	0.470	0.499	0.482	0.500	0.474	0.499	0.467	0.499	0.487	0.500
Asian	0.067	0.250	0.072	0.259	0.065	0.246	0.061	0.239	0.062	0.241
white	0.311	0.463	0.351	0.477	0.328	0.470	0.319	0.466	0.336	0.473
underrepresented minority	0.283	0.451	0.264	0.441	0.285	0.452	0.269	0.444	0.289	0.453
population density is low	0.401	0.490	0.387	0.487	0.385	0.487	0.386	0.487	0.388	0.487
population density is medium	0.302	0.459	0.324	0.468	0.311	0.463	0.320	0.467	0.326	0.469
maximum of parents' education is high school	0.714	0.452	0.672	0.470	0.712	0.453	0.698	0.459	0.715	0.452

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control (obs = 2732)		application guidance (obs = 2713)		net cost (obs = 2748)		fee waiver (obs = 2764)		parent intervention (obs = 2676)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
number of high achievers per cohort in high school (including student himself)	6.928	7.254	7.014	7.379	7.021	7.256	7.209	7.331	6.930	7.225
high school was public	0.845	0.362	0.850	0.357	0.852	0.355	0.851	0.356	0.838	0.368
high school was independent non-religious	0.026	0.158	0.025	0.156	0.028	0.165	0.025	0.156	0.027	0.162
high school was Catholic	0.040	0.195	0.046	0.209	0.045	0.207	0.046	0.210	0.044	0.204
high school was other relig affil	0.039	0.194	0.036	0.188	0.029	0.169	0.035	0.183	0.044	0.204
high school was home schooling	0.002	0.039	0.003	0.052	0.002	0.044	0.003	0.052	0.002	0.044
high school was charter	0.011	0.105	0.012	0.111	0.015	0.122	0.010	0.099	0.012	0.108
high school was magnet	0.038	0.192	0.028	0.164	0.029	0.167	0.030	0.171	0.034	0.180
number of student in high school's of graduating cohort	242.581	162.073	233.505	157.393	243.518	162.664	242.753	166.762	235.856	164.937
% of students in high school Native American	1.336	4.515	1.337	4.206	1.319	4.697	1.417	4.956	1.307	4.350
% of students in high school Asian	3.254	7.200	3.122	7.333	3.223	6.830	3.223	6.905	3.224	7.768
% of students in high school Hispanic	12.988	21.299	12.465	20.926	12.591	20.725	12.460	20.498	11.929	19.700
% of students in high school black	13.963	21.158	13.412	20.623	13.784	21.106	13.292	20.235	13.921	21.253
% of students in high school white	68.459	29.557	69.665	29.462	69.083	29.483	69.609	28.990	69.620	29.597

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control (obs = 2732)		application guidance (obs = 2713)		net cost (obs = 2748)		fee waiver (obs = 2764)		parent intervention (obs = 2676)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
pupil-teacher ratio of high school	16.860	13.965	16.708	15.215	16.475	6.704	16.659	14.388	16.644	12.824
inside urban area & inside principal city w pop of 250k+	0.101	0.301	0.104	0.305	0.110	0.313	0.094	0.292	0.118	0.322
inside urban area & inside principal city w pop of 100-250k	0.065	0.247	0.061	0.240	0.059	0.237	0.064	0.246	0.056	0.229
inside urban area & inside principal city w pop of <100k	0.106	0.308	0.112	0.315	0.110	0.313	0.113	0.317	0.116	0.321
outside principal city & inside urban area w pop of 250k+	0.152	0.359	0.152	0.359	0.154	0.361	0.158	0.365	0.136	0.343
outsid principal city & inside urban area w pop of 100-250k	0.029	0.168	0.024	0.152	0.032	0.176	0.026	0.159	0.029	0.169
outsid principal city & inside urban area w pop <100k	0.024	0.154	0.026	0.160	0.022	0.145	0.022	0.146	0.026	0.161
inside urban cluster that <=10 miles from urban area	0.051	0.220	0.055	0.228	0.049	0.215	0.047	0.211	0.042	0.202
inside urban cluster that >10 & <=35 miles from urban area	0.088	0.284	0.082	0.275	0.096	0.294	0.097	0.296	0.092	0.289
inside urban cluster that 35+miles from urban area	0.095	0.294	0.104	0.305	0.091	0.287	0.102	0.303	0.095	0.293

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part B: Students who were matched to NSC data (those who do not enroll immediately after high school should not match)

	control (obs = 2732)		application guidance (obs = 2713)		net cost (obs = 2748)		fee waiver (obs = 2764)		parent intervention (obs = 2676)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
<=5miles frm urban area	0.145	0.352	0.136	0.343	0.146	0.354	0.140	0.347	0.144	0.351
<=2.5miles frm urb cluster										
<=25mls frm urban area	0.095	0.293	0.090	0.287	0.092	0.289	0.088	0.283	0.101	0.302
>2.5&<=10mls frm urb cluster										
>25miles frm urban area &	0.048	0.214	0.054	0.226	0.039	0.194	0.050	0.217	0.044	0.204
>10miles frm urb cluster										
population in student's block group in 2000 Census	1636.540	1063.430	1597.440	1187.150	1614.440	1020.880	1615.090	1077.960	1599.510	1032.980
% of population was white in 2000 Census, student's block group	77.608	24.834	77.557	24.828	76.986	25.408	77.911	24.263	76.948	25.605
% of population was black in 2000 Census, student's block group	11.375	21.296	11.442	21.200	11.738	21.666	11.035	20.514	11.961	21.700
% of population was Asian in 2000 Census, student's block group	2.36031	6.95605	2.41552	7.25171	2.38006	6.54793	2.35105	6.46123	2.53179	8.08189
% of adult without high school degree, 2000 Census, student's block group	19.4543	10.62	19.3064	10.6823	19.3896	10.8527	19.0858	10.554	19.2799	10.5442
% of adult with high school degree only, 2000 Census, student's block group	44.6468	10.129	44.1182	10.8639	43.9381	10.4825	44.3019	10.3355	44.3406	10.4454

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part C: Students who completed ECO survey

	control (obs = 1998)		application guidance (obs = 1876)		net cost (obs = 1897)		fee waiver (obs = 2013)		parent intervention (obs = 1852)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score (converted from ACT if necessary)	1353.7	67.6	1352.9	67.8	1353.8	66.9	1359.9	70.7	1356.6	68.4
estimated family income	33644	10680	33571	10634	34327	10711	34016	11064	33590	11076
female	0.497	0.500	0.502	0.500	0.505	0.500	0.483	0.500	0.513	0.500
Asian	0.074	0.262	0.084	0.277	0.071	0.256	0.073	0.259	0.073	0.261
white	0.087	0.282	0.103	0.305	0.089	0.284	0.091	0.288	0.093	0.290
underrepresented minority	0.477	0.500	0.416	0.494	0.487	0.501	0.429	0.496	0.500	0.501
population density is low	0.380	0.486	0.367	0.482	0.371	0.483	0.367	0.482	0.367	0.482
population density is medium	0.304	0.460	0.321	0.467	0.311	0.463	0.314	0.464	0.322	0.467
maximum of parents' education is high school	0.708	0.455	0.672	0.470	0.722	0.448	0.708	0.455	0.716	0.451
number of high achievers per cohort in high school (including student himself)	6.850	7.118	7.253	7.707	7.156	7.302	7.119	7.329	7.012	7.279
high school was public	0.845	0.362	0.845	0.362	0.855	0.353	0.853	0.354	0.845	0.362
high school was independent non-religious	0.024	0.153	0.024	0.152	0.028	0.164	0.022	0.146	0.027	0.162
high school was Catholic	0.034	0.182	0.040	0.196	0.044	0.205	0.046	0.211	0.039	0.194
high school was other relig affil	0.044	0.205	0.037	0.189	0.029	0.167	0.030	0.169	0.044	0.206
high school was home schooling	0.002	0.040	0.002	0.047	0.003	0.058	0.003	0.051	0.003	0.054
high school was charter	0.012	0.108	0.018	0.133	0.013	0.113	0.012	0.107	0.009	0.095

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part C: Students who completed ECO survey

	control (obs = 1998)		application guidance (obs = 1876)		net cost (obs = 1897)		fee waiver (obs = 2013)		parent intervention (obs = 1852)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
high school was magnet	0.040	0.196	0.034	0.181	0.029	0.167	0.035	0.183	0.033	0.179
number of student in high school's of graduating cohort	244.974	163.714	236.779	160.094	248.729	164.744	246.025	166.525	243.535	167.253
% of students in high school Native American	1.377	4.562	1.392	4.598	1.195	4.281	1.491	5.375	1.320	4.049
% of students in high school Asian	3.430	7.239	3.281	7.280	3.274	6.461	3.403	7.029	3.235	7.265
% of students in high school Hispanic	13.379	21.573	12.934	21.217	13.439	21.575	13.261	21.206	12.950	20.792
% of students in high school black	13.780	20.891	13.345	20.783	13.594	21.194	14.323	21.433	13.552	21.133
% of students in high school white	68.034	29.951	69.048	29.882	68.498	29.915	67.521	30.196	68.943	29.853
pupil-teacher ratio of high school	16.675	8.047	16.824	15.806	16.523	4.198	16.412	7.301	16.692	10.544
inside urban area & inside principal city w pop of 250k+	0.111	0.314	0.116	0.320	0.116	0.320	0.109	0.312	0.123	0.329
inside urban area & inside principal city w pop of 100-250k	0.071	0.257	0.070	0.255	0.059	0.236	0.066	0.248	0.064	0.245
inside urban area & inside principal city w pop of <100k	0.109	0.311	0.118	0.323	0.120	0.326	0.116	0.320	0.134	0.341

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part C: Students who completed ECO survey

	control (obs = 1998)		application guidance (obs = 1876)		net cost (obs = 1897)		fee waiver (obs = 2013)		parent intervention (obs = 1852)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
outside principal city & inside urban area w pop of 250k+	0.148	0.355	0.145	0.352	0.156	0.363	0.164	0.370	0.134	0.341
outsid principal city & inside urban area w pop of 100-250k	0.028	0.165	0.022	0.146	0.031	0.174	0.024	0.152	0.026	0.159
outsid principal city & inside urban area w pop <100k	0.023	0.151	0.022	0.147	0.023	0.149	0.024	0.152	0.025	0.156
inside urban cluster that <=10 miles from urban area	0.054	0.226	0.046	0.209	0.043	0.204	0.049	0.217	0.039	0.195
inside urban cluster that >10 & <=35 miles from urban area	0.080	0.271	0.080	0.271	0.102	0.302	0.094	0.292	0.087	0.282
inside urban cluster that 35+miles from urban area	0.098	0.298	0.103	0.304	0.086	0.281	0.102	0.303	0.095	0.293
<=5miles frm urban area <=2.5miles frm urb cluster	0.141	0.348	0.135	0.342	0.134	0.341	0.128	0.334	0.143	0.350
<=25mls frm urban area >2.5&<=10mls frm urb cluster	0.091	0.288	0.084	0.278	0.088	0.283	0.078	0.268	0.085	0.278
>25miles frm urban area & >10miles frm urb cluster	0.045	0.208	0.060	0.237	0.041	0.197	0.048	0.213	0.045	0.208
population in student's block group in 2000 Census	1621.700	1011.020	1560.790	1039.750	1600.740	1020.760	1602.180	1048.060	1586.170	1011.100

Table A3
Predetermined Variables for Control and Intervention Target Students in the 2010-11 and 2011-12 Cohorts

Part C: Students who completed ECO survey

	control (obs = 1998)		application guidance (obs = 1876)		net cost (obs = 1897)		fee waiver (obs = 2013)		parent intervention (obs = 1852)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
% of population was white in 2000 Census, student's block group	76.875	25.286	76.905	25.318	76.684	25.367	76.427	25.082	76.466	26.044
% of population was black in 2000 Census, student's block group	11.437	21.354	11.394	21.227	11.745	21.435	11.509	20.863	11.714	21.905
% of population was Asian in 2000 Census, student's block group	2.561	7.478	2.528	7.565	2.459	6.739	2.817	7.852	2.675	8.566
% of adult without high school degree, 2000 Census, student's block group	19.286	10.797	19.702	10.995	19.390	11.161	18.982	10.659	19.186	10.699
% of adult with high school degree only, 2000 Census, student's block group	44.343	10.414	44.005	11.021	43.821	10.430	43.927	10.393	44.265	10.742

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 9 and 10.

Table A4
Descriptive Statistics for Application Outcomes, 2011-12 Cohort Only

dependent variable:	number of ECO-C observations	number of control observations	control mean	control standard deviation
Number of Applications Submitted	918	917	4.666	3.602
Submitted at least Five Applications	918	917	0.408	0.492
Applied to a "Peer" Public University	872	876	0.236	0.425
Applied to a "Peer" Private University	894	893	0.521	0.500
Applied to a "Peer" Liberal Arts College	894	894	0.304	0.460
Applied to a "Peer" Institution of any Type	872	876	0.547	0.498
Applied to an Institution that was at least "Peer" minus about 10 percentiles	872	876	0.694	0.461
Applied to an Institution that was at least "Peer" minus about 20 percentiles	872	876	0.744	0.437
Applied to an Institution that was at least "Peer" minus about 30 percentiles	872	876	0.881	0.324
Applied to an Institution that was "Peer" plus 5 percentiles	918	917	0.519	1.333
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	862	867	67.307	21.933
Instructional Spending, Maximum Among Colleges to which Applied	872	873	35012	30686
Student-Related Spending, Maximum Among Colleges to which Applied	872	873	58713	47191
Median SAT Score of Students, Maximum Among Colleges to which Applied	851	854	1319.3	152.5

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 1 and 2. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A5
Descriptive Statistics for Admissions and Other Outcomes, 2011-12 Cohort Only

dependent variable:	number of ECO-C observations	number of control observations	control mean	control standard deviation
Number of Colleges to which Admitted	918	917	2.055	1.373
Admitted to a "Peer" Institution	868	870	0.300	0.459
Admitted to an Institution that was at least "Peer" minus about 10 percentiles	868	870	0.492	0.500
Admitted to an Institution that was at least "Peer" minus about 20 percentiles	868	870	0.555	0.497
Admitted to an Institution that was at least "Peer" minus about 30 percentiles	868	870	0.754	0.431
Admitted to an Institution that was "Peer" plus 5 percentiles	918	917	0.492	1.227
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	847	847	46.434	18.490
Instructional Spending, Maximum Among Colleges to which Admitted	868	867	16597	13912
Student-Related Spending, Maximum Among Colleges to which Admitted	868	867	29563	22433
Median SAT Score of Students, Maximum Among Colleges to which Admitted	819	819	1222.4	126.3
Filed a Free Application for Federal Student Aid (FAFSA)	886	885	0.908	0.289
Used Any Application Fee Waivers	893	893	0.450	0.498
Number of Application Fee Waivers Used	539	400	3.590	3.258

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 3 and 4. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A6
Descriptive Statistics for Enrollment Outcomes, 2011-12 Cohort Only

dependent variable:	number of ECO-C observations	number of control observations	control mean	control standard deviation
Enrolled in a "Peer" Institution	838	849	0.286	0.452
Enrolled in an Institution that was at least "Peer" minus about 10 percentiles	838	849	0.451	0.498
Enrolled in an Institution that was at least "Peer" minus about 20 percentiles	838	849	0.517	0.500
Enrolled in an Institution that was at least "Peer" minus about 30 percentiles	838	849	0.718	0.450
Enrolled in an Institution that was "Peer" plus 5 percentiles	918	917	0.035	0.183
Four-Year Graduation Rate of College where Enrolled	817	827	51.537	22.598
Instructional Spending of College where Enrolled	837	845	16494	14022
Student-Related Spending of College where Enrolled	837	845	29120	23513
Median SAT Score of Students at College where Enrolled	768	785	1214.5	136.2

Notes: The descriptive statistics shown in the table are useful for interpreting Tables 5 and 6. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A7
Descriptive Statistics for Students from Feeder High Schools

dependent variable:	number of ECO-C observations	number of control observations	control mean	control standard deviation
Number of Applications Submitted	392	399	6.456	4.235
Median SAT Score of Students, Maximum Among Colleges to which Applied	357	367	1396.6	119.5
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	358	374	76.701	18.428
Instructional Spending, Maximum Among Colleges to which Applied	361	379	49969	32195
Student-Related Spending, Maximum Among Colleges to which Applied	361	379	79411	47835
Number of Colleges to which Admitted	392	399	2.533	1.683
Median SAT Score of Students, Maximum Among Colleges to which Admitted	347	353	1291.7	114.0
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	353	363	64.774	20.256
Instructional Spending, Maximum Among Colleges to which Admitted	358	373	23621	19647
Student-Related Spending, Maximum Among Colleges to which Admitted	358	373	39235	29647
Median SAT Score of Students at College where Enrolled	324	337	1283.2	134.2
Four-Year Graduation Rate of College where Enrolled	340	353	60.096	23.472
Instructional Spending of College where Enrolled	346	364	23000	19985
Student-Related Spending of College where Enrolled	346	364	39307	31669

Notes: The descriptive statistics shown in the table are useful for interpreting Table 7. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A8
Descriptive Statistics for Students from More Affluent Families

dependent variable:	number of ECO-C observations	number of control observations	control mean	control standard deviation
Number of Applications Submitted	557	547	5.271	3.822
Median SAT Score of Students, Maximum Among Colleges to which Applied	523	494	1351.8	144.9
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	529	503	71.964	20.823
Instructional Spending, Maximum Among Colleges to which Applied	532	515	41558	32121
Student-Related Spending, Maximum Among Colleges to which Applied	532	515	67264	47629
Number of Colleges to which Admitted	557	547	2.252	1.557
Median SAT Score of Students, Maximum Among Colleges to which Admitted	509	486	1247.8	128.3
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	520	497	58.817	21.376
Instructional Spending, Maximum Among Colleges to which Admitted	530	511	18852	15379
Student-Related Spending, Maximum Among Colleges to which Admitted	530	511	32523	23786
Median SAT Score of Students at College where Enrolled	471	455	1237.6	135.5
Four-Year Graduation Rate of College where Enrolled	500	486	54.780	22.483
Instructional Spending of College where Enrolled	510	503	18563	17160
Student-Related Spending of College where Enrolled	510	503	31819	27150

Notes: The descriptive statistics shown in the table are useful for interpreting Table 8. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A9
Descriptive Statistics for the Sub Interventions, 2011-12 Cohort Only

	number of observations			
dependent variable:	Application Guidance	Net Cost	Fee Waiver	Parent Intervention
Number of Applications Submitted	844	901	958	829
Applied to a "Peer" Institution	803	860	917	784
Median SAT Score of Students, Maximum Among Colleges to which Applied	780	840	898	764
Four-Year Graduation Rate, Maximum Among Colleges to which Applied	794	845	909	773
Instructional Spending, Maximum Among Colleges to which Applied	803	859	917	784
Student-Related Spending, Maximum Among Colleges to which Applied	803	859	917	784
Number of Colleges to which Admitted	844	901	958	829
Admitted to a "Peer" Institution	791	846	909	772
Median SAT Score of Students, Maximum Among Colleges to which Admitted	744	809	868	735
Four-Year Graduation Rate, Maximum Among Colleges to which Admitted	773	825	888	759
Instructional Spending, Maximum Among Colleges to which Admitted	790	845	908	771
Student-Related Spending, Maximum Among Colleges to which Admitted	790	845	908	771
Median SAT Score of Students at College where Enrolled	714	765	820	697
Four-Year Graduation Rate of College where Enrolled	754	800	859	734
Instructional Spending of College where Enrolled	767	833	879	756
Student-Related Spending of College where Enrolled	767	833	880	756

Notes: The descriptive statistics shown in the table are useful for interpreting Table 9. The data source is the Expanding College Opportunities survey. The number of observations varies slightly by outcome because students may skip a survey question or because the college named by a student has missing data. For instance, missing data occur when we are unable to compute or otherwise find the median score of the students enrolled in the college that a student names.

Table A10a
Descriptive Statistics for Freshman College Grades, 2010-11 Cohort Only

	control (obs = 581 mean GPA = 3.466 std dev of GPA = 0.546)		application guidance (obs = 527)		net cost (obs = 509)		fee waiver (obs = 580)		parent intervention (obs = 507)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score	1361.3	80.7	1356.8	76.4	1353.8	66.9	1359.9	70.7	1356.6	68.4
estimated family income	33794	9678	33823	9431	34327	10711	34016	11064	33590	11076
female	0.555	0.497	0.551	0.497	0.505	0.500	0.483	0.500	0.513	0.500
Asian	0.050	0.218	0.067	0.250	0.071	0.256	0.073	0.259	0.073	0.261
white	0.701	0.458	0.673	0.470	0.089	0.284	0.091	0.288	0.093	0.290
underrepresented minority	0.245	0.430	0.252	0.435	0.487	0.501	0.429	0.496	0.500	0.501

Table A10b
Descriptive Statistics for Persistence in College through Autumn Term of Sophomore Year, 2010-11 Cohort Only

	control (obs = 761 mean GPA = 0.828 std dev of GPA = 0.378)		application guidance (obs = 717)		net cost (obs = 691)		fee waiver (obs = 781)		parent intervention (obs = 761)	
variable	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
SAT math plus verbal score	1353.7	67.6	1352.9	67.8	1353.8	66.9	1359.9	70.7	1356.6	68.4
estimated family income	33644	10680	33571	10634	34327	10711	34016	11064	33590	11076
female	0.497	0.500	0.502	0.500	0.505	0.500	0.483	0.500	0.513	0.500
Asian	0.074	0.262	0.084	0.277	0.071	0.256	0.073	0.259	0.073	0.261
white	0.087	0.282	0.103	0.305	0.089	0.284	0.091	0.288	0.093	0.290
underrepresented minority	0.477	0.500	0.416	0.494	0.487	0.501	0.429	0.496	0.500	0.501

Notes: The descriptive statistics shown in the table are useful for interpreting Table 10. The data source is the Expanding College Opportunities survey. The number of observations varies by outcome because students may skip survey questions --especially the long series of grade questions that must be answered if we are to compute a grade point average.