The Impact of College Outreach on High Schoolers' College Choices – Results From Over 1,000 Natural Experiments

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Abstract

We estimate the impact of one of the largest college-to-student outreach efforts in the nation, the College Board's Student Search Service. In an oversubscribed "order", colleges receive contact information of a randomly chosen subset of PSAT and SAT Exam takers who opted into the service and meet colleges' search criteria from a larger set of students with identical backgrounds. We find that students who receive outreach enabled by Student Search Service ("licensed") are 23 percent (0.1 percentage points) more likely to apply to the licensing college than students with similar backgrounds who did not receive outreach. Nearly 20% of students induced to apply to a college because of the Student Search Service also enroll, increasing the probability of enrolling in the college that licensed their contact information by 22 percent (0.02 percentage points). These impacts are twice as large for traditionally underserved students. Responsiveness to college outreach is larger for racial/ethnic minorities, first generation students, and low- and moderate-income students. Despite the fact that one additional license changes the specific institution to which students send scores and enroll, we cannot detect changes to the broad types of colleges in which students ultimately enroll.

JEL Codes: I2, I23, L15

*The views of the paper are those of the authors and not necessarily The College Board. Jonathan Smith used to work at the College Board and continues to consult for them.

1. Introduction

Every year millions of students enroll in thousands of different colleges for the first time. Where they initially enroll can have lasting effects on their chances of earning a degree (e.g., Smith, 2013; Goodman, Hurwitz, and Smith, 2017) and economic and labor market opportunities (e.g., Zimmerman, 2014; Chetty et al., 2017; Kozakowski, 2019; Mountjoy, 2020; Smith, Goodman, and Hurwitz, 2020). With so many choices and so much uncertainty in the admissions process, the probability of completion, and future earnings, how do students decide where to apply to and enroll in college?

Both student survey responses and a body of research demonstrate that students' college decisions are influenced by factors large and small.[1] Many of the factors share a common thread – information and knowledge about colleges, or lack thereof. The information about colleges that influences students' applications and enrollment decisions comes from many sources. It comes from people that students interact with, such as siblings (e.g., Altmejd et al., 2020) and teachers or high school counselors (Mulhern, 2020). Conversely, deficits in college opportunities can also arise through information barriers resulting from geographic isolation from colleges d (Hillman, 2016; Dillon and Smith, 2017; Hoxby and Avery, 2013). Information about colleges also comes from sources with the explicit intent of providing college advice and data. For example, college and career software in high schools (Mulhern, forthcoming), *U.S. News and World Report's* college rankings (Luca and Smith, 2013), and the federal government's College Scorecard (Hurwitz and Smith, 2018) have all been shown to influence college applications and enrollment.

Colleges and universities also provide information and outreach directly (and indirectly) to students. A recent report estimates that not-for-profit colleges spend approximately $400-600 per applicant and over $2,000 per enrollee to provide information through advertising and recruitment efforts (Silber, 2016). The intensity and efficacy of such efforts is largely unknown. Cellini et al. (2018) examine how different modes of advertising, including, print, radio, or television translate into enrollees, particularly among for-profits who are by far the largest advertisers on these traditional modalities. Through an

[1] See Stolzenberg et al., (2019) *The American Freshman National Norms Fall 2019* (p. 44) for a survey of current freshman in college on reasons they chose their particular college.

impressive data collection effort on college recruitment visits to high schools, Jaquette and Salazar (2018) show colleges' propensity to visit more resourced high schools. We add to the emerging literature on college recruitment by providing the first causal estimates of large scale, low-cost, direct-to-student college outreach on student application and enrollment choices.

We estimate the impact of college outreach on student application and enrollment choices by using a rich data set from the College Board's Student Search Service (Search). Students who take one of the College Board's assessments, such as PSAT, SAT and Advanced Placement (AP), have the option of participating in Search, which allows colleges and scholarship organizations to "license" the contact information of students who opt into the service and fit the college-specified Search criteria.[2] For example, a college may license the names of all students with a particular PSAT exam score range, who live in a specific state, and with stated interest in a particular college major. Collectively, colleges and scholarship organizations license millions of students' names each year and reach out to them with information and opportunities via mail and/or email.

College outreach enabled by Search may impact college choice in two broad ways. First, licensed students may learn about an institution and be more likely to apply and enroll in that specific college. This outreach may provide information regarding the campus, programs of study, or other hard to find information that colleges deem worth of highlighting. Those same colleges may also offer incentives to apply and enroll, such as application fee waivers, all expenses paid campus visits, or student-customized financial aid information, variants of which have proven effective at encouraging application and enrollment, especially those with larger incentives.[3] Second, receiving information from a single college or multiple colleges may change either student self-perception or the way they conduct a college search

[2] Licensing means that institutions are permitted to access student information subject to certain restrictions and for the limited purpose of providing students with information about educational and scholarship opportunities.

[3] Dynarski et al. (2018) experimentally show that a letter from the University of Michigan to high achieving low-income students that guarantees free tuition for four years increases applications and enrollment. Gurantz, Hurwitz, and Smith (2017) show that outreach to high achieving Hispanic students who are National Hispanic Recognition Program recipients also increases applications and enrollment to the colleges doing the outreach. Both papers state that salient and large reductions in tuition are likely driving the results. By contrast, outreach from Search is largely informational, especially at first contact, with no guarantees of admission or tuition.

(Moore and Cruce, 2017). Unexpected recruitment materials from colleges that students might have viewed as out of reach, either academically or financially, may entirely reframe how these same students approach their college selection processes. Such materials from one college may have important spillover effects that ultimately lead students to apply to and enroll in colleges that may not have directly recruited them but are instead peer colleges of these recruiting colleges. These theories of student decision-making motivate this paper and our analyses.

To estimate the causal impact of student licensing via Search on SAT score sending behavior – a proxy for college application (Pallais, 2015; Smith, 2018) – and college enrollment, we exploit a randomization process in Search that created 1,068 small natural experiments in 2014 and 2015. When colleges submit their criteria in a Search "order" (e.g., all students in Georgia with an SAT greater than 1300), the number of students satisfying these criteria often exceeds the total number of students that colleges are willing to license. If the college is interested in licensing 8,000 students and 10,000 students fit the specified criteria, the Search system randomly selects the 8,000 students that the college receives while the observationally identical 2,000 students are not shared with the college and serve as a natural control group. Within an order (and students in the same sets of orders), we compare the outcomes of students who are randomly licensed to those not licensed.

We find that students who are licensed by a college are 23 percent (0.1 percentage points) more likely to send their SAT scores to that college. The impact on enrollment at the licensing college is 22 percent (0.02 percentage points). Taken together, these two estimates suggest that one out of five of the students induced to send their SAT scores to a college by Search ultimately enroll.

In the research most similar to ours, Moore and Cruce (2017) use ACT's data and find that "opting-in" to the ACT-equivalent of Search increases the number of score sends to any college and the number of colleges receiving score sends. We show that students licensed more frequently are not just sending more SAT score sends to colleges, but they are sending them to the very colleges that licensed them in the first place. We also contribute the literature beyond the work of Moore and Cruce (2017) because we analyze

the impacts of being licensed on where students enroll in college, which is a more consequential outcome than where students apply to college.

In contrast to Moore and Cruce (2017), the experimental results in this paper do not find that the total number of SAT score sends increases if a student is licensed by one additional college, nor do students' broad college enrollment patterns change. Similarly, the average characteristics of the colleges (e.g., average SAT score) that license a student's contact information have no impact on broad college enrollment patterns. Our finding implies that outreach by one additional college, on average, leads to a substitution effect, where a licensing college is added to the student's application portfolio, while an existing college is removed. While our lotteries allow for estimates of these marginal treatments (e.g., 10 versus 11 licenses) it is not well suited for determining the impacts of more sizeable shifts (e.g., 10 versus 20 licenses). As Moore and Cruce (2017) suggest, it appears that changing student application portfolios and perhaps enrollment patterns beyond substituting a single college may require more dramatic shifts in the number and composition of licensing institutions. It also suggests that small pieces of information do have impacts on the transition to college but competing information and influences necessitate larger scale, more nuanced, or more targeted information or intervention to achieve substantial change in the way students approach their decisions. This last point is consistent with a growing literature on low-cost "nudges" in educational contexts that can be cost effective (e.g., Bird et al., 2017) but don't always work to create systemic change (e.g., Oreopolous and Petronijevic, 2019).

These results may have important implications given that recent research focusing on the student-college matching process has consistently revealed similar results. Students, especially those from underserved populations, make application and enrollment decisions that look very different, and are often suboptimal, compared to their well-resourced peers (e.g., Long, 2004; Hoxby and Avery, 2013; Smith et al., 2013). Traditional explanations, such as sticker price shock, are still prominent but there is now growing consensus that more is at play (e.g., Levine, Ma, and Russell, 2020). Even before students begin their postsecondary careers, the decisions about what colleges to consider are based on small and upfront costs

– such as application fees – perceived net prices, and often misinformation about what colleges offer (Hoxby and Turner, 2013; Smith, 2015).

The previously documented disparities motivate our set of heterogeneity analyses. The impacts of being licensed by a college on SAT score sending and college choice are present for most types of students, as measured by demographics and SAT scores. However, the impact on the probability of sending an SAT score to the college that licensed the student is greater than 40 percent for traditionally informationally and financially constrained students – Black, Hispanic, low parental education and income, as well as students with more modest SAT scores. The score sending impact of Search is largest when "reach" colleges license students' information, which suggests that colleges play an important role in convincing students to aspire to colleges where their own academic credentials are a bit lower than that of the typical enrollee. Moreover, our results highlight the potential role colleges can have in reaching out to under resourced students and reducing existing inequities.

The results in this paper highlight the role of low cost information, less than $0.42 per student license over the sample period. They show that Student Search opens up opportunities for colleges to improve the match with their students, perhaps resulting in improved longer-term outcomes for students and institutions. Previous low-cost outreach (or "nudges") and information often come from a third party, not colleges. For example, Hoxby and Turner (2013) sent informational packets, and application fee waivers in their "Expanding College Opportunities" experiment. Non-profits, such as the Jack Kent Cooke Foundation and College Advising Corps are additional examples of actors in the college choice space that carry out work under their own name. Our results show that direct outreach from colleges also have the power to influence a student's college choice process.

2. Student Search and Data

2.1. Student Search Background

The College Board's Student Search Service was established in 1972 to facilitate a connection between colleges and students, as well as scholarship organizations and students.[4] The service works as follows. Students who register for the PSAT, SAT, and/or AP fill out their contact information, including a mailing address and email. Students are given the opportunity to opt into Search during every exam registration and while engaging in college planning on the College Board's Big Future website, and are able to opt-out at any time.[5] Once students agree to participate in Search, colleges may place a Search "order" for students using certain criteria. Criteria frequently include expected high school graduation date, cumulative GPA, geography, exam score ranges, intended college major, demographics, and responses on student questionnaires regarding collegiate interests. For example, a college may license all residents of Georgia who are currently seniors that received at least a 1300 on the SAT. In exchange for a per student licensing fee of between $0.38 and $0.42 during our study period, colleges receive the students' contact information. After colleges and scholarship organizations license student names, they can engage in outreach efforts. This communication takes the form of mailings and emails with information about the college.

There are several points worth noting. First, colleges may make several Search orders per year, and may alter their search criteria across orders. Second, students can and do opt-in or opt-out of Search at any time. This means that two identical students may be licensed a different number of times based purely on their opt-in or opt-out status. Third, a majority of Search is done based on information through students' junior years, including searches based on their PSAT score, in order to contact students in the spring of their junior year and the following summer and fall. When colleges license student information in the fall of their senior year, usually after taking the SAT, it is known as Senior Search. Fourth, scholarship organizations also participate in Search, which gives them the opportunity to find students whose

[4] According to College Board's website (July 2020), nearly 1,900 colleges, universities, and scholarship organizations connect with students through Search.

[5] The Search opt-out form is available at https://cbsearch.collegeboard.org/student-search-service/opt-out and students can also opt out by calling College Board customer service.

credentials meet the scholarship organization's goals. Finally, ACT has an analogous service such that students who take both exams may be licensed from multiple sources.

2.2. Student Search Randomization and Data Collection

For the purpose of this study, starting in October 2014, the College Board began retaining the list of students who met colleges' search criteria but were randomly selected to be withheld by the system (control students). Prior to that, only records of licensed students were preserved (treatment students). Most of the Search orders placed in the fall are for the contact information of high school seniors, so the 2015 graduating high school cohort is the first cohort to have some experimental data whereas the 2016 cohort is the first graduating high school cohort to include junior year control and treatment orders.

Appendix Table 1 shows some of the summary statistics of the colleges where Search list randomization is used relative to colleges where randomization is not used. This gives us insight into whether the colleges where randomization is used differ from those where randomization is not used. The number of students requested in randomized orders is about 20 percent larger than other orders and comes from colleges with slightly lower average SATs. The Search order types have the same likelihood of coming from public colleges and from colleges with similar graduation rates.

2.3. Data

The base data for these analyses are SAT takers in the 2015 and 2016 cohorts. We rely on the SAT taking sample, despite the fact that a college's order can be based on PSAT, SAT, or AP, because it provides us with one of our two main outcomes – SAT score sends.[6] SAT score sends are official SAT score reports that students send to colleges as official documentation of their SAT scores and these serve as a measure of student interest in a college, and likely college applications. Students receive four free score sends at the time of SAT registration but prior to knowing their SAT score and after about 10 days after the exam, each

[6] This also means that many of the SAT takers enter our sample because they were part of a Search order on something other than the SAT (e.g., PSAT).

additional score send costs approximately $10.[7] This implies that students who take the SAT relatively early (e.g., spring of junior year) may not have been licensed or contacted by colleges by the time they need to decide on their four free score sends while the same is less likely to be true for late SAT takers (e.g., fall or winter or senior year). We also observe exam scores and basic student demographics.

From the SAT takers, our analytic dataset consists of students who show up in at least one Search natural experiment. That is, we use the 1,068 Search orders placed by colleges between October 2014 and September 2015 where their Search criteria produced more students than the colleges budgeted to license. As Table 1 shows, the average Search order criteria produced 11,891 students, but colleges only licensed an average of 5,362 students. Across all the randomized orders, 55.9 percent of the students matching a college's Search criteria are actually licensed to the college in that order. The fraction varies tremendously across Search orders from very close to 0 to very close to 100 percent.

Table 1 also shows the descriptive statistics of the over 1.7 million unique students who took the SAT and are in at least one natural experiment.[8] Sampled students are in an average of 4.7 natural experiments, each with different probabilities of being licensed, which translates into sampled students being licensed twice, on average. Students are also in other Search orders where no such randomization exists (i.e., they are licensed with probability one) and can also be licensed in a subsequent Search order even if they are randomized out in a natural experiment (though infrequent). These additional orders and licenses result in students' contact information being licensed an average of 28.5 times. This implies that the natural experiments account for only a small fraction of all the licenses and information students may receive from colleges. Students also send an average of 3.2 SAT score sends to colleges and the average SAT of those colleges is 1156.[9]

[7] Low-income students are eligible for fee waivers and unlimited free SAT score sends. Students who retake the SAT receive an additional four free score sends.

[8] This represents nearly two-thirds of all SAT takers who are in at least one randomized order. As Appendix Table 1 shows, there are roughly 30 times as many non-randomized orders as randomized orders such that most SAT takers who opt-in to Search are licensed at least once.

[9] Some students send no SAT scores and some send to colleges with no reported average SAT, hence the smaller number of observations.

The bottom panel of Table 1 shows some statistics at the student-order level for Search orders with randomization. That is, there are over 7.3 million student-orders who match colleges' Search order criteria and are potential licensees; however, only 47.3 percent of those entries resulted in a license through randomization, with 57 percent licensed either through randomization or another Search order from the same college. The second to last row of Table 1 shows that 0.8 percent of licenses resulted in an SAT score send to those colleges in which they were potential licensees, regardless of whether they are licensed.

These data are merged with data from the National Student Clearinghouse (NSC), which tells us where the student ultimately enrolls. NSC includes over 3,600 colleges and universities, which accounts for over 98 percent of students enrolled in the U.S. Table 1 shows that 0.19 percent of students enroll in a college that Searched for them in a natural experiment.[10]

Table 2 describes the characteristics of students who are licensed by regressing counts of licenses on student SAT scores and demographics. It is important to note that some of these differences may be driven by college preferences, but students' decisions to opt-out of Search for differing lengths of time may also factor into the estimates. The outcome shown in the first column shows the number of times a student's name is licensed through a natural experiment. Not surprisingly, students with higher SAT scores are licensed more frequently than those with lower scores. An increase of 100 SAT points is associated with 0.4 more licenses. Men are licensed less frequently than are women. Black students are licensed slightly more than the omitted category of White students, but other races are licensed fewer times than are White students. There do not seem to be strong relationships between licensing volume and parental income and education, conditional on these other variables, where the omitted dummy variables are non-responders. Finally, students in the 2016 cohort are licensed over two more times via natural experiment than the 2015 cohort, but this is simply because we do not observe all natural experiments for the 2015 cohort due to changes in data storage policy. The next column in Table 2 adds high school fixed effects to the regression,

[10] The match with NSC happens in the winter after high school graduation but a small fraction of students have enrolled in multiple colleges by that point, which we observe. Whether we use first college enrolled in or look across the colleges has no practical effect on our analyses.

but coefficients are largely unchanged, suggesting that geography and high school attributes are not driving these relationships.

The next two columns of Table 2 use the outcome "total licenses," which can come from randomized or non-randomized orders, and consequently reflect the total number of colleges that are interested in contacting the student. The same general patterns as the previous columns hold, but the magnitudes of the estimates are larger. For example, increasing a student's SAT score by 100 points would increase the expected number of times the student was licensed by a factor of 7.3. As with the first two columns, the addition of high school fixed effects in the last column does not change the estimates much.

3. Methodology

This paper has two primary sets of analyses: (1) at the student-order level and (2) at the student level. Each method is explained in turn.

3.1. Student-Order Level

An observation is a student in a college's randomized order. Therefore, the same student can show up in multiple observations if they are in multiple orders that had some degree of randomization. The first specification is akin to a reduced-form analysis on the impact of being licensed through the randomization process and is as follows:

$$y_{ijs} = \alpha_0 + \alpha_1 LicensedRandom_{ijs} + \alpha_2 X_i + \Omega_j + \varepsilon_{ijs} \qquad (1)$$

Where y_{ijs} is an outcome for student *i* whose characteristics satisfy the Search criteria of order *j* from school *s*, such as sending an SAT score to college *s*. $LicensedRandom_{ijs}$ equals one if student *i* is randomly licensed from the set of students whose characteristics satisfy the criteria in order *j* and equals zero

otherwise. X_i is a vector of student characteristics that is often excluded, Ω_j is a set of order fixed effects, and ε_{ijs} is a random disturbance term.

The coefficient α_1 tells us the causal impact of being licensed by a college on some outcome within the randomization sample. Identification comes from the fact that a subset of students is randomly selected from a larger subset of students within an order. However, students whose characteristics satisfy the criteria of a college's order are not random. That is, colleges endogenously choose students in an order and therefore it is imperative to include order fixed effects (Ω_j), such that identification comes from the randomization of students within an order.[11]

Equation (1) provides the impact of being licensed from a randomized order, but a more important policy question focuses on the impact of being licensed, which can also happen through a non-randomized order. To that end, we estimate an instrumental variables specification:

$$y_{ijs} = \beta_0 + \beta_1 Licensed_{ijs} + \beta_2 X_i + \Omega_j + e_{ijs} \quad (2)$$

where $Licensed_{ijs}$ is whether the student is ever licensed by the college and it is instrumented with whether a student is licensed through a randomized order in the first-stage regression in equation (3):

$$Licensed_{ijs} = \gamma_0 + \gamma_1 LicensedRandom_{ijs} + \gamma_2 X_i + \Omega_j + \tilde{e}_{ijs} \quad (3)$$

In practice, the primary way a student who is in a randomized order is licensed by that same college is through the randomized order, making the first stage extremely strong, as we will show.

[11] OLS estimates without order fixed effects are presented in Appendix Table 2 and demonstrate the upwards bias in the relationship between being licensed and sending a score to a college.

There are two important caveats regarding the identification strategy. First, causal estimates rely on true randomization within an order. We test that assumption with a set of balancing tests whereby we look whether the treatment (licensed) and control (not licensed) groups have the same average characteristics within a randomized order. This results in the following equation:

$$X_i = \delta_0 + \delta_1 LicensedRandom_{ijs} + \Omega_j + \sigma_{ijs} \quad (4)$$

The results of the series of separate regressions for each covariate are in Table 3. The first column that includes all 7.3 million observations has only two characteristics related to the probability of being licensed and the magnitudes are quite small. Overall, these results suggest that randomization within an order was performed with fidelity and the identifying assumption is satisfied.

The second issue related to interpreting the coefficients as causal is more methodological and deals with how students build score sending portfolios. The above coefficients (α_1 and β_1) are unbiased if licensing through a randomized order only has an impact on the probability of sending an SAT score to or enrolling in that specific college and not on the probability of sending a score or enrolling in another college. That score sends are independently chosen from one another and not dependent on one another when choosing a portfolio is admittedly a strong assumption, but may be true under certain circumstances. We relax that assumption below in our preferred student level analysis.

3.2. Student Level

The student level analysis uses the information from all randomized orders to which a student could potentially be licensed into a single observation. We create a fixed effect for each set of randomized orders. Since the average sampled student is in 4.7 randomized orders and there are thousands of colleges, there are many potential fixed effects and also the possibility that there are not many students with the same set of randomized orders. Fortunately, colleges seem to compete with one another for similar students and we do not have many students with a unique fixed effect (and consequently, we have variation within a fixed

effect). We only include students who are in up to 15 randomized orders, which accounts for over 90 percent of students. The primary specification in these analyses is as follows:

$$y_i = \eta_0 + \eta_1 LicensedCount_i + \eta_2 X_i + \Gamma_J + \omega_i \quad (5)$$

where y_i is an outcome for student *i*, such as total number of score sends to the colleges in the set of orders. $LicensesCount_i$ is the number of times a student is licensed from the colleges in the set of randomized orders, even if not licensed through those orders. Similar to before, the endogenous variable requires an instrument, specified in the first stage regression:

$$LicensedCount_i = \theta_0 + \theta_1 LicensedCountRandom_i + \theta_2 X_i + \Gamma_J + w_i \quad (6)$$

where $LicensedCountRandom_i$ is the number of licenses from the set of randomized orders. In both equations (5) and (6) we include the set of orders fixed effect, Γ_J. Therefore, we are comparing students who are in the same set of orders and exploiting the random variation in the number of licenses from randomized orders. Since the individual orders are balanced on covariates, the set of orders are as well, as demonstrated in column (2) of Table 3. These controls also alleviate any concerns from the student-order level analysis whereby the outcome of one randomized order may be impacted by other randomized orders. In this context, we are only comparing students in the same set of randomized orders, so the experiment is that two students with the same chances of getting licensed by multiple colleges actually end up getting licensed by different colleges.[12]

[12] A more comprehensive approach would be to use a fixed effects for the same randomized orders and same treatment/control for all orders but for one. We do not have the statistical power for such an analysis and random assignment will get us to the same result. As seen at the bottom of column 1 in Table 2, within an order, students in

Finally, a related question is not whether students send scores to or enroll in colleges that license their names but rather, how their score sending and enrollment decisions changes more generally, in response to being licensed relatively more. To answer that question, we use equation (5) but replace $LicensesCount_i$ with $TotalLicensesCount_i$, which is the total number of licenses regardless of whether from a randomized order or not.

4. Results

4.1. Probability of Sending SAT Scores

Table 4 shows the parameter estimates for the outcome of SAT score sending to the college that licenses students' information. The first two columns show the instrumental variable estimates from equation (2), which correspond to the impact of being licensed.[13] Using all student orders with randomization, we find that being licensed increases the probability of sending an SAT score to that college by 0.115 percentage points (or 27 percent). For students in exactly one randomized order, the estimate is 0.126 percentage points (or 50.2 percent). While these are somewhat small in magnitude, they are precisely estimated and extremely large percent increases because of the low base rates of score sending to a college.

The next two columns are our preferred instrumental variable estimates at the student-level with a set of order fixed effects, corresponding to equation (5). We find that students who are licensed one more time than another are approximately 0.1 percentage points (22.3 percent) more likely to send SAT scores to any of the colleges in the order set. This corresponds to sending 0.11 more SAT scores (23 percent) to any of the licensing colleges in the order set.

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the treatment and control groups have the same number of other licenses through randomization, which suggests that on average, within a set of orders, we are comparing students who has one more license than another.

[13] The reduced-form estimates that correspond to equation (1) are in Appendix Table 3 and show similar effects since the first stage estimates that correspond to equation 3 (in Appendix Table 4 with t-statistics greater than 3,000) are not far from one.

Appendix Table 5 replicates Table 4 for students with at least one SAT score send. While being licensed may certainly impact the extensive margin of sending any scores, there are a large number of students who will never send any scores simply because they do not plan to attend college or they plan to submit ACT scores or no score at all. As expected, the magnitudes of the coefficients between Table 4 and Appendix Table 5 increase by almost 50 percent.

4.2. Probability of Enrollment

We now turn to the impact of being licensed on the probability of enrolling in the licensing college in Table 5. One should expect the impact on enrollment to be bounded above by the magnitude of the impact on SAT score sending. In reality, since not all score sends turn into applications (Smith, 2018), there is uncertainty around whether the application turns into an offer of admission, and offers of admission are not all accepted by students, so we should expect the estimates on enrollment to be well below the impacts on score sending. Table 5 confirms this.

The first column of Table 5 is the instrumental variable estimate from equation (2). We find an 0.015 percentage point increase in the probability of enrolling in the college that licenses students' information, which is approximately an order of magnitude smaller than the score sending estimates.[14] This precise estimate corresponds to a 17.8 percent increase in the probability of enrolling in the licensing college relative to students who are not licensed. The next column is the preferred specification since it is at the student-level. We find a 0.024 percentage point (21.6 percent) increase in the probability of enrolling in any of the colleges that licenses students' information if they are licensed by one more college. Being licensed by one more college may decrease the probability of enrolling in the other colleges that licensed a student and therefore the fact that this estimate is positive implies that students are more likely to enroll in the very college that is licensing them through a randomized order.

4.3. Heterogeneous Effects

[14] The reduced-form estimates that correspond to equation (1) are in Appendix Table 3 and show similar effects.

There are several reasons to believe the above impacts of being licensed on score sending and enrollment at the licensing colleges may differ across student attributes. Informational asymmetries exist among students and the recruitment activities enabled by Search may serve to close informational gaps. On the other hand, if colleges target informationally-unconstrained students, existing gaps in students' SAT score sending and enrollment choices could be exacerbated. The same is true if only savvy students who are well informed and resourced know how to act on the college and scholarship information that comes from being licensed. Due to the ambiguity, heterogeneous impacts are an empirical question that we examine in Table 6.

The columns of Table 6 represent different student demographics and attributes. Scrolling across the 16 subsamples of results from equation (5), there are two broad conclusions in the top panel of Table 6. First, all groups of students have positive estimates and most are statistically significant. This implies that, for most types of students, their SAT score sending choices are sensitive to whether they are licensed randomly by a college. Second, there are some student types who have larger probabilities of sending an SAT score to a college that licenses their information. Notably, the SAT score sending impacts for Black and Hispanic students are 46 and 65.3 percent, respectively, compared to 23 percent among all students. Students whose parents have the lowest income and the least education have SAT sending estimates greater than 40 percent as well. Finally, students with relatively lower SAT scores (below 1000) also have large percent increases as a result of Search. In the aforementioned cases, the large percent impacts are usually driven by a combination of larger percentage point impacts and smaller base probabilities of sending SAT scores. These student subgroups are the most likely to be informationally- and financially-constrained.

The bottom panel of Table 6 shows results when the outcome is enrollment in the licensing college. Since the impacts are small in magnitude and we are using small subsamples of students, we lose the ability to statistically detect small differences between subgroups. But the same general patterns from the top panel of Table 6 hold – mostly positive coefficients, many of which are statistically significant, and some groups (e.g., Black students) have larger percentage impacts on enrollment than in the full sample.

There may also be differential effects based on several other dimensions related to the match between students and colleges. We explore whether the number of licenses and selectivity of colleges, relative to students' SAT scores, relates to impact sizes. For the number of licenses, it is feasible that students who are licensed more frequently respond to an additional piece of information differently than other students. On the one hand, more information may lead to a more informed decision. On the other hand, more information may be either ignored or overwhelming. Unfortunately, students who are licensed more differ substantially compared to students who are licensed relatively infrequently, so we cannot adequately disentangle drivers based on student characteristics from the impacts of large versus small amounts of licenses. Nevertheless, we look for suggestive evidence on the differential impact in Table 7.

The first five columns of Table 7 split the sample into students who receive increasingly larger amounts of "potential" licenses, not licenses, such that we avoid splitting the sample on an endogenous variable. Potential licenses represents the sum of the number of orders students are in with some randomization, regardless of whether they are licensed, and the number of times a student is licensed through an order with no randomization. There are positive coefficients across the columns, most of which are statistically significant. The largest coefficient is for those who are potentially licensed between 26-50 times but then it shrinks for those who have more than 50 potential licenses. The enrollment patterns in the bottom panel of Table 7 are too imprecise to make broad conclusions.

The next five columns of Table 7 only examine students who are in exactly one randomized order and compare the average SAT of the college matriculants to that of the student who is potentially licensed. The coefficients decrease in magnitude across the columns, suggesting that students are more likely to send their SAT scores when licensed by colleges that enroll students who tend to have higher SAT scores. That is, students respond the most to licensing by colleges that are commonly called "reaches" and still to a reasonable extent "fits." The enrollment panel in Table 7 shows no statistically significant effects for reaches/fits/safeties, but that is likely due to sample restrictions and size.

Appendix Table 6 performs the same analyses as Table 7 but by college characteristics. Since it only uses students in exactly one randomized order and sample size can be quite small for some college characteristics, it is challenging to make many conclusions.

5. Portfolios

In this section, we consider whether the portfolio of licenses, which can be characterized by attributes like the total number of licenses and measures of quality of the colleges, impacts score sending and enrollment outcomes. This is in contrast to the previous section which considers the impact of a single license from a specific college. This will give a better sense of how marginal changes to the set of licenses can impact outcomes.

On top of that, we consider score sending portfolios. Unlike the previous section, which considers whether students send SAT scores or enroll in the very college that licenses their contact information, we consider whether there are broader changes to the portfolio since sending a score to one college may impact (positively or negatively) the probability of sending scores or enrolling in another college.

5.1. Impact of Number of Licenses

We begin by estimating the impacts of being licensed on a broader set of outcomes related to the SAT score send portfolio and college enrollment rather than the impact of sending scores or enrolling in the exact institution doing the licensing. For example, Figure 1 shows a strong positive relationship between the probability of enrolling in college (or four-year college) and the number of times a student is licensed. There is a steep positive slope for low license counts that asymptotes around 90 (85) percent chance of enrolling in college (four-year college). We ask whether such a relationship is causal or whether colleges are more likely to reach out to students who are likely to attend college, even in the absence of being licensed.

The explanatory variable in the top panel of Table 8 is "total licensed," which is the number of times a student is licensed, whether it is through a randomized order or not. It is instrumented by the number of licenses through randomized orders (equation 5). It is important to emphasize that the identification strategy does not answer the question of how being licensed many times compared to few or no times impacts students' outcomes but rather, what is the marginal effect of being licensed one more time.[15]

The first column's outcome is total number of score sends. The coefficient is not statistically significant and is marginally significant in the bottom panel when using the subsample of students who send at least one score send. This suggests that students who are licensed are not generating substantially larger SAT score send portfolios and that there is instead some substitution that keeps the size of their portfolio unchanged. The next few columns of Table 8 are measures of college quality (graduation rate and average SAT of matriculants) among the colleges in students' portfolios of SAT score sends. We find no evidence that being licensed relatively more changes the composition of students' SAT score send portfolios. Columns (6) through (9) outcomes consider where students enroll. There is no strong statistical evidence that the types of colleges in which students enroll is affected by being licensed an additional time.

Overall, these results suggest that while licensing students' information is effective at attracting students to one's college, there is no statistically detectable change in the broader way students apply to and enroll in colleges. But there are two big questions that these analyses do not answer. First, we cannot assess whether going from relatively few to relatively many licenses (e.g., 10 versus 100 licenses) has an impact on student score sends and enrollment. This has the potential to influence the enrollment process in a way that our analysis on one additional license does not show. Moore and Cruce (2017) address this question using ACT's data and find that "opting-in" to their equivalent of Search, which should increase the number of times licensed, leads to increases in sending scores to any colleges and the number of colleges

[15] Non-linearity tests are theoretically plausible but stretch the data beyond their limit since students are only in so many orders with randomization and they typically result in some licenses.

receiving score sends. And second, we do not know if these are better fit schools for students on other dimensions.

5.2. Impact of College Characteristics in License Portfolio

Next, we consider whether the average SAT of colleges in the portfolio of licenses impacts student outcomes. To do so, we replicate the top panel of Table 8 but change the explanatory variable of interest to the "Average SAT of Colleges in All Licenses." The variable takes the average SAT score for each of the colleges that licensed the student's contact information and takes the mean of those averages. The variable is instrumented with the "Average SAT of Colleges in Licenses via Randomization," which is the same as the endogenous explanatory variable but has the value of randomly varying from one student to the next, conditional on the same set of orders. The first stage has an F-Stat over 70.

The bottom panel of Table 8 displays the results of these regressions. The first column suggests that being licensed by colleges with higher average SAT scores does not impact the number of score sends. Columns (2)-(5) show little evidence that the quality of score sends are changing either. Combined, these results indicate that getting licensed by more selective colleges does not statistically change the score sending portfolio. This is consistent with the previous results on the impact of total licenses whereby students' score sends are not broadly impacted by marginal changes to which colleges license their contact information. Finally, columns (6)-(9) show no impact of the average SAT of licensing colleges on enrollment outcomes. This is not surprising given the null effects on the score sending portfolios.

The results in Table 8 paint a clear picture that marginal changes to getting licensed are not impacting score sending portfolios or enrollment outcomes. Combined with the previous section, which finds that students are more likely to send scores to the very college that licenses their contact information, we have evidence that students are relatively set in the broad types of colleges they consider and their college application portfolio. This is consistent with findings from Bond et al. (2018), who find that score sending portfolios are largely set and new information is unlikely to substantially change them.

6. Conclusion

This paper provides evidence that students who are licensed through the College Board's Student Search Service are much more likely to apply to and enroll in that college than observationally equivalent students who are not licensed, but who opted into Search. In relative terms, the impacts on each outcome are over 20 percent with absolute impacts on the order of 0.1 percentage points and 0.02 percentage points on the probability of sending a score to and enrolling in a specific college, respectively. A lingering question involves the return on investments for college? Our estimates imply that to get one more score send (applicant), colleges need 1,000 additional licenses, which costs approximately $400. To get one more enrollee, colleges need 5,000 licenses, which costs approximately $2,000. These estimates are very much in line withreports of what colleges spend per applicant and enrollee (Silber, 2016). The estimates do not account for additional costs that colleges may face after licensing, such as development of outreach and (e)mailing the content.

Our results demonstrate how Search plays a role in colleges meeting their objectives and potentially finding well matched students. The higher education market has become increasingly national as students are increasingly attending colleges farther from home (Hoxby, 1997; Long, 2004; Bound, Hershbein, and Long, 2009; Hoxby, 2009). This is particularly true for selective colleges who compete with other postsecondary institutions that are relatively far away and across state lines (Smith, Pender, and Howell, 2018). Without Search or similar outreach, it is not clear what today's college landscape would look like. Would there be fewer enrolled students or would there be reduced academic stratification? Would the same number of students be enrolled but sort into more local institutions? Would there be less diversity at colleges? Unfortunately, we can only estimate the impacts of one small piece of the larger puzzle, the marginal outreach from a college.

While this research sheds light on the efficacy of one specific college recruitment tool, it opens the door to many more questions and potential future research. First, what else are colleges doing to recruit students and what is the best use of their resources? Cellini et al. (2018) provide evidence that even not-

for-profit colleges advertise in traditional media. We are unaware of aggregate statistics of outreach on social media, but suspect it has been growing in importance. Consequently, our results should be interpreted as the impact of Search over and above existing outreach conducted by institutions, which we simply cannot quantify or evaluate. This also includes outreach through ACT's analogous service, which would mute our estimates for those who interact with both organizations and are licensed.

Another question is whether colleges could change the way they use Search to achieve their goals? For instance, they may be able to spend their money on students who will be more responsive to their outreach, focusing on enrollment over and above applications (Arcidiacono, Kinsler, and Ransom, 2019). Or without changing the students they Search, colleges could alter the material they send to students. Our results do not account for differences in how colleges contact students (mail or email) or what outreach content colleges send to students. Those decisions are housed in enrollment management offices and their vendors, who almost certainly conduct their own research.

Overall, our results shed light on one of the broadest college recruitment processes in the country. More generally, they suggest that college outreach can play an important role in students' transitions into college. As such, education policy need not only focus on student, parent, counselor, and high school interventions. Rather, colleges' efforts, whether it be through Search or other initiatives, can shape the student-college match and improve educational outcomes.

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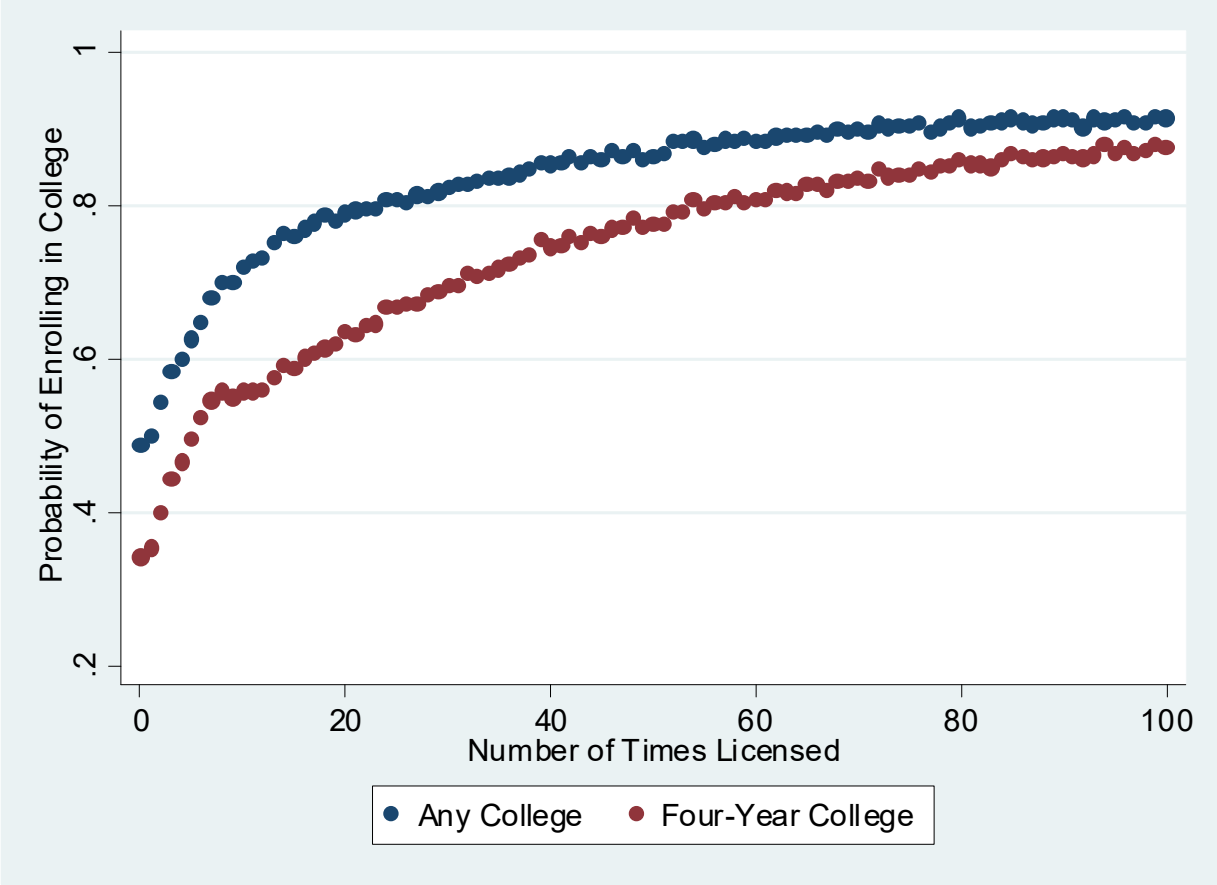
Figure 1 – Probability of Enrolling in College by the Number of Times Licensed



Notes: Uses the 2016 high school graduating cohort that was in at least once randomized order. Only showing number of times licensed between 0 and 100.

Table 1 - Summary Statistics

Variable	Obs	Mean	Std. Dev.
Order Level			
Names Requested	1,068	11,891.06	42,052.28
Names Licensed	1,068	5,362.27	11,851.13
Fraction of Requested Names Licensed	1,068	0.5591	0.2946
Student Level			
Male	1,739,280	0.4485	0.4973
White	1,739,280	0.5089	0.4999
Asian	1,739,280	0.1280	0.3341
Black	1,739,280	0.1163	0.3206
Hispanic	1,739,280	0.2023	0.4017
Parental Education - No College	1,739,280	0.1623	0.3688
Parental Education - Some College, no BA	1,739,280	0.1827	0.3865
Parental Education - BA or Higher	1,739,280	0.5376	0.4986
Parental Income < $50k	1,739,280	0.1703	0.3759
Parental Income $50k - $100k	1,739,280	0.1798	0.3840
Parental Income > $100k	1,739,280	0.2162	0.4117
High School Graduation Cohort	1,739,280	2015.61	0.4879
Student SAT	1,739,280	1057.52	197.50
Count of Randomized Orders	1,739,280	4.7245	4.7041
Count of Licensed Through Randomized Orders	1,739,280	1.9949	2.3944
Count of Ever Licensed from Colleges in Randomized Order	1,739,280	2.4101	2.8701
Total Licenses	1,739,280	28.5007	36.0237
Number of SAT Score Sends	1,739,280	3.1776	3.6458
Avg. Six-Year Graduation Rate of Score Sends	1,129,907	66.8164	14.1557
Average of Average SAT of College Score Sends	1,123,918	1155.66	119.45
Minimum of Average SAT of College Score Sends	1,123,918	1059.41	120.46
Maximum of Average SAT of College Score Sends	1,123,918	1251.17	148.417
Enroll in Any College	1,739,280	0.7964	0.4027
Enroll in Four-Year College	1,739,280	0.6703	0.4701
Six-Year Graduation Rate of Enrolled College	1,128,876	64.37	17.26
Average SAT Score of Enrolled College	1,073,885	1129.41	132.45
Student-Order Level			
Licensed via Randomization	7,326,936	0.4736	0.4993
Licensed	7,326,936	0.5721	0.4948
Sent Score Send	7,326,936	0.0079	0.0888
Enrolled	7,326,936	0.0019	0.0433

Notes: Only includes students who are in at least one randomized order, regardless of whether licensed. Parental income and education do not sum to 100% because of non-response.

Table 2 - Relationship Between License Counts and Student Characteristics

	Outcome = Count of Licenses via Randomization		Outcome = Count of Licenses	
	OLS	High School Fixed Effect	OLS	High School Fixed Effect
Student SAT	0.00361***	0.00369***	0.07298***	0.07203***
	(0.00001)	(0.00001)	(0.00012)	(0.00012)
Male	-0.26584***	-0.28841***	-3.03843***	-3.27533***
	(0.00308)	(0.00292)	(0.04251)	(0.03980)
Black	0.13228***	0.07066***	2.97326***	3.27876***
	(0.00517)	(0.00552)	(0.07149)	(0.07522)
Hispanic	-0.14923***	-0.01790***	-1.16660***	1.70069***
	(0.00429)	(0.00464)	(0.05928)	(0.06327)
Asian	-0.23937***	-0.06389***	-3.93509***	-0.45494***
	(0.00484)	(0.00519)	(0.06685)	(0.07079)
Other Race	-0.16266***	-0.03207***	-1.71463***	1.27308***
	(0.00757)	(0.00730)	(0.10465)	(0.09943)
Parental Income $50k - $100k	0.02643***	-0.02516***	0.48742***	-0.69598***
	(0.00531)	(0.00500)	(0.07344)	(0.06814)
Parental Income > $100k	0.20084***	-0.00745	3.59816***	-0.37114***
	(0.00538)	(0.00513)	(0.07441)	(0.06998)
Parental Education - Some College, no BA	0.02322***	0.04147***	-0.00639	0.51347***
	(0.00529)	(0.00499)	(0.07314)	(0.06799)
Parental Education - BA or Higher	0.19631***	0.18068***	3.29670***	3.02533***
	(0.00480)	(0.00465)	(0.06632)	(0.06335)
2016 High School Cohort	2.17393***	2.27783***	35.72079***	37.07533***
	(0.00317)	(0.00300)	(0.04383)	(0.04094)
Constant	-2.70157***	-3.00127***	-63.78562***	-66.95019***
	(0.01076)	(0.01071)	(0.14862)	(0.14596)
Observations	1,739,280	1,739,280	1,739,280	1,739,280
R-squared	0.300	0.314	0.409	0.416

Notes: *** p<0.01, ** p<0.05, * p<0.1. Only includes students who are in at least one randomized order. White students, parental income less than $50k, and parental education no college are the omitted categories.

Table 3 - Balancing Tests

Outcome	Licensed via Randomization	Count of Licensed via Randomization
Male	-0.00368*	0.00007
	(0.00212)	(0.00089)
Black	-0.00036	0.00010
	(0.00036)	(0.00058)
Hispanic	-0.00076	-0.00100
	(0.00048)	(0.00068)
Asian	-0.00074	0.00025
	(0.00053)	(0.00058)
Other Race	0.00015	-0.00016
	(0.00017)	(0.00042)
Parental Income < $50k	0.00023	-0.00019
	(0.00035)	(0.00081)
Parental Income $50k - $100k	0.00056	-0.00027
	(0.00043)	(0.00075)
Parental Income > $100k	-0.00017	0.00042
	(0.00046)	(0.00074)
Parental Education - No College	-0.00011	-0.00182**
	(0.00038)	(0.00078)
Parental Education - Some College, no BA	0.00066	0.00097
	(0.00052)	(0.00078)
Parental Education - BA or Higher	-0.00093	0.00056
	(0.00078)	(0.00096)
Student SAT	-1.63386**	-0.41584
	(0.78002)	(0.40281)
2016 High School Cohort	-0.00002	-0.00005
	(0.00007)	(0.00012)
Randomized Licenses (less order)	0.00427	--
	(0.00521)	--
Observations	7,329,460	1,696,991
Number of (Sets of) Orders	1,068	557,095

Notes. All estimates come from separate regressions that inclue (set of) order fixed effects. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4 - Impact of Being Licensed on the Probability of Sending an SAT Score to that College

	Outcome = Sent Score Send to Licensing College		Outcome = Sent Score Send to Any Licensing College	Outcome = Count of Score Sends Sent to Licensing Colleges
Licensed	0.00115***	0.00126***	--	--
	(0.00011)	(0.00027)	--	--
Count Licensed	--	--	0.00105***	0.00109***
	--	--	(0.00021)	(0.00021)
Order Fixed Effects (obs = student-order)	X	X	--	--
Set of Orders Fixed Effects (obs = student)	--	--	X	X
Only in One Randomized Order	--	X	--	--
Control Mean	0.00426	0.00251	0.00472	0.00473
Percent Impact	27.0%	50.2%	22.3%	23.0%
Observations	7,326,936	605,502	1,696,991	1,696,991

Notes: *** p<0.01, ** p<0.05, * p<0.1. Only includes students who are in at least one randomized order. All estimates come from an instrumental variables where the instrument for licensed is whether licensed through randomization (or count of licenses through randomization).

Table 5 - Impact of Being Licensed on the Probability of Enrolling in that College

	Outcome = Enrolled	Outcome = Enrolled in Any Licensing College
Licensed	0.00015***	--
	(0.00006)	--
Count Licensed	--	0.00024**
	--	(0.00011)
Order Fixed Effects (obs = student-order)	X	--
Set of Orders Fixed Effects (obs = student)	--	X
Control Mean	0.00084	0.00111
Percent Impact	17.8%	21.6%
Observations	7,326,936	1,696,991

Notes: *** p<0.01, ** p<0.05, * p<0.1. Only includes students who are in at least one randomized order. All estimates come from an instrumental variables where the instrument for licensed is whether licensed through randomization (or count of licenses through randomization).

Table 6: Heterogeneous Effects (Student Characteristics) on Score Sending and Enrollment Probabilities, Outcome = Count Sent or Enrolled, IV = Count of Licensed via Randomization

	(1) Male	(2) Female	(3) White	(4) Black	(5) Hispanic	(6) Asian	(7) No College	(8) Some College, no BA	(9) BA or Higher	(10) Income < $50k	(11) Income $50k-$100k	(12) Income > $100k	(13) SAT < 800	(14) SAT 800-1000	(15) SAT 1000-1200	(16) SAT > 1200
Score Sending																
Count Licensed	0.00071**	0.00134***	0.00074**	0.00247***	0.00199***	0.00060	0.00165***	0.00056	0.00103***	0.00162***	0.00183***	0.00149***	0.00172***	0.00185***	0.00103***	0.00021
	(0.00032)	(0.00029)	(0.00032)	(0.00069)	(0.00037)	(0.00066)	(0.00045)	(0.00048)	(0.00033)	(0.00048)	(0.00050)	(0.00050)	(0.00056)	(0.00035)	(0.00035)	(0.00060)
Control Mean	0.00472	0.00474	0.00526	0.00538	0.00305	0.00543	0.00335	0.00350	0.00621	0.00390	0.00439	0.00590	0.00207	0.00377	0.00411	0.00978
Percent Impact	15.0%	28.3%	14.1%	46.0%	65.3%	11.0%	49.3%	16.0%	16.6%	41.6%	41.7%	25.3%	83.1%	49.0%	25.1%	2.1%
Observations	764,125	932,866	860,396	199,394	345,523	215,643	279,318	313,111	902,517	293,035	306,670	361,889	141,498	541,633	614,238	399,622
Enrollment																
Count Licensed	0.00009	0.00030*	0.00032*	0.00073*	0.00004	0.00000	-0.00007	0.00077***	0.00046***	0.00031	0.00083***	0.00011	0.00051	0.00049**	0.00007	0.00028
	(0.00016)	(0.00015)	(0.00017)	(0.00040)	(0.00018)	(0.00024)	(0.00024)	(0.00028)	(0.00016)	(0.00026)	(0.00029)	(0.00025)	(0.00035)	(0.00020)	(0.00019)	(0.00022)
Control Mean	0.00113	0.00109	0.00125	0.00172	0.00077	0.00054	0.00098	0.00102	0.00120	0.00090	0.00122	0.00124	0.00107	0.00124	0.00096	0.00114
Percent Impact	7.9%	27.4%	25.7%	42.5%	5.2%	0.0%	-7.1%	75.8%	38.2%	34.5%	68.2%	8.9%	47.7%	39.6%	7.3%	24.5%
Observations	764,125	932,866	860,396	199,394	345,523	215,643	279,318	313,111	902,517	293,035	306,670	361,889	141,498	541,633	614,238	399,622

Notes: Observation is at the student-level and each regression includes fixed effects for the set of orders with randomization the student was in. Count licensed is the number of times a student is licensed by the set of colleges that had orders with randomization. Since a student can later be licensed by a college without randomization, we instrument Count Licensed with Count of Licensed via Randomization. *** p<0.01, ** p<0.05, * p<0.1.

Table 7 - Score Sending and Enrollment Probabilities by Student and College Characteristics, Outcome = Count Sent or Enrolled, IV = Licensed via Randomization

	All Students, Number of Times Potentially Licensed					Students in Exactly in One Randomized Order				
	5 or Fewer	6-10	11-25	26-50	More Than 50	School Avg SAT - Student SAT > 200	School Avg SAT - Student SAT > 100	School Avg SAT - Student SAT Within 100	School Avg SAT - Student SAT < -100	School Avg SAT - Student SAT < -200
Score Sending										
Count Licensed	0.00104***	0.00080**	0.00142***	0.00219**	0.00024	0.00205***	0.00189***	0.00114*	0.00027	0.00031
	(0.00036)	(0.00036)	(0.00044)	(0.00103)	(0.00300)	(0.00039)	(0.00038)	(0.00059)	(0.00036)	(0.00030)
Control Mean	0.00351	0.00510	0.00523	0.00942	0.00999	0.00334	0.00434	0.00604	0.00401	0.00413
Percent Impact	29.6%	15.7%	27.1%	23.2%	2.4%	61.4%	43.5%	18.9%	6.7%	7.5%
Observations	315,549	356,551	342,265	226,847	350,406	206,793	277,953	170,425	157,124	97,831
Enrollment										
Count Licensed	0.00001	0.00043**	0.00034	0.00066	-0.00199	0.00017	0.00023	0.00005	-0.00004	0.00019
	(0.00017)	(0.00018)	(0.00024)	(0.00057)	(0.00148)	(0.00022)	(0.00022)	(0.00030)	(0.00020)	(0.00020)
Control Mean	0.00085	0.00110	0.00112	0.00315	0.00272	0.00093	0.00112	0.00151	0.00067	0.00061
Percent Impact	1.2%	39.1%	30.2%	20.9%	-73.0%	18.2%	20.5%	3.3%	-6.0%	31.2%
Observations	420,922	356,551	342,265	226,847	350,406	206,793	277,953	170,425	157,124	97,831

Notes: Observation is at the student-level and each regression includes fixed effects for the set of orders with randomization the student was in. Number of times potentially licensed (the left panel) is the sum of randomized orders, which may or may not result in licenses, and non-randomized licenses. Count licensed is the number of times a student is licensed by the set of colleges that had orders with randomization. Since a student can later be licensed by a college without randomization, we instrument Count Licensed with Count of Licensed via Randomization. *** p<0.01, ** p<0.05, * p<0.1.

Table 8 - Impact of portfolio of licenses on score sending portfolios and enrollment outcomes, Obs = Student, IV = Count or Avg College SAT of Licensed via Randomization

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Count of Score Sends	Avg. Six-Year Grad Rate of Score Sending Colleges	Avg. of Avg. SAT of Score Sending Colleges	Min of Avg. SAT of Score Sending Colleges	Max of Avg. SAT of Score Sending Colleges	Enrolled in Any College	Enrolled in Four-Year College	Six-Year Grad Rate of Enrolled College	Avg. SAT of Enrolled College
Total Licensed	-0.00219	-0.00975	-0.02935	-0.20113	0.15311	-0.00079	-0.00192*	-0.00662	-0.01069
	(0.00740)	(0.03529)	(0.28998)	(0.30510)	(0.38151)	(0.00087)	(0.00101)	(0.04464)	(0.34624)
Observations	1,696,991	1,096,996	1,091,134	1,091,134	1,091,134	1,696,991	1,696,991	1,091,959	1,038,530
Average SAT of Colleges in All Licenses	-0.00101	-0.00121	-0.01861	0.00267	-0.05655*	-0.00004	-0.00005	0.00396	0.01710
	(0.00067)	(0.00285)	(0.02384)	(0.02601)	(0.03165)	(0.00006)	(0.00006)	(0.00678)	(0.04882)
Observations	973,540	642,777	639,603	639,603	639,603	973,540	973,540	512,631	488,678

Notes: Observation is at the student-level and each regression includes fixed effects for the set of orders with randomization the student was in. Total licensed is the number of times a student is licensed by a college, with or without randomization. We instrument Total Licensed with Count of Licensed via Randomization. Average SAT of Colleges in All Licenses is the mean of the average SAT for all colleges that licensed the student's contact information, with or without randomization. We instrument Average SAT of Colleges in All Licenses with Average SAT of Colleges in Licenses via Randomization. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 1 - Summary Statistics of Orders

	Orders With Randomization (n = 1,422)		Orders Without Randomization (n = 31,371)	
	Mean	Std. Dev.	Mean	Std. Dev.
Names Requested	5105.5	11601.8	4097.2	20507.9
Public	0.237	0.425	0.226	0.418
Six Year Graduation Rate	61.309	15.175	62.247	16.645
Average SAT of College	1099.2	116.1	1110.7	143.0

Notes: Includes all orders between October 2014 and Sepember 2015.

Appendix Table 2 - OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Obs = Student-Order				Obs = Student		
	Outcome = Sent Score Send		Outcome = Enrolled		Outcome = Sent Any Score Send	Outcome = Count of Score Sends	Outcome = Enrolled in Any
Licensed via Randomization	0.00457**	--	0.00165**	--	--	--	--
	(0.00228)	--	(0.00064)	--	--	--	--
Licensed	--	0.00644***	--	0.00181***	--	--	--
	--	(0.00193)	--	(0.00055)	--	--	--
Count Licensed	--	--	--	--	0.01354***	0.01529***	0.00340***
	--	--	--	--	(0.00110)	(0.00138)	(0.00029)
Observations	7,326,936	7,326,936	7,326,936	7,326,936	1,696,991	1,696,991	1,696,991
R-squared	0.001	0.001	0.000	0.000	0.042	0.042	0.010

Notes: Only includes students who are in at least one randomized order. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 3 - Impact of Being Licensed on the Probability of Sending an SAT Score to or Enrolling in that College

	Outcome = Sent Score Send to Licensing College		Outcome = Enroll
Licensed via Randomization	0.00089***	0.00109**	0.00011***
	(0.00014)	(0.00044)	(0.00004)
Order Fixed Effects (obs = student-order)	X	X	X
Only in One Randomized Order	--	X	--
Control Mean	0.00578	0.00243	0.00110
Percent Impact	15.4%	44.9%	10.0%
Observations	7,326,936	605,502	7,326,936

Notes: *** p<0.01, ** p<0.05, * p<0.1. Only includes students who are in at least one randomized order. These are the reduced-form estimates corresponding to equation (1) in the text.

Appendix Table 4 - First Stage Regressions

	Outcome = Licensed		Outcome = Count Licensed
Licensed via Randomization	0.77695***	0.87142***	--
	(0.00023)	(0.00069)	--
Count of Licensed via Randomization	--	--	0.86004***
	--	--	(0.00052)
Order Fixed Effects (obs = student-order)	X	X	--
Set of Orders Fixed Effects (obs = student)	--	--	X
Only in One Randomized Order	--	X	--
Observations	7,326,936	605,502	1,696,991
R-squared	0.612	0.725	0.707

Notes: Only includes students who are in at least one randomized order. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 5 - Impact of Being Licensed by a College on the Probability of Sending an SAT Score to that College, At Least One Score Senders

	Outcome = Sent Score Send to Licensing College		Outcome = Sent Score Send to Any Licensing College	Outcome = Count of Score Sends Sent to Licensing Colleges
Licensed	0.00167***	0.00191***	--	--
	(0.00016)	(0.00042)	--	--
Count Licensed	--	--	0.00142***	0.00148***
	--	--	(0.00033)	(0.00033)
Order Fixed Effects (obs = student-order)	X	X		
Set of Orders Fixed Effects (obs = student)			X	X
Only in One Randomized Order		X		
Control Mean	0.00629	0.00398	0.00754	0.00756
Percent Impact	26.5%	48.0%	18.8%	19.6%
Observations	5,049,841	381,064	1,101,075	1,101,075

Notes: *** p<0.01, ** p<0.05, * p<0.1. Only includes students who are in at least one randomized order. All estimates come from an instrumental variables where the instrument for licensed is whether licensed through randomization (or count of licenses through randomization).

Appendix Table 6 - Heterogeneous Effects (College Characteristics) on Score Sending and Enrollment Probabilities, Outcome = Count Sent or Enrolled, IV = Licensed via Randomizatio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Public	Private	Barrons 1	Barrons 2	Barrons 3	Barrons 4	Six-Year Grad Rate < 50	Six-Year Grad Rate -50-70	Six-Year Grad Rate > 70	Avg SAT < 1015	Avg SAT - 1015-1175	Avg SAT > 1175
Score Sending												
Count Licensed	0.00112	0.00291***	-0.00119	-0.00118	0.00352***	0.00106***	0.00064*	0.00234***	0.00075	0.00129***	0.00174***	0.00060
	(0.00069)	(0.00083)	(0.00200)	(0.00490)	(0.00113)	(0.00030)	(0.00034)	(0.00038)	(0.00124)	(0.00044)	(0.00042)	(0.00053)
Control Mean	0.00546	0.00293	0.01050	0.01227	0.01022	0.00374	0.00363	0.00432	0.01061	0.00345	0.00502	0.00611
Percent Impact	20.5%	99.2%	-11.3%	0.0%	34.4%	28.4%	17.6%	54.1%	7.1%	37.4%	34.7%	9.8%
Observations	142,655	82,566	33,455	3,799	36,214	421,754	352,509	194,253	58,740	270,099	159,825	175,578
Enrollment												
Count Licensed	-0.00002	0.00005	-0.00052	0.00125	-0.00003	0.00021	-0.00014	0.00052***	-0.00009	-0.00002	0.00051**	-0.00025
	(0.00041)	(0.00042)	(0.00054)	(0.00235)	(0.00038)	(0.00019)	(0.00023)	(0.00018)	(0.00041)	(0.00028)	(0.00022)	(0.00023)
Control Mean	0.00172	0.00093	0.00127	0.00110	0.00157	0.00105	0.00109	0.00108	0.00127	0.00105	0.00122	0.00106
Percent Impact	-1.2%	5.4%	-41.0%	114.1%	-1.9%	19.9%	-12.8%	48.2%	-7.1%	-1.9%	41.6%	0.0%
Observations	142,655	82,566	33,455	3,799	36,214	421,754	352,509	194,253	58,740	270,099	159,825	175,578

fixed effects for the set of orders with randomization the student was in. Count licensed is the number of times a student is licensed by the set of colleges that had orders with randomization. Since a student can later be licensed by a college without randomization, we instrument Count Licensed with Count of Licensed via Randomization. *** p<0.01, ** p<0.05, * p<0.1.