Do College Admissions Criteria Matter? Evidence from Discretionary vs. Grade-Based Admission Policies

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Abstract

This paper examines the implications of college admissions criteria on students' academic and non-academic performance in university and their labor market outcomes. We exploit a unique feature of the admissions system at a large university that has two admission tracks – a regular admission track where admission is based exclusively on academic performance and a discretionary admission (DA) track where applicants can instead gain admission on the basis of demonstrated non-academic qualities. Comparing students admitted through each track, we find that DA students fare similarly in terms of academic performance in university as marginal students admitted through the regular route. However, they are significantly more likely to be involved in optional academic and non-academic college activities and earn substantially higher labor market earnings up to three years after graduation. These results are not driven by the DA process differentially selecting students on the basis of family background or unobserved academic ability.

Keywords: College selection; Higher education; Non-academic skills

JEL Classification: I21, I23, J31

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I. Introduction

Selective colleges and universities with capacity constraints face a choice problem. They need to decide which students to admit, among those who apply. Conceptually, one can think of each student as possessing two broad types of attributes – academic skills and non-academic skills. Selective colleges with the aim of admitting students meritoriously would presumably like to admit those who are strong on both measures. However, they face a trade-off, since there may be some students who are strong in terms of academic ability but somewhat weaker in terms of non-academic ability. Conversely, there may be students who are strong in terms of non-academic ability but somewhat weaker in terms of academic ability. Colleges must therefore weigh these qualities in deciding which students to admit. A college's preference manifests in its selection criteria.

Colleges are confronted with a question of how best to select students. Two common selection modes have emerged. Some colleges select students exclusively on the basis of academic performance, whereas other colleges use a combination of academic performance and demonstrated non-academic ability. In the former case, no weight is given to non-academic skills; instead, the focus is solely on whether an applicant is well prepared academically to attend college. In the latter case, non-academic qualities are given some weight. These non-academic considerations may include, for instance, whether a student possesses certain special skills or talents, whether she has an outstanding record of extracurricular activities, or whether she can demonstrate having interests aligned with a specific choice of study. The weight given to non-academic qualities and the precise non-academic qualities considered for admission varies widely across colleges.

Globally, most higher education systems rely primarily on measured academic achievement and/or general cognitive ability to admit students (Helms 2008; Edwards et al. 2012; Freeman 2015). In these systems, selection is typically based on students' performance on some academic assessment (often in the form of standardized assessments such as secondary school leaving examinations, university entrance examinations, and aptitude tests). Often, these assessments are administered nationally or regionally and coordinated by a government agency, though many may also be institution-based. Notable systems which rely heavily on performance on standardized academic assessments for undergraduate selection include universities in China (*Gaokao*), France (*Baccalaureat*), Australia (*Senior Secondary Certificate of Education*), Japan (*Center Test*) and South Korea (*Suneung*). Admissions with consideration partly given to non-academic qualities appear to be less prevalent globally and

practiced commonly only in a few countries such as the United States, United Kingdom, and Canada (Helms 2008; Edwards et al. 2012; Freeman 2015). In the United States, for instance, where individual colleges possess relatively high levels of autonomy over their own admissions policies, many colleges select their undergraduates based on a wide array of application materials – from teacher recommendation letters to extracurricular activities, personal statements, and essays, apart from academic performance (such as high school grade point averages / rank and performance on standardized tests such as the ACT or SAT), arguing that these serve to make admissions more "holistic" (Rosinger et al. 2021); of course, this is far from universal and not all colleges in the United States practice such "holistic admissions". Those that do tend to be more selective and well-resourced (Helms 2008; Gentsch 2016).[2]

There are arguments both for and against "holistic admissions" (relative to academic-only based admissions). Holistic admissions may allow for a more diverse student body but are costlier to implement since colleges need to expend time, effort, and financial resources to understand and evaluate individual application portfolios and their merits before they can select applicants. Selection is more subjective and easier to game since whether one type of non-academic ability (say ability in sport) is preferred to another (like ability in music) depends on the subjective preferences of the selection panel and their interpretation of the information provided. In contrast, academic-merit-only based admissions focus only on a single dimension of student ability, but the admission standard is easier to measure and more transparent. Whether a college chooses to employ "holistic" or "academic-only based" admissions depend on what the institution's goals[3] are and whether it has the ability to be selective.[4]

[2] Apart from these two common admissions regimes (academic-only versus holistic), some universities also practice hybrid admission schemes. Under a hybrid regime, some applicants are admitted based on narrow academic criteria while others are admitted based on broader holistic considerations. Hybrid regimes are practiced by some universities such as the University of Texas (under the "Top Ten Percent Rule", where students in the top 10 percent of their high school class in Texas are eligible for automatic admissions to Texas public universities of their choice while students not in the top 10 percent compete through a more holistic admissions process) (see for instance, Long and Tienda 2010; Niu and Tienda 2010; Black et al. 2015; Cortes and Lincove 2018; and Black et al. forthcoming, for discussions on how the Texas hybrid regime works), the University of California (under the "Eligibility in the Local Context" program, which works in a similar way to the Texas "Top Ten Percent Rule") and the National University of Singapore (beginning in 2004). Hybrid regimes are, however, relatively uncommon internationally.

[3] Colleges have different institutional goals. These may range from profit maximization (for private colleges), to maximization of graduation rates, having wide/top student representation in key extracurricular activities, having a socioeconomically diverse student body, and so on. Colleges choose their admissions policies to meet these goals, subject to capacity constraints.

[4] The choice between "holistic" versus "academic-only based" admissions is more relevant for selective institutions. Open-access or non-selective institutions are guided by missions that prevent them from rejecting applicants so long as applicants meet minimum academic standards (have a high school diploma) and can finance their education; so this choice is irrelevant for them. On the other hand, institutions which are not bound by open-access missions, and which face a larger pool of applicants than there are spaces, can afford to be selective. And

These differences in selection methods raise a natural question: Does the type of selection method matter? More specifically, does selecting based on a broader array of applicant attributes, beyond just academic achievement, allow colleges to better pick up individuals who will be more successful in the labor market?

There is now increasing evidence that noncognitive skills are just as important as cognitive skills for worker productivity, and therefore, for how individuals perform in the labor market (Heckman and Rubinstein 2001; Heckman et al. 2006; Almlund et al. 2011; Lindqvist and Vestman 2011; Weinberger 2014; Cubel et al. 2016). It is therefore natural to ask whether admission criteria that consider broader non-academic qualifications would be more successful at picking up individuals with skills that are valued in the labor market. Despite the importance of such questions for the choice of admissions policies and for education policy in general, they remain understudied.

Existing studies on college admissions criteria have focused on evaluating the impact of affirmative action practices on the composition of the entering class (Hinrichs 2012; Blume and Long 2014), student outcomes (Cortes 2010; Alon and Malamud 2014), and student behavior (Grau 2018), the impact of early decision programs on the composition of the entering class (Antecol and Smith 2012), likelihood of being admitted (Avery and Levin 2010), and college performance (Jensen and Wu 2010), the role of admissions guarantees in influencing academic fit (academic "undermatching" or "overmatching") (Black et al. 2015; Cortes and Lincove 2018) and the composition of applicants and enrollees (Long and Tienda 2010; Niu and Tienda 2010), as well as the impact of gaining or losing access to a selective college induced by changes in admissions rules on students' graduation and subsequent labor market outcomes (Black et al. forthcoming). Only a handful of studies have attempted to evaluate the impact of holistic college admissions practices. Much of the work concerning holistic admissions tries to understand how admissions officers make admissions decisions, conditional on colleges adopting holistic admissions policies (Bastedo et al. 2018; Hossler et al. 2019; Rosinger et al. 2021). Rosinger et al. (2021) find that instead of boosting admission and enrollment among racial-minority and economically disadvantaged students, holistic admissions practices may in some cases serve to decrease access to these students instead. A series of experimental studies shows that the way admissions officers contextualize information has implications for the type of student being admitted. For instance, Bastedo and Bowman

these colleges have the ability to decide on the criteria to admit students. The discussion in this paper focuses on selective colleges with the ability to choose their students.

(2017) find that providing detailed information on high school contexts increases the likelihood that admissions officers recommend admitting low socioeconomic status applicants. Similarly, Bastedo et al. (2018) find that when provided with high quality information on applicants' high school contexts, admissions officers that espoused a definition of holistic admissions emphasizing educational and family contexts were more likely to admit a low-income applicant. It is worth noting that these experimental studies are aimed at evaluating whether information provided to admission officers and the way that admission officers interpret the concept of holistic review affects their choice of students to admit (conditional on colleges adopting holistic admissions), not at understanding whether the types of students being admitted differ based on college admission criteria.

A few studies have tried to compare the college performance of students admitted based on holistic considerations with those admitted based on academic achievement. But these have been done narrowly in the context of medical school (Urlings-Strop et al. 2013; Grabowski 2018) and engineering program admissions (Hilliger et al. 2018), and are typically based on simple comparisons between students admitted through different regimes. Still, these studies have found that the use of holistic review to determine admissions is associated with greater diversity in student composition as measured by gender and socioeconomic status (Grabowski 2018). Also, they find that students admitted based on holistic review perform either just as well or better in college (Urlings-Strop et al. 2013; Hilliger et al. 2018).

To our knowledge, no study has yet tried to understand whether the use of holistic admissions practices (as opposed to admissions based solely on academic achievement) allow colleges to admit different types of students and whether students selected on the basis of holistic review subsequently perform differently in college and in the labor market compared to peers of similar incoming academic achievements selected on the basis of academic achievement. In this paper, we exploit a unique feature of the admissions system of the National University of Singapore (NUS) – Singapore's largest public university – to provide some answers to the question of how students admitted to the same university under two different admissions schemes – one that focuses only on academic achievement vs. one based on holistic considerations – fare in college and in the labor market.

Specifically, regular admission to NUS was based exclusively on the academic performance of students. However, starting in 2004, the university had also set aside a small share of places (up to 10 percent each year) for admission on the basis of a holistic set of

aptitudes beyond academic achievement. Through this scheme, known as "Discretionary Admissions" (DA), applicants who did not meet the usual academic cutoff requirements for regular admission might nonetheless be able to gain admission, if they were able to demonstrate that they possessed certain traits or achievements, including "ability and interest, work experience, leadership, community service [or] exceptional talent, subject to a minimum level of academic competence". In practice, the latter clause guaranteed that students admitted through the DA route were those who missed the academic threshold requirement narrowly for regular admission. The academic cutoff requirement was set prior to the start of the university's admission exercise each year and was determined based on the targeted intake for each program and the expected demand from students. Students were unaware of these admission cutoffs when they applied to NUS.

In order to evaluate whether selection based on non-academic achievements makes a difference in the types of students enrolled, we compare students admitted through the DA scheme – that is, students who narrowly miss the academic cutoff requirement but who are able to demonstrate that they possess certain non-academic skills or talents – to students admitted through regular admission. In many cases, we pay special attention to students in the first decile of regular admission (based on incoming academic achievement), since these students are most comparable, in terms of incoming academic ability, to those admitted through DA. Comparing the outcomes of students admitted through DA to those narrowly admitted through regular admission provides one answer as to whether the types of students entering through a regime that selects based on both academic and non-academic achievements are different from those entering through a regime that selects exclusively based on academic ability within a single institution. In other words, the (causal) treatment effect that we seek to estimate is the extent and nature of selection on non-academic characteristics and skills induced by the admissions regime and how this selection matters for subsequent educational choices and labor market outcomes of students.

It is worth noting that while our setup does not allow us to examine how the selection of students varies if admissions had been entirely holistic versus if it had been entirely based on incoming academic achievement, it does provide insights as to how student composition would change if a college that has an existing policy of admitting students based exclusively on academic achievement were to expand the number of places available to allow students who would otherwise not have been admitted through the regular admissions process (based on incoming academic achievement) a chance to be considered based on a more holistic set of

factors. Given that there may be a sizeable number of colleges with an interest to adopt such "holistic" admissions processes, we believe that the results from this study would be valuable.

We find that, while DA students enter with slightly lower academic achievement scores compared to students marginally admitted through regular admission (specifically, they enter with an admission score that is 2.7 points lower on average, or in terms of standard deviation units, with an admission score that is 0.47 of a standard deviation lower on average), they do better than expected eventually, faring similarly compared to those marginally admitted through regular admission in terms of university academic performance, and consistent with the DA process selecting students with more non-academic skills, DA students are more likely to be involved in certain optional academic and non-academic college activities. More interestingly, we find that DA students obtain substantially higher labor market earnings after graduation compared to students marginally admitted through regular admission. We are able to rule out that the results are driven by differences in family background or unobserved academic ability that may not be adequately captured by pre-university admission scores. In particular, DA students and students marginally admitted through regular admission are comparable in terms of parents' education, housing type, and academic grades achieved in primary and secondary school, suggesting that the DA admission process is unlikely to be differentially selecting students on the basis of family background or unobserved academic ability. Therefore, the fact that DA students outperform students who were marginally admitted via regular admissions suggests that the non-academic skills that DA students are selected on are highly rewarded in the labor market.

Overall, our findings imply that because DA and regular admission students (at least regular admission students in the first decile of incoming academic achievement) exhibit similar levels of academic ability, admissions policies that consider not just academic performance but also other non-academic achievements, can allow colleges and schools to pick up students with certain non-academic skills who would subsequently be more successful in the labor market. While we cannot entirely rule out the possibility that differences in outcomes between DA students and students marginally admitted through regular admission could have partly arisen due to behavioral changes in DA students (it is conceivable that DA students may have altered their effort levels in response to being branded a "discretionary admit"), we believe that such behavioral responses are unlikely to be a primary driver of the observed differences. First, the track through which an applicant enters NUS is not observable to anyone else except the student, limiting to some extent the need to have to "prove one's worth." Nevertheless, such

desire could be internal to the student; however, we find that DA students, in fact, do as well academically in university as marginal students admitted through the regular route, suggesting that they are not simply making up for inferior academic performance with increased extra-curricular involvement. Finally, it is hard to imagine that such "branding effects" (that are not observable to others) would be so strong as to lead to the large and persistent differences in labor market outcomes seen between DA students and students marginally admitted through the regular process for up to 7 years after admission into NUS. Because any behavioral responses are likely to be more short-term in nature, we believe the observed differences are more likely to be reflecting differences in the types of students being picked up by the DA process.

II. Institutional Background

The National University of Singapore (NUS) is a large public university in Singapore. It is widely perceived to be the most selective university in the country and traditionally ranks highly on university ranking systems such as the Quacquarelli Symonds (QS) and the Times Higher Education (THE) world university rankings. Until 2004, admission to the university was exclusively based on academic performance.

Singapore-based students that enter NUS do so through three main routes. The vast majority enter through the academically oriented junior college route. These students take the GCE A level examinations, which are standardized national examinations that assess student knowledge in academic subjects such as physics, chemistry, and economics. A smaller fraction come in through the polytechnic route. This is a vocationally oriented route which emphasizes industry-relevant applied skills. Finally, an exceedingly small minority enter through the international baccalaureate (IB) route. Like the junior college route, the IB route is academically oriented, but culminates in the international baccalaureate examinations instead of the GCE A level exams. The IB exams are also nationally standardized assessments.

Students are admitted to NUS primarily based on academic performance. This means that for students entering through the junior college route, admission is based on their performance on the GCE A level exams; for students entering through the polytechnic route, admission is based primarily on their polytechnic grade point average (with a small weight

placed on their academic performance in the GCE O level exams[5]); for students entering through the IB route, admission is based on their performance in the IB exams. For ease of comparison, NUS converts each applicant's pre-university achievement to a numerical score known as the university admission score (UAS). A higher UAS indicates higher academic performance prior to admission. The UAS are standardized within entry route and admission cohort. Details on the computation of UAS are provided in Appendix 1.

Administratively, NUS is made up of several faculties. A faculty is a division within the university comprising a number of related subject areas or courses. For instance, the Faculty of Science offers science-related subjects or courses such as Chemistry, Life Sciences, Mathematics, Physics, and Statistics. Students apply to NUS through a centralized admissions process. In the first stage, all students interested to gain admission to NUS select and rank their faculty choices in order of preference. Following this, students are offered admission to their most preferred faculty (and course, for some faculties) that they qualify for, based on the cutoff UAS for each faculty/course. Each year, each faculty has a targeted number of students to admit and whether a student gets into her preferred faculty is based on academic merit, subject to meeting the UAS required for entry into the faculty/course. The UAS cutoff scores are set by NUS prior to the start of the admission exercise each year and are determined based on the targeted intake for each program and the expected demand from students; they vary by faculty/course, entry route (whether junior college, polytechnic, or IB), and admission cohort. Students are not aware of these UAS cutoff scores when they apply to NUS. If successful in their application to NUS, a student would receive an offer of admission to a single faculty/course from her list of choices. Whether a student gets admitted to her preferred faculty/course depends on whether his/her incoming UAS exceeds the threshold UAS required for admission. If so, the student is admitted. Otherwise, the student is not.[6]

In 2004, in line with the Singapore Ministry of Education's national initiative to reduce overemphasis on academic performance, NUS introduced the discretionary admissions (DA) scheme to allow up to 10 percent of each undergraduate cohort to be admitted based on non-academic consideration. Under this scheme, students who did not meet the cutoff academic scores can nevertheless be considered for admission if they could demonstrate that they possessed non-academic achievements/talents. Examples of such achievements include

[5] Like the GCE A level examinations, the GCE O level examinations are standardized national examinations that assess student knowledge in academic subjects.
[6] Apart from admission through the DA route, there are never cases where students who fall short of the threshold UAS come to be admitted to NUS for other reasons.

performance in international competitions, alternative or non-traditional qualifications, work experience, involvement in key leadership positions in extracurricular activities, and active participation in community service. Applicants who wished to be considered for DA must provide details of their skills, talents, or achievements under the "Outstanding Achievements" section of the admission application form when applying. Applicants had to provide a set of documents to support their claims. To ensure that students would still be well prepared academically for higher education, students admitted through the DA scheme would nevertheless have to meet certain minimum levels of incoming academic performance. In practice, this meant that students entering through DA were those who narrowly missed the academic performance threshold required for regular admission. The rest of the seats in each faculty/course were allocated to students through regular admission – and these were based exclusively on the incoming academic performance of students.[7] Over the sample period (2009-2013), the acceptance rate (number of students accepted as a proportion of number of applications received) for NUS was approximately 32 percent. Out of all the acceptances, approximately 7 percent came through the DA scheme.

The DA process was administered by each faculty within the university instead of through the centralized university admissions system. Each faculty would receive the names and information of applicants who fell just below the cutoff points from the central admissions office, and would then filter this set of applications based on the applicants' non-academic portfolio and perceived competency to adapt to the rigor of the course curriculum. Applicants who were selected were invited for an interview. Those who were successful would receive an offer from the faculty. To ensure that each student was not considered concurrently by more than one faculty, the central admissions office would forward only a unique set of student names to each faculty for consideration. Each student was therefore eligible to receive only a

[7] The admissions regime adopted by NUS as described in this paper was operational from 2004 to 2019 (and is applicable to the sample of students in our dataset). NUS has since altered its admissions regime beginning 2020. The new admissions regime continues to be centered on shifting emphasis away from incoming academic achievement. However, operationalization of the admissions process is somewhat different. In particular, while the former admissions process, described in this paper, is a scheme that sets aside a small share of places for applicants who *marginally* fall short of the entry cut-off score, but who may have other non-academic talents and achievements, and can therefore be viewed as one which primarily still assesses applicants based on their incoming academic achievement, the new admissions process is a scheme that sets aside a larger share of places for applicants to be admitted on the basis of their demonstrated aptitude and interest in the courses they apply to, while placing less emphasis on the extent to which the applicant's incoming academic achievement falls short of the entry cutoff score. In other words, under the new "aptitude-based admissions scheme", it is possible for applicants with UAS considerably lower than the cutoff to be admitted if they can sufficiently demonstrate having the aptitude and interest in the course they apply to. Also, the share of places devoted to non-regular achievement-based admissions has increased substantially, from a small share of places to about half of all places, for each cohort.

maximum of one interview offer if shortlisted and would ultimately receive only one admission offer if successful. Figure 1 provides a flow chart of the admissions process at NUS and explains in greater detail how the DA process works.

While there are no universally defined criteria for selecting students, making it possible that selection criteria may have varied by faculty and admission cohort, the university did offer several general principles underlying the purpose and aims of the DA policy. These principles, which are broadly similar to those of universities and colleges practicing holistic admissions in the United States, stipulate that the aim of the DA policy is to recognize a more diverse range of achievements and talents that go beyond just academic performance and that selection should take into account whether a student can demonstrate possessing traits, experiences, skills, or talents which are valued by society.[8] Within each faculty, selection decisions were collectively made by a committee comprising of senior faculty members who were aware of these principles. It should be noted that while students might be admitted to NUS either through regular admissions or discretionary admissions, these should not be viewed as two alternative pathways that students could choose between. Indeed, students filled out only a single application form, and did so with the understanding that admission was based primarily on academic merit. Discretionary admission was considered only if a student fell short of the cut-off required for regular admission, but nonetheless was able to demonstrate that he or she possessed achievements or talents which were considered "exceptional."[9] Since there is no guarantee that students who fell short of the grades threshold for regular admission would be considered for discretionary admission to a particular faculty, it seems reasonable to assume that students applied to NUS with the hope of gaining admission to their course of choice through the regular admission process.

Table 1 compares the characteristics and outcomes of students admitted through DA (Column 3) to those admitted through the regular process (Column 1). On average, DA students are more likely to be male and to enter through the polytechnic route (instead of the junior

[8] Several colleges and universities which practice holistic admissions in the United States look for similar things in their applicants. For instance, Stanford University aims "to enroll a class of diverse backgrounds and experiences, talents, academic interests, and ways of viewing the world." (Stanford University, nd) while the University of Pennsylvania looks for students with qualities that enable them to be of "service to society" (University of Pennsylvania, nd). This is usually achieved by collecting and assessing information on extracurricular activities, letters of recommendation, and interviews with applicants, in addition to academic achievement.

[9] While it may be difficult to know what exactly is meant by "exceptional", examples of cases where students had successfully been admitted through the DA scheme include representing the nation (Singapore) in arts or sports, active participation in community service and volunteer programs, and holding key leadership positions in community organizations, sports and athletic clubs outside of school.

college route). As expected, the average incoming academic achievement (as measured by UAS) of DA students is much lower than that of regular admission students. In terms of university-level academic performance, DA students also perform worse (as measured by cumulative average point and the likelihood of obtaining an honors degree[10]). Interestingly however, DA students do not appear to perform worse than regular admission students in the labor market after they graduate. If anything, they appear to outperform regular admission students in terms of salary.

It is not surprising that DA students are quite different from regular admission students since, by definition, DA students are those who miss the threshold for regular admission into NUS. A more appropriate comparison would be to compare DA students with students who marginally made it to NUS via regular admission (and are therefore more similar to DA students in terms of incoming academic scores). We define these marginal students as those belonging to the bottom decile of regular admission within each application year cohort, entry route and faculty category (as measured by UAS). Columns 2 and 3 of Table 1 show that while DA students enter with slightly lower UAS relative to students marginally admitted through regular admission (specifically, they enter with a UAS that is 2.7 points (or 0.47 standard deviations) lower on average), they do catch up subsequently, so much so that their university academic performance (as measured by final cumulative average point and the probability of obtaining an honors degree) eventually converges. Strikingly, in terms of labor market outcomes, DA students outperform those in the bottom decile of regular admission. In particular, they command earnings that are roughly 3 to 5 percent higher and are more likely to be employed and be in full-time employment six months after graduation. These differences in outcomes reflect not only the effect of admission criteria (whether "holistic" or "academic-merit based" admission) but also differences in the skills (non-academic and academic) and other characteristics of students (demographic and socioeconomic background) in the two groups. In Section V, we discuss how outcomes between DA students and those in the bottom decile of regular admission differ when we adjust for observable student characteristics.

[10] In the Singapore context, graduating with an honors degree is widely perceived as being more academically successful as whether a person is able to qualify for an honors is based on academic merit and carries a certain degree of prestige. An honors degree is also widely perceived to open up more job opportunities (Davie 2014; Tan 2014).

III. Data

We are interested in how students who are admitted to NUS via DA fare relative to students who performed marginally better based on their high school grades and obtain admission through the regular admission procedure. The main analysis sample consists of enrolled students at NUS who were admitted between the years 2009 and 2013.[11] Most of the enrolled students were admitted through regular admission but a small fraction came in through DA. Table 2 reports statistics on discretionary admissions to NUS for each application year. On average across the years, 7 percent of all admissions were granted through the DA route.[12]

The data used in this study comes from three main sources. The university administrative records provide student-level information on application and admission details, a rich set of individual characteristics and background information, as well as their university academic portfolio.[13] We create a binary variable equal to 1 if a student has a UAS below the cutoff requirement for the course he/she is enrolled in and equal to 0 if the student has a UAS above the cutoff requirement. This binary variable effectively indicates whether the student entered through DA. We then merge the university records with the Graduate Employment Survey (GES). This annual survey is conducted each November, six months after the graduation period, and gathers graduates' responses pertaining to their labor force status and monthly income. Lastly, using administrative tax records, we track the annual income of graduates up to three years after graduation.

[11] Although the Discretionary Admissions programme began in 2004, we were not able to include the pre-2009 admission cohorts in our sample because data on discretionary admissions were not captured properly for these cohorts.

[12] There are small differences in the probability of attendance conditional on acceptance for students admitted through DA and for students admitted through the regular process. This is not surprising since DA applicants have lower UAS and would have a smaller set of outside options to begin with (the application process in other local universities are similar in that it is largely, if not exclusively, based on pre-university academic performance as summarized by the UAS score). Moreover, students who were extended an offer through DA would have known that they fell below the cutoff point set for that course/faculty. It is therefore more likely that they would have accepted the offer given that they know they are not as strong academically compared to their peer applicants and may therefore have perceived their chances of entering another university to be low. In contrast, applicants with UAS in the first decile might not have been aware that they were at the tail end of the regular distribution and may have been pickier (since students are not aware of the cutoff points). This may have made them less likely to accept the NUS offer. Since the probability of acceptance is lower among those from regular admission, it is likely that those who choose to come to NUS are those that really want to study at NUS (i.e. they are positively selected in terms of their perceived fit and likelihood of doing well at NUS). If anything, this would imply that our estimates of how DA students fare relative to those admitted via the regular admission route is likely to be a lower bound of the true effect among the set of potential admits.

[13] One limitation of this data source is that we do not have information on NUS applicants who had been earmarked by the faculties as potential DA candidates but who do not eventually enroll to the university. As a result, we are unable to make any comparison between them and those who are eventually granted admission through the DA route.

Table 3 provides the descriptive statistics and difference in means between the full student sample and the subsample which is observed in each labor market data source. Across all the observable characteristics and measures derived from the university records, we see that, on average, the subsample of graduates who responded in the GES and the subsample captured in the tax records are quite similar in terms of background characteristics as the full sample of graduates. While some of the differences are statistically significant, the magnitude of these differences is small (relative to the sample means), suggesting that both subsamples are broadly representative of the universe of NUS graduates.

It should be noted however, that not all NUS students are included in the full sample. We keep students who are admitted to faculties or schools that use the same modular system for their course curricula and that share the same admission procedure.[14] International students, which account for about 10 percent of the undergraduate enrollment, are excluded from the sample as they typically possess high school qualifications and social backgrounds that are not comparable with students who are residents of Singapore. Because students entering through DA came mainly from the local junior colleges and polytechnics, we further restrict the sample to students who are admitted through these two routes, which account for 83 percent of all undergraduates admitted to NUS.

IV. Empirical Strategy

Does a college's choice of admission criteria matter? In other words, will student composition change if a college selects its students based on both non-academic qualities and academic performance rather than just academic performance? And if so, how will it change?

Answering these questions is challenging because colleges do not choose their admission criteria randomly. Colleges that choose to admit students partly based on non-academic considerations are likely to differ systematically, in both observable and unobservable ways, from those who choose to admit students exclusively based on academic achievement. Further, there is likely to be non-random self-selection of students into these two types of colleges. As such, simple comparisons between graduates from colleges that admit

[14] They are Faculty of Arts and Social Sciences, NUS Business School, School of Computing, School of Design and Environment, Faculty of Engineering and Faculty of Science. We exclude students who are enrolled in the Architecture and Industrial Design courses from the School of Design and Environment as all shortlisted applicants to both courses are subjected to a compulsory interview by the school, regardless of their admission score.

partly on the basis of non-academic considerations and those from colleges that admit exclusively on the basis of academic achievement, will not yield credible causal estimates of the effect of admission criteria.

The ideal experiment would involve randomly assigning various admission regimes to colleges located in different geographic areas (assuming limited geographic mobility of students) and then comparing outcomes. Given the lack of such exogenous policy variation that would permit a direct comparison across colleges with different admission regimes, in this paper, we approximate such an experiment by focusing on a large publicly-funded university in Singapore (NUS) that utilizes a unique admission system that admits students based on two tracks – one that is based solely on academic considerations, and another that is based on a combination of academic and non-academic considerations. Importantly, students do not get to choose which track they are applying for – only students who do not make it through the regular grades-based admission process are considered for the "discretionary-based" track that admits students based on their academic and non-academic achievements. By comparing the outcomes of students close to the threshold of admission through the two different admission tracks, we can assess how differences in admission considerations influence the type of students admitted into the college.

As described in Section II, the majority of undergraduate places in NUS were allocated solely on the basis of students' incoming academic achievement. Every year, NUS would set a numerical cutoff requirement for each of its faculties prior to the university admission exercise. These cutoffs were determined based on the targeted intake and the expected demand from students. Students were unaware of these admission cutoffs when they applied to NUS. Applicants whose UAS were above the cutoff were offered admission, while applicants whose UAS were below the cutoff were denied. However, some of those who had initially been denied could nevertheless still find their way into NUS through the DA scheme. NUS set aside up to 10 percent of its undergraduate places each year for aptitude-based admissions through this scheme. In practice, students admitted through DA were often those who missed the academic cutoff requirement narrowly for regular admission. Their incoming academic achievements are therefore comparable to those who marginally made it to NUS through regular admission – that is, to those of students in the first decile of regular admission by UAS. Comparing the college and labor market outcomes of students who enter through DA and those in the first decile of regular admission therefore provides one answer to the question of whether colleges may be

picking up different types of students when selection is based partly on non-academic achievements (as opposed to exclusively based on academic achievement).

While this setup answers a somewhat narrower question than the ideal experiment, we believe that it is still informative about the effects of different admissions regimes. Using the current setup, we cannot, for example, examine how the selection of students varies if admissions were entirely based on academic-only (grades-based) considerations vs. holistic considerations. Our setup, however, does allow us to examine whether and how students admitted through an admissions track that considers holistic achievements differ from those who are admitted through an academic-only selection process within a single institution in terms of university and labor market outcomes. More specifically, our setup allows us to quantify how the types of students who would be selected would change if a college that otherwise uses incoming academic achievement as the metric to admit students puts aside some places to allow students who fall short of the academic-based admissions threshold the possibility of gaining admission to the same institution through more holistic considerations. In our setup, because students have imperfect control over which side of the grades-based admissions threshold that they end up, by comparing students close to the grades threshold that determine placement into the two different admission tracks, this essentially allows us to compare students with similar observable academic ability and background characteristics (we test for this specifically in Section V.D) who enter NUS via different admission tracks.

It should be noted that while our empirical strategy bears some semblance to a regression discontinuity design, it is conceptually different. In a regression discontinuity design, receipt of a treatment is based on whether the running variable exceeds some cut-off threshold value. The treatment effect is estimated by comparing outcomes of individuals that fall narrowly on both sides of the threshold. The underlying assumption is that apart from the treatment, individuals to the left and to the right of the threshold are similar in terms of both observable and unobservable characteristics. In our setup, however, individuals to the left as well as to the right of the admissions cut-off are both enrolled students, and indeed, our hypothesis is that they differ in terms of (un)observable characteristics. Students to the left of the admissions cut-off – that is DA students – should not have been admitted but nevertheless found their way into NUS only because they could demonstrate having certain desirable non-academic skills. Hence, they are expected on average to possess higher non-academic skills compared to students to the right of the threshold – that is, to those who were marginally admitted through the regular admissions process. Hence, comparisons of students to the left

and to the right of the threshold in our setup essentially reflects how the type of students who are selected differs under a regime where admissions is based on a more holistic set of considerations versus a regime where admissions is based exclusively on academic merit. As such, the (causal) treatment effect that we seek to estimate is precisely the extent and nature of selection on non-academic characteristics and skills induced by the admissions strategy – in particular, what it implies for educational choices/outcomes and how it is rewarded in the labor market.

To systematically analyze the relationship between discretionary admissions and students' outcomes, we compare the outcomes of DA students to regular admission students in different quantiles of the UAS distribution. Specifically, we group the regular admission students into 10 quantiles (indexed by *d*) based on their UAS (within each faculty, entry route and application year) and estimate the following regression specification:

$$Y_i = \alpha + \beta_{DA} DA_i + \sum_{d=2}^{10} \beta_q RegAdmit^d + \mathbf{X}_i'\delta + \varepsilon_i \quad (1)$$

where Y_i denotes the outcome of interest for individual i, DA_i is a dummy variable for students admitted to NUS via DA and $RegAdmit^d$ is a dummy variable for regular admission students in each quantile of the UAS distribution. The reference category is students admitted via the regular admission route who are in the first decile (lowest 10 percent) of the UAS distribution within each faculty, entry route and application year cohort. Students in the reference category are those who have admission scores just above the cutoff required for entry into a particular faculty or program, and were those who scored marginally higher than students who entered through the DA route. The baseline controls $\boldsymbol{X}_i$ includes fixed effects for faculty, admission year, application year, and entry route (local junior college or polytechnic). We control for faculty, admission/application year, and entry route to account for the possibility that admission through the DA scheme might vary along these characteristics (e.g. some faculties may admit more students through DA or more students may have been admitted via DA in some years compared to others).[15]

We examine several outcomes of interest, including university academic achievement as measured by cumulative average point (CAP), propensity to graduate with an honors degree, propensity to participate in non-academic and academic programs in college, employment

[15] All results in this paper are broadly similar when we control for major fixed effects instead of faculty fixed effects. For brevity, the results controlling for major fixed effects are not shown, but are available upon request.

status six months after graduation and real earnings. To be clear, CAP is a measure of academic performance in the university and is defined as the weighted average grade point of all modules taken by a student. A student's CAP is computed using the following formula: $CAP = \frac{sum(module\ grade\ point \times modular\ credits\ assigned\ to\ module)}{sum(modular\ credits\ assigned\ to\ all\ modules\ used\ in\ calculating\ the\ numerator)}$. The maximum CAP achievable is 5.0. In all our regressions, we cluster standard errors at the applicant pool level to account for the fact that the treatment (i.e. whether a student was admitted through DA or not) is applied to applicant pools rather than individual students. In our context, this translates to clustering standard errors at the application cohort-faculty-entry route-admission track level, leaving us with 120 clusters.

In the baseline specification, the coefficient of interest is β_{DA}, which captures how the outcome of interest differs among DA students and students in the first decile of regular admission, within the same faculty, admission/application cohort, and entry route. Because DA students and students in the first decile of regular admission exhibit similar levels of incoming academic ability, one interpretation is that β_{DA} is capturing the effects due to non-academic skills, which are expected to be higher for students that enter through DA. In additional specifications, we test, and subsequently reject, the alternative possibility that β_{DA} is driven by features of the selection process which may differentially select students on the basis of demographic characteristics, family background, or adolescent academic achievement.

In particular, we progressively expand the list of background characteristics in $\boldsymbol{X}_i$ to include demographic controls for gender, age, race, residency status (Singapore permanent resident or Singapore citizen) to test whether the observed associations are driven by differences in background characteristics between DA and non-DA students. We find little evidence that this is the case. Next, for some outcomes, we are able to further include an even richer set of controls for family background (as proxied for by parents' education and housing type) as well as adolescent academic achievement (e.g. grades achieved in primary and secondary school) to further test whether the effects that we observe is due to the DA process differentially selecting students from better backgrounds or those with stronger pre-university academic achievement. [16] To the extent that the rich set of observable background characteristics available in the data are representative of unobservable background characteristics, these robustness checks suggest that the β_{DA} is unlikely to be driven by

[16] These additional controls for family background and academic achievement in adolescence are not available in the Graduate Employment Survey (GES).

differential selection based on unobservable family background characteristics and unobserved academic ability (Altonji et al. 2005; Oster 2019). The similarity of the estimates across specifications with different sets of controls also implies that the DA process does not appear to be disproportionately selecting students along sociodemographic lines in a way that matters for the outcomes that we consider.[17]

V. Results

A. Academic Outcomes

Table 4 presents results from regressions based on Equation 1, with various academic outcomes as the dependent variable. Specifically, we examine three academic outcomes, namely the student's final CAP at the point of graduation, whether the student was awarded an honors degree, and whether the student enrolled in a minor or a second major program. For each outcome variable, we show results from 3 different specifications. The first columns (i.e. columns 1, 4, and 7) show the coefficient estimates of the β's from Equation 1 of our baseline specification, where we control only for faculty, admission/application cohort, and entry route. The β's indicate how students in the DA group and regular admit students in the second to tenth decile of the UAS distribution fare relative to regular admit students in the first decile in terms of the outcome of interest. The coefficient of interest is β_{DA}, which captures how the outcome differs between DA students and students in the first decile of regular admission. Given that DA students and students in the first decile of regular admission exhibit similar levels of incoming academic ability, one interpretation is that β_{DA} captures the effect in the outcome due to the higher non-academic skills possessed by students in the DA group. However, another possible interpretation is that β_{DA} may simply be capturing selection in the DA process where students are differentially selected on the basis of background characteristics (demographic characteristics and family background) and unobserved academic ability. If the latter interpretation is true, then students in the DA group and those in the first decile of regular admission would differ along these lines and, consequently, any difference in outcomes would

[17] To the extent that the DA selection process systematically alters the composition of the student body not only along non-academic skill lines but also along sociodemographic lines (i.e. it disproportionally selects students from say a given gender, entry route, residency status, or socioeconomic background), then the estimates from the baseline specification provide us with what we want to know – comparisons in outcomes between the types of students being picked up by the DA process and the types of students being picked up by the regular admissions process. In practice, however, we find that controlling for differences in sociodemographic characteristics does not change our estimates materially, suggesting that the treatment effect is not driven by differential selection of students on the basis of such characteristics through the DA process.

simply be reflecting such compositional background differences rather than the effect due to non-academic skills/traits. To test if the latter interpretation could be at work, for each of the outcomes analyzed, we examine two other specifications – one where we control for demographic characteristics (specifically, gender, race, age, and residency status) in addition to the baseline controls (columns 2, 5 and 8), and another where we further control for family background and academic achievement in adolescence (specifically, parents' education, housing type, and academic achievement in primary and secondary school; where academic achievement in primary and secondary school are meant as proxies for unobserved academic ability) (columns 3, 6, and 9).

Table 4 shows that, for each of the three academic outcomes analyzed, estimates of the β's remain virtually unchanged when demographic characteristics and family background and adolescent academic achievement are progressively added to the baseline specification, suggesting that estimates of β_{DA} in columns 1, 4, and 7 are not driven by differences in these characteristics between students in the DA group and those in the first decile of regular admission.

Focusing on CAP, we see that while the relationship between UAS quantile and CAP is generally positive, DA students graduate with a CAP that is similar to those in the first decile of regular admission.

A similar finding emerges when we use a binary variable indicating whether the student is awarded an honors degree as the outcome variable.[18] Here again, we find that DA students are as likely to be awarded an honors degree compared to those in the first decile of regular admission.

More interestingly, when we use a binary variable indicating whether the student enrolled in a minor or a second major program as the outcome variable, we find that DA students are 3.5 to 3.8 percentage points more likely to be enrolled in a minor or a second major program compared to regular admission students in the bottom decile of the UAS distribution.

[18] NUS awards two types of undergraduate degrees: a three-year bachelor's degree without honors and a four-year degree with honors. The "honors" degree is used as a signal to indicate that a student has read a larger volume of material than required for a three-year bachelor's program. Students must meet strict cumulative academic performance thresholds, evaluated at an advanced stage of their academic career to qualify for the honors track. Roughly 60 percent of students graduate with an honors degree. The rest graduate with a three-year bachelor's without honors.

In fact, they are significantly more likely than regular admission students belonging to the first to third deciles of the UAS distribution to be enrolled in such academic programs.[19]

Panels A, B, and C of Figure 2 present the above information visually. Specifically, Panel A plots the coefficient estimates of all the β's from Equation 1 with CAP as the outcome variable, while Panels B and C show the corresponding plots for the case where a binary variable indicating whether the student is awarded an honors degree and a binary variable indicating whether the student enrolled in a minor or a second major program is used as the outcome variable. In each panel, the β estimates, along with their 95 percent confidence intervals, are presented for each of the 3 different specifications, and they make it clear that the β estimates remain virtually unchanged even as controls for demographic characteristics and family background and adolescent academic achievement are included.

B. Participation in Optional College Activities

We next explore students' involvements in college activities outside of their regular curriculum. Specifically, we measure the extent to which DA students are more/less likely to participate in an overseas program and to enroll in a residential college program compared to regular admission students. Overseas programs typically require the participating student to spend between four weeks to one year in the host country of the participating external institution. They are largely categorized as either a student exchange program during the normal semester, a summer/winter exchange program during the term break, or an entrepreneurship-focused program. Between 2009 and 2013, 41.4 percent of students participated in at least one overseas program.[20] The residential college program on the other hand allows students who are admitted to stay in one of the few residential colleges on campus during the semester that they are enrolled in, and participate in curricular and noncurricular activities offered by the college. The overall participation rate for residential college program between 2009 and 2013 was 5.4 percent. Participation in these two activities is optional and the eligibility criteria in terms of academic grades are not stringent if any. Rather, the purpose

[19] These differences are statistically significant at the 10 percent level.

[20] NUS has tried to make overseas programs accessible to students. Students only need to pay normal NUS tuition fees during their time overseas. They are not required to pay any tuition fees at the partner university. The typical costs that would have to be borne by a student include airfare, visa fees, food, accommodation, daily transport, books, and insurance (if required by the country). The cost of living varies by country and city. However, NUS does provide numerous financial support schemes (bursaries, awards, scholarships, and loans) to students, especially those from lower income families, to help alleviate the financial burden of participating in these programs.

of these programs is to offer a holistic student experience.[21] Table 5 presents the results of this analysis. Columns 1 to 3 show the estimates of the β's when a binary variable indicating whether the student participated in an overseas program is used as the outcome variable while columns 4 to 6 show the estimates when a binary variable indicating whether the student participated in a residential college program is used. The way the columns are organized in Table 5 is the same as Table 4. We find that, for both outcomes, estimates of β_{DA} are positive, significant, and very similar in magnitude across the 3 specifications. They suggest that DA students are 6.0 to 7.0 percentage points more likely to participate in an overseas program, and 3.1 to 3.3 percentage points more likely to enroll in a residential college program relative to students in the first decile of regular admission.

As with enrollment in a minor or a second major program, the fact that estimates of β_{DA} are positive, significant, and similar in magnitude across the 3 specifications for both overseas program participation and residential college program participation suggests that the greater tendency for DA students to participate in these activities is not driven by demographic, family background, or unobserved academic ability differences between DA students and those in the first decile of regular admission.

For visual clarity, we also plot the coefficient estimates of the β's presented in Table 5 in Panels D and E of Figure 2.

Overall, the above findings suggest that selecting students on the basis of non-academic traits does not necessarily come at the expense of academic performance. Students admitted through the DA scheme attain similar, if not higher, levels of academic performance in college as those in the first decile of regular admission. At the same time, DA students participate more intensively in optional college activities such as residential college life and outbound programs relative to the majority of regular admission students. It therefore appears that DA students are able to balance both the academic demands of college while maintaining high levels of participation in extracurricular activities.

Because students who enter through the DA scheme would not have been admitted to NUS through the regular route due to their somewhat lower incoming academic achievement,

[21] The cost of the residential college program varies by residence and whether it is air-conditioned, but typically ranges between 80 SGD per week to 160 SGD per week. NUS has tried to make the residential college experience as accessible as possible by offering a suite of financial assistance schemes (bursaries and scholarships) to students wishing to participate in a residential college program. Eligibility for bursaries is based on the family income of applicants. The bursaries and scholarships are typically able to fund a considerable part of the cost of these programs.

our results also contribute to the literature on academic fit, specifically the literature on academic "overmatch" (where students who are academically less-able attend relatively high-quality colleges) (see, for instance, Arcidiacono et al. 2012, 2016; Dillon and Smith 2020). Our results suggest that it is possible for academically less-able students in high-quality colleges to perform as well as their peers in college if they possess high non-academic skills.

Next, we examine the relationship between students' admission route and labor market outcomes.

C. Labor Market Outcomes

We examine five labor market outcomes, extracted from two data sources. The first source of labor market data is the Graduate Employment Survey (GES), which is conducted six months after students have graduated. This data source provides information on each graduate's monthly earnings, whether the graduate has found a job, and whether the graduate has secured a full-time permanent job, six months after graduation. The second source of labor market data come from administrative tax records. The tax records provide each graduate's annual earnings up to three years after graduation. Specifically, we are able to observe each graduate's annual earnings two and three years after they have graduated. One drawback with using the labor market outcomes provided by the GES is that we are not able to further include the rich set of family background characteristics (parents' education and housing type) and adolescent academic achievement (academic achievement in primary and secondary school) as controls in our regressions because information on these characteristics is unavailable in the GES data. Fortunately, these characteristics are available and we can control for them when labor market outcomes provided by the administrative tax records are used.

Tables 6 and 7 show the results from this analysis. Specifically, Table 6 shows the regression results when the three labor market measures extracted from the GES are used as the outcome variable while Table 7 shows the regression results when the two labor market measures extracted from the administrative tax records are used. Because, as noted, information on parents' education, housing type and academic achievement in primary and secondary school are not available when using the GES data, Table 6 presents only two columns of results for each outcome. The first (columns 1, 3, and 5) contain estimates of the β's from the baseline specification, which control only for faculty, admission/application cohort, and entry route, while the second (columns 2, 4, and 6) contain the corresponding estimates after demographic

controls are included. Table 7, on the other hand, shows for each outcome, the familiar three columns of results.

When using the GES data, we limit our sample to graduates whose response indicates that they are in the labor force six months after graduation. This is to avoid including those who intend to pursue higher studies or are not actively looking for a job. Column 1 of Table 6 indicates that DA students are 3.9 percentage points more likely to secure a full-time permanent job six months after graduation compared to those in the first decile of regular admission. When we control for demographic characteristics, this estimate hardly changes, suggesting that the higher likelihood of securing full-time permanent employment for DA students is not due to differences in the demographic composition of DA students and those in the first decile of regular admission. When we examine differences in the probability of being employed (regardless of type of employment), however (columns 3 and 4 of Table 6), there does not appear to be evidence (at the 10 percent level) that DA students are more likely to be employed six months after graduation compared to those in the first decile of regular admission, though estimates of β_{DA} are notably noisy here.

Turning to earnings outcomes, column 5 of Table 6 indicates that gross monthly earnings of DA students six months after graduation are 4.5 percent higher than those in the first decile of regular admission. These higher earnings are significant at the 1 percent level, and they remain substantively unchanged even after adjusting for demographic differences between the groups (column 6 of Table 6). The results pertaining to log annual incomes two and three years after graduation using administrative tax data yield similar findings.[22] In particular, the estimates in Table 7 indicate that the earnings advantage enjoyed by DA students over those in the first decile of regular admission remain at roughly 4.5 percent and 5.3 percent respectively in the second and third year after graduation (columns 1 and 4 of Table 7). Strikingly, for all three earnings measures, DA students enjoy earnings that are significantly higher (at the 10 percent level) than regular students belonging to the first to sixth deciles of the UAS distribution. These earnings advantages do not disappear even after we control for demographic characteristics, family background, and academic achievement in adolescence, suggesting that the higher earnings enjoyed by DA students is not driven by these

[22] Annual income in the tax records is defined as the total income earned from employment for the year. This includes but is not limited to gross salary, overtime pay, bonuses, income from all sources of work, as well as other benefits such as gain from employee stock options. It excludes income that is not directly derived from employment such as rental of property and income from investment such as dividends and interest.

characteristics.[23] We interpret these labor market effects as suggesting that the higher non-academic skills/traits possess by students in the DA group, resulting from the nature of DA selection process, is highly rewarded in the labor market.

We plot the coefficient estimates of the β's presented in Table 6 in Panels A, B, and C of Figure 3, and those presented in Table 7 in Panels D and E. The fact that, for each outcome, estimates of β_{DA} remain virtually unchanged when we control for demographic, family background, and academic grades achieved in primary and secondary school, is perhaps unsurprising given the information we already know from Table 1. In particular, Table 1 told us that DA students and students marginally admitted through regular admission were comparable in terms of parents' education, housing type, and academic grades achieved in primary and secondary school. This is true as well when we compare histograms of the distribution of housing types and parents' education categories for DA students and for students in the first decile (see Figure 4).[24] Taken together, the results suggest that differences in background characteristics and unobserved academic ability are not driving the observed relationship between admission through DA and the various outcomes we have examined. Of course, we cannot fully rule out the possibility that differences in outcomes could have arisen

[23] Because the labor market outcomes we examine are measured soon after students have completed university, one could be concerned about sample selection issues related to students who enroll in graduate school. To see if such selection issues could be problematic, we examine enrollment in graduate school as an outcome. Specifically, in the GES, administered to students 6 months after they graduate, students are asked whether they are enrolled or will soon be enrolling in graduate school. Appendix Table A1 and Appendix Figure A1 show the regression results when a binary variable for whether students are enrolled/will soon be enrolling in graduate school is used as the outcome variable. As can be seen, at the 5% significance level, DA students are as likely as those in the first to eighth deciles of regular admission to be enrolled in a graduate program. Hence, the difference in labor market outcomes between DA students and students in the first decile is not driven by a difference in their propensity to enter graduate school.

[24] Figure 4 Panel A shows histograms of the distribution of housing types for DA students and for students in the first decile superimposed on the same picture while Figure 4 Panel B shows histograms of the distribution of parents' education categories for DA students and for students in the first decile superimposed on the same picture. The distributions pertaining to DA students are shown in pink while the distributions pertaining to students in the first decile of regular admission are shown in green. The area in which the two distributions overlap is shown in brown. As can be seen, the distributions pertaining to DA students and students in the first decile are similar. To complement this visual check, we also formally test whether the distributions are the same by performing a Kolmogorov-Smirnov test. We test the hypothesis that housing for the DA group contains larger values than for students in the first decile and the hypothesis that parents' education for the DA group contains larger values than for students in the first decile (since it is reasonable to expect that students with exceptional non-academic achievement would come from richer families on average). The p-value of this test is 0.766 and 0.649 respectively. Since both p-values exceed 0.1, there is no evidence at the 10% level that housing or parental education values are larger for DA students than for students in the first decile of regular admission. We also test the hypothesis that housing for the DA group contains smaller values than for students in the first decile and the hypothesis that parents' education for the DA group contains smaller values than for students in the first decile. The p-value of this test is 0.706 and 0.986 respectively. Again, since both p-values exceed 0.1, there is no evidence at the 10% level that housing or parental education values are smaller for DA students than for students in the first decile of regular admission. Overall, there is no evidence at the 10% level of a difference in the distribution of housing type or parental education for these two groups of students.

partly due to behavioral changes on the part of DA students. It is conceivable that being branded a "discretionary admit" may have spurred DA students to increase their effort levels relative to students who were marginally admitted through the regular route. If this is true, then differences in outcomes between DA students and students marginally admitted through the regular route would not just be reflecting how the DA process differentially selects students based on unobservable non-academic skills but also such behavioral responses. That being said, we believe that behavioral responses are unlikely to be a primary driver of the observed differences. First, the track through which an applicant enters NUS is not observable to anyone else except the student, limiting to some extent the need to have to "prove one's worth." Nevertheless, such desire could be internal to the student; however, we find that DA students, in fact, do as well academically in university as marginal students admitted through the regular route, suggesting that they are not simply making up for inferior academic performance with increased extra-curricular involvement. Finally, it is hard to imagine that such "branding effects" (that are not observable to others) would be so strong as to lead to the large and persistent differences in labor market outcomes seen between DA students and marginally admitted students for up to 7 years after admission into NUS. Because any behavioral responses are likely to be more short term in nature, we believe the observed differences are more likely to be reflecting actual differences in the types of students being picked up by the DA process.[25]

VI. Conclusion

Colleges vary widely in their admission policies and criteria. Some colleges admit students based solely on academic performance while others consider both academic and non-academic achievements. Yet, little is known about the policy-relevant question "do college admissions criteria matter?" Would colleges be picking up different sorts of students if admissions were based on a more holistic set of considerations rather than exclusively based on academic achievement? Given that globally, many universities admit students based exclusively on academic achievement, what might they be missing out on?

[25] Because one of our primary interests is to examine how outcomes differ between DA students and students in the first decile of regular admission. we additionally reproduce Tables 4, 5, 6, and 7, limiting the sample to only DA students and students in the first decile of regular admission. The results from these specifications are presented in Appendix Tables A2, A3, A4, and A5 respectively, and they show that regardless of the outcome considered, estimates of β_{DA} are remarkably similar whether we use the full student sample or limit the sample to only DA students and students in the first decile of regular admission.

Ordinarily, attempts to answer these questions are thwarted by selection bias since colleges' choice of admission criteria are non-random. Colleges which choose to admit students based solely on academic performance are likely to differ in many ways, both observable and unobservable, from those which choose to admit students based on both academic and non-academic considerations. Hence, simple comparisons of student outcomes between the two types of colleges will not yield reliable estimates of the effect of admissions criteria on student composition.

In this paper, we attempt to answer this question by exploiting a unique feature of the admissions system of NUS, a large public university in Singapore. In the past, admissions to NUS was based exclusively on academic performance. The university imposes a quantitative cutoff requirement in academic performance which is unknown to students at the point of application. Students whose incoming achievement scores exceed this cutoff are offered admission automatically while those whose incoming achievement scores fall below are denied. At the same time, some of those who are denied can nonetheless find their way into NUS if they are able to demonstrate that they possess certain non-academic traits and talents. Applicants who wish to be considered for such discretionary admissions must provide details of their "outstanding achievements" at the point of application and must provide a set of documents to support these claims. In practice, students admitted to NUS through such discretionary admissions are often those who missed the academic threshold requirement narrowly for regular admission. Comparing the outcomes of students who were admitted through discretionary admissions to the outcomes of those who were narrowly admitted through regular admission provides one answer as to whether the types of students entering through a regime which selects based on both academic and non-academic achievements are different from those entering through a regime which selects based exclusively on academic ability within a single institution.

We examine several outcomes of interest, including university academic performance, propensity to graduate with an honors degree, propensity to enroll in a minor or a second major program, propensity to participate in optional non-academic college activities, probability of being employed 6 months after graduation, and real earnings 6 months, 2 years, and 3 years after graduation.

DA students enter NUS with slightly lower academic achievements than those marginally admitted through regular admission. Yet, despite the fact that UAS strongly predicts university academic performance and subsequent labor market performance, we find that DA

students do not actually fare worse eventually. Rather, they fare just as well in terms of university academic performance and are more likely to participate in optional academic and non-academic college activities. More interestingly, we find that DA students outperform those marginally admitted in terms of labor market earnings; half a year after graduation, the average earnings of DA students exceed that of regular admission students in the bottom decile of the UAS distribution by about 4 percent. This earnings advantage persists even two to three years after graduation. Strikingly, DA students enjoy earnings that are significantly higher (at the 10 percent level) than regular students belonging to the first to sixth deciles of regular admission.

Overall, these results suggest that college and school admission policies which focus on a holistic evaluation of students' abilities could potentially allow institutions to better identify and select individuals who would be most successful in the labor market and contribute to the diversity of student experiences in college. It also suggests that such admission policies can reward individuals who are weaker in academic performance but who possess high non-academic skills and talents, and who may well have been denied entry into their college of choice if academic achievement had been the only yardstick for admission. Our results suggest that, given the opportunity to pursue these opportunities, these individuals may "make the most out of it", attaining labor market outcomes eventually comparable to the most academically-able graduates.

It is important to be clear about what our research informs. Using our research design, we would not be able to tell how student composition would change if admissions had been 100 percent holistic versus if it had been 100 percent based on incoming academic achievement. However, it would tell us how student composition would change if a college which has an existing policy of admitting students based exclusively on academic achievement were to expand the number of places available to allow students who would otherwise not have gotten in through the regular admissions process (based only on incoming academic achievement) a chance to be considered based on a more holistic set of factors. Given that there may be a sizeable number of colleges with an interest to adopt such "discretionary admissions processes", we believe that the results from our study would be useful for education policymakers.

There are several potential extensions to our work. One is to identify *why* DA students are more successful in the labor market. This would reveal something about which non-academic traits or skills are rewarded most in the labor market. Another would be to consider how the results would change if holistic admissions were scaled up. Indeed, in our data, only a

small share of students (less than 10 percent) came through the DA process. But what if the university had decided to admit a larger share through the DA scheme – say 50 percent? Would differences between DA students and regular admission students be different if that were the case? Colleges seeking to implement holistic admissions should ideally have a good understanding of this policy-relevant question. We leave these important questions for future research.

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Figure 1: Flow Chart of the Application Process

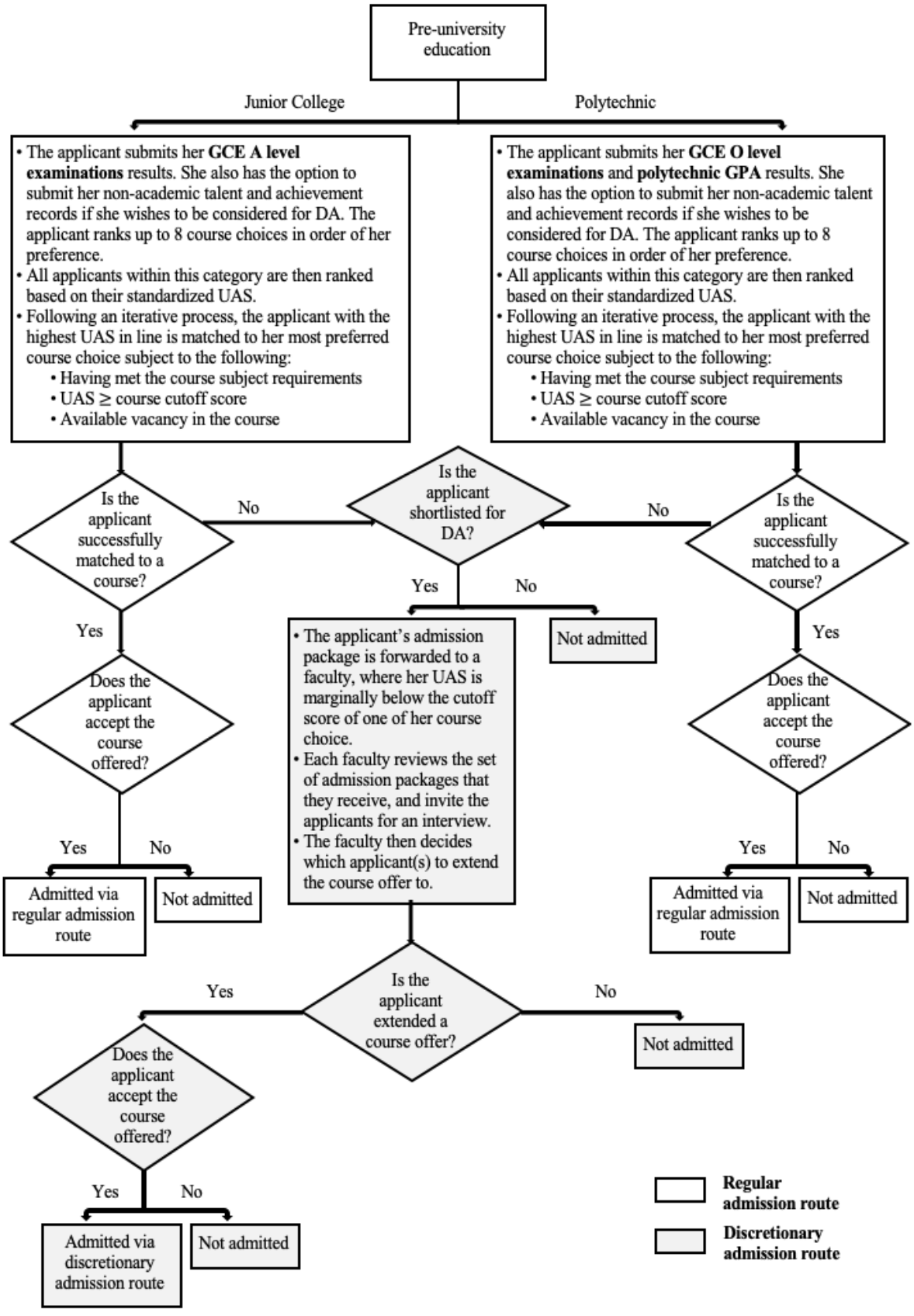
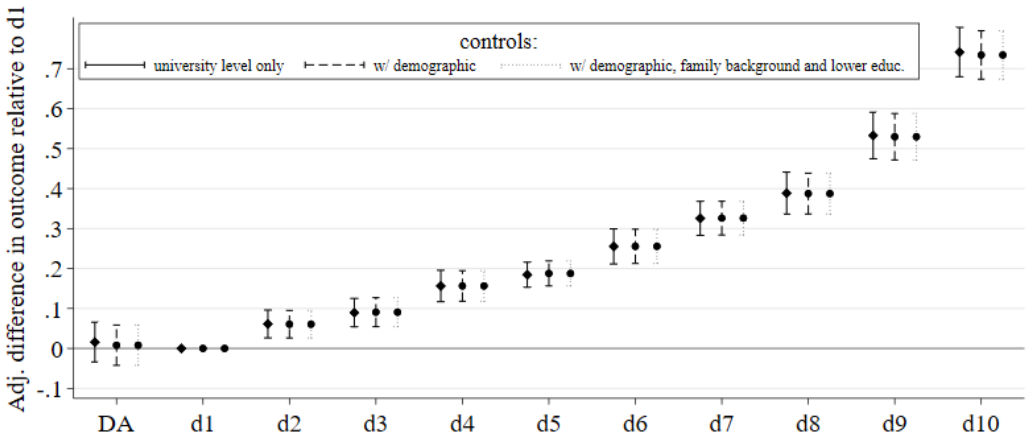
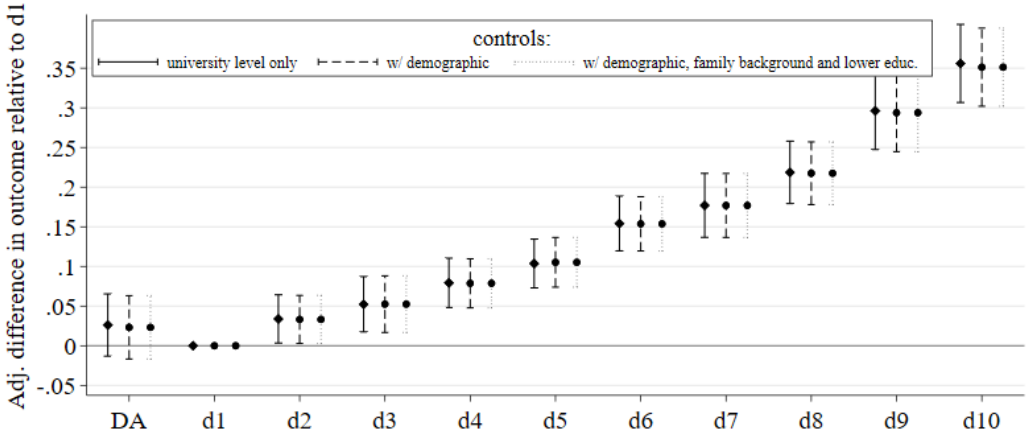


Figure 2: Academic Performance and Optional Non-Academic College Involvement of Discretionary Admission Students Relative to Regular Admission Students

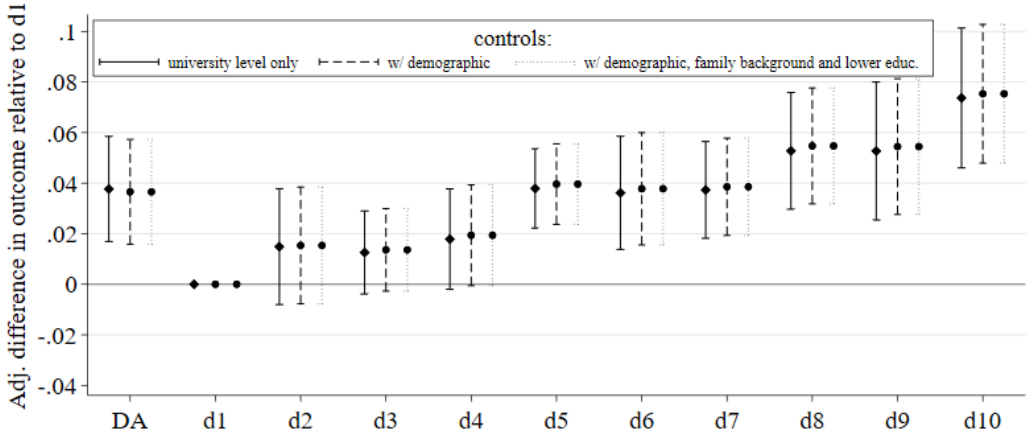
Panel A: Final Cumulative Average Point (CAP)



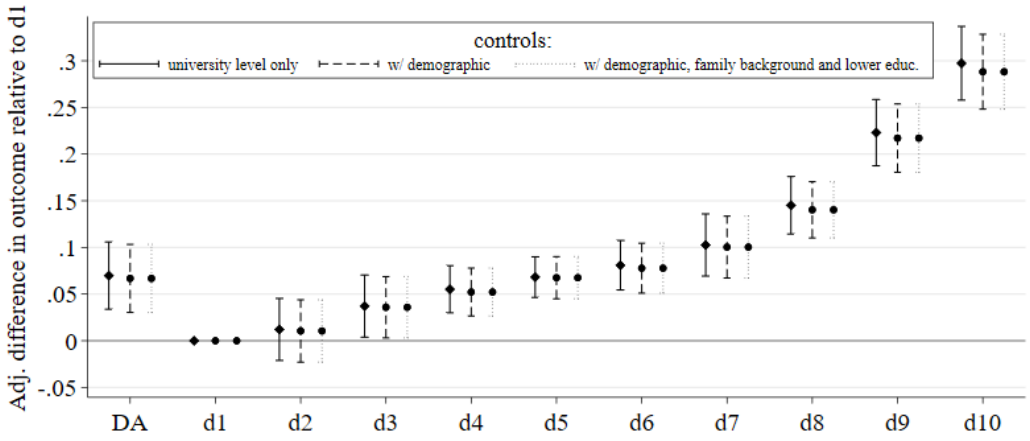
Panel B: Awarded an Honors Degree (1=yes)



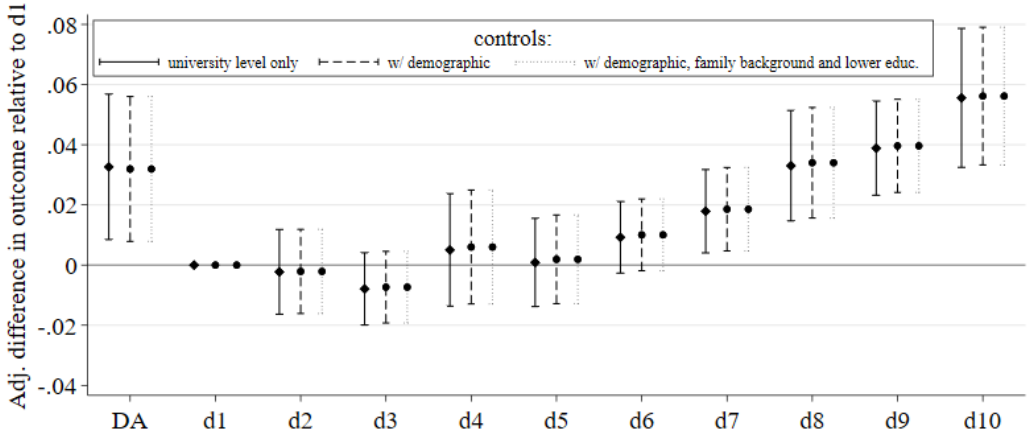
Panel C: Enrolled in a Minor or a Second Major Program (1=yes)



Panel D: Has Done any Outbound Program (1=yes)



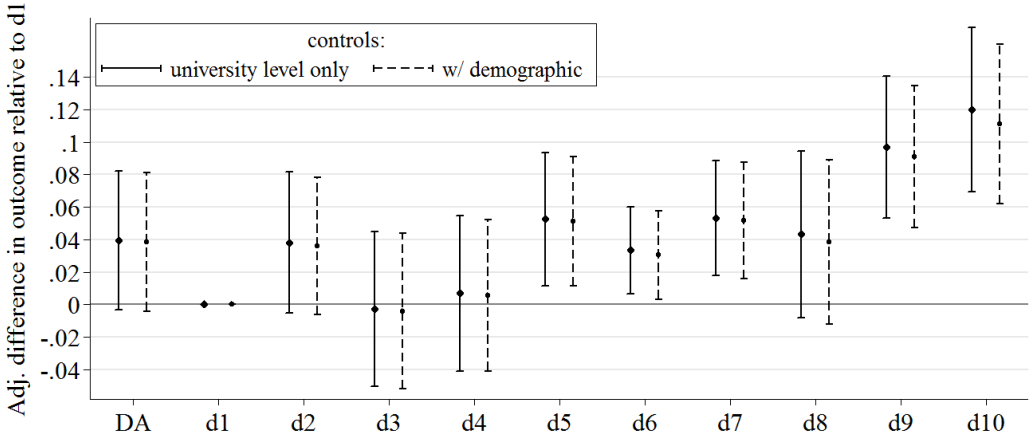
Panel E: Enrolled in a Residential College Program (1=yes)



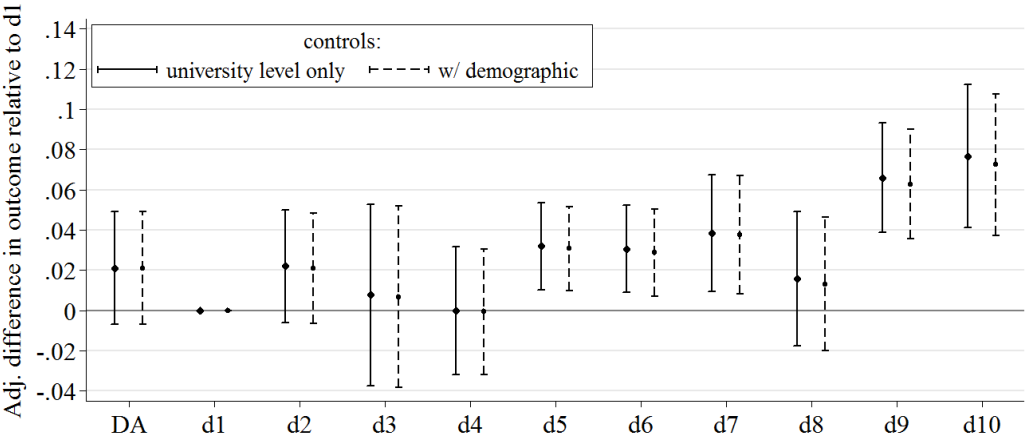
Notes: These figures present the coefficient estimates of the OLS regressions that are reported in Tables 4 and 5. Panels A, B, and C correspond to Table 4 while Panels D and E correspond to Table 5. For each outcome, coefficient estimates from 3 different regression specifications are presented: (1) baseline specification, which controls for admission/application cohort, faculty, and entry route (labelled "university level only"), (2) baseline plus demographic controls, and (3) baseline plus demographic controls, and controls for family background and academic achievement in primary and secondary school. The vertical capped lines show the 95 percent confidence intervals based on standard errors which are clustered at the application cohort-faculty-entry route-admission track level.

Figure 3: Labor Market Outcomes of Discretionary Admission Students Relative to Regular Admission Students

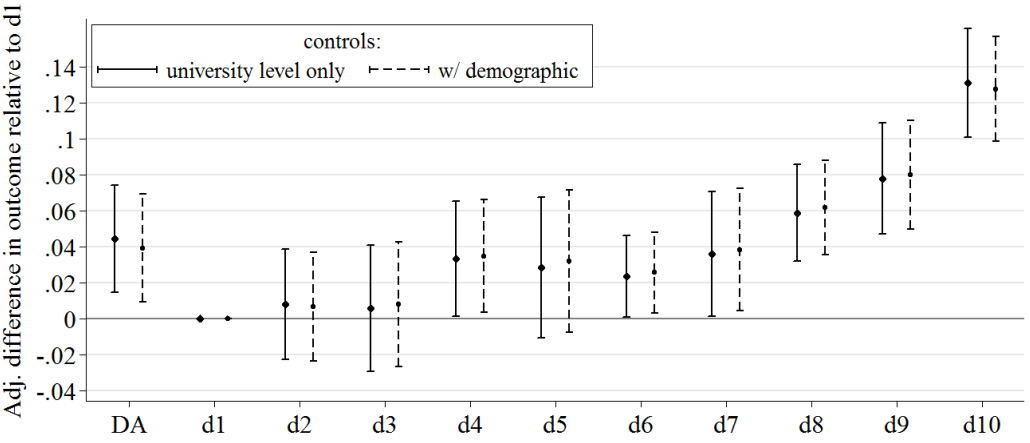
Panel A: Has Full-Time Permanent Job within 6 Months from Graduation (1=yes)



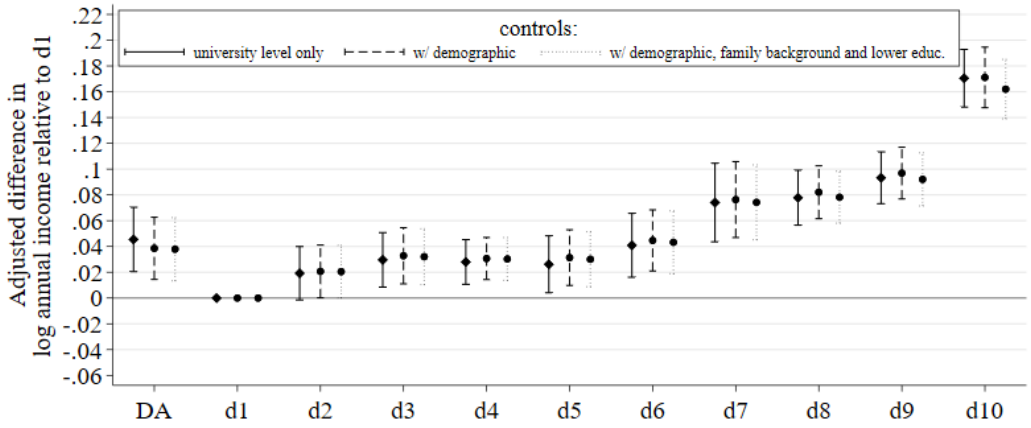
Panel B: Has Job within 6 Months from Graduation (1=yes)



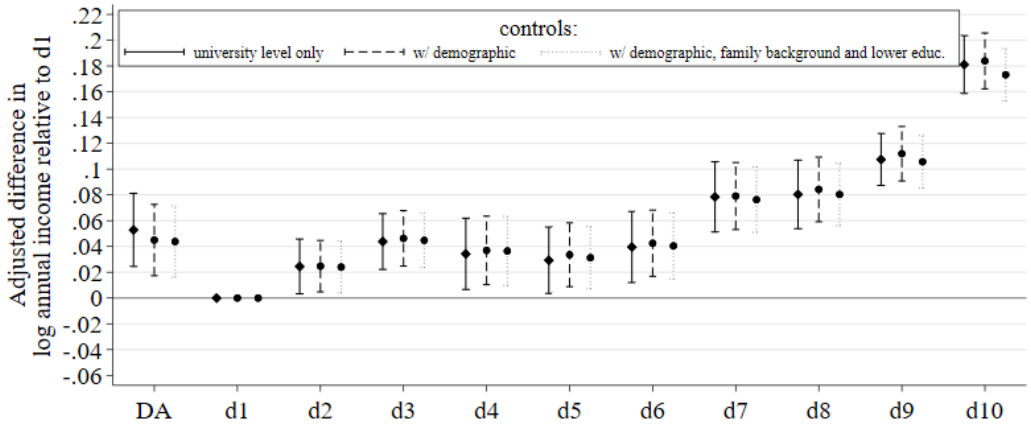
Panel C: Log Gross Monthly Salary 6 Months After Graduation



Panel D: Log Annual Income 2 Years after Graduation



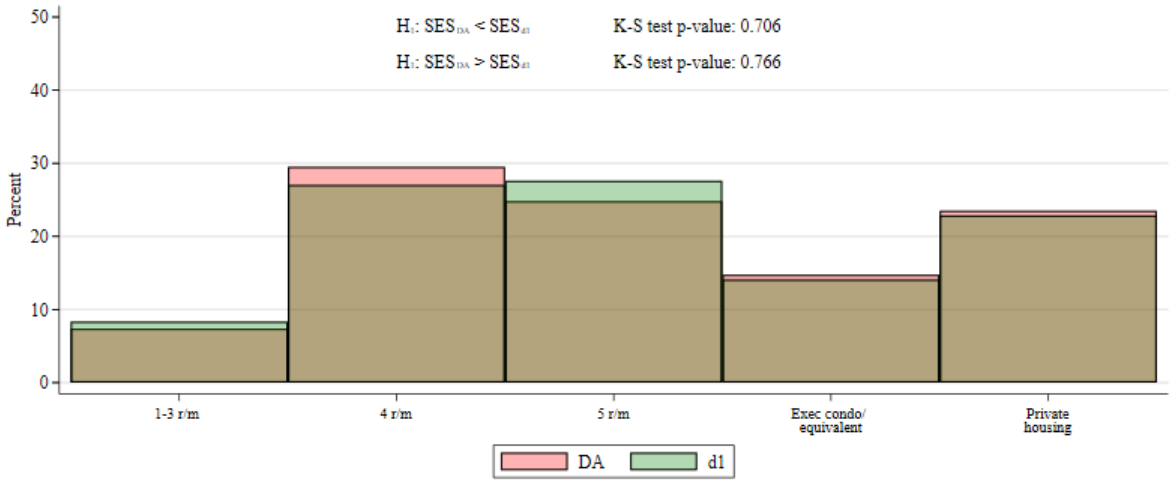
Panel E: Log Annual Income 3 Years after Graduation



Notes: These figures present the coefficient estimates of the OLS regressions that are reported in Tables 6 and 7. Panels A, B, and C correspond to Table 6 while Panels D and E correspond to Table 7. For Panels A, B, and C, coefficient estimates from 2 different regression specifications are presented: (1) baseline specification, which controls for admission/application cohort, faculty, and entry route (labelled "university level only") and (2) baseline plus demographic controls. For Panels D and E, coefficient estimates from one additional regression specification are presented: (3) baseline plus demographic controls, and controls for family background and academic achievement in primary and secondary school. The vertical capped lines show the 95 percent confidence intervals based on standard errors which are clustered at the application cohort-faculty-entry route-admission track level.

Figure 4: Distribution of Housing Type / Parents' Education for DA Students and for Students in First Decile of Regular Admission

Panel A: Distribution of Housing Type



Panel B: Distribution of Parents' Education

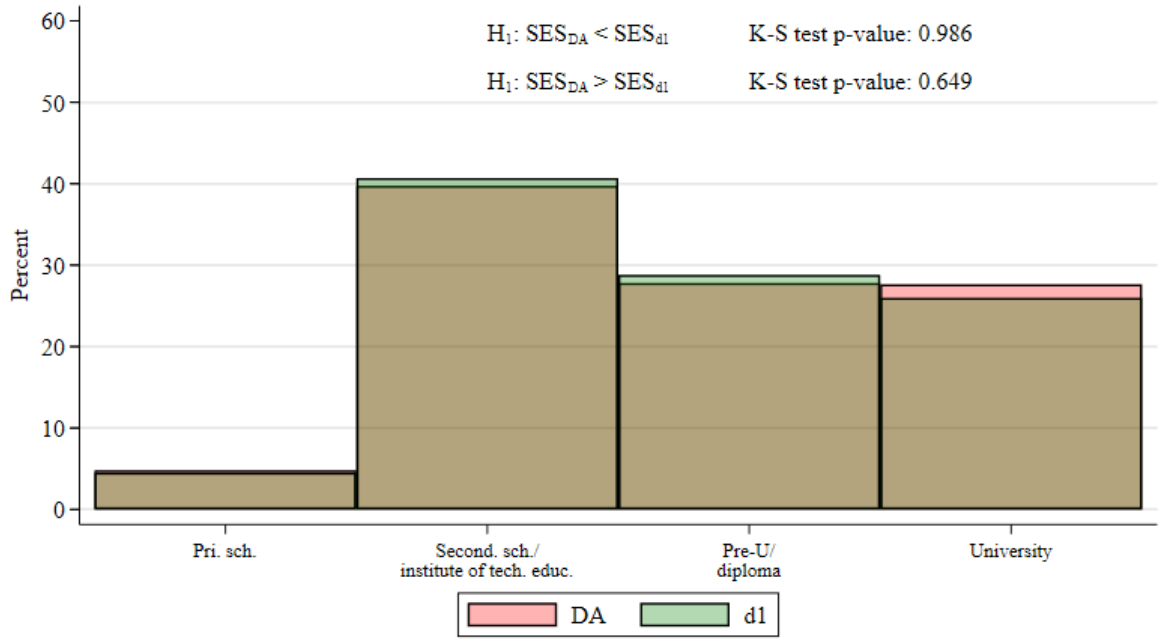


Table 1: Descriptive Statistics for the Discretionary Admission Sample and the Regular Admission Sample

	Regular admission sample N = 16,111 (1)	Bottom decile of regular admission sample N = 2,157 (2)	Discretionary admission sample N = 1,278 (3)	p-value of difference in means test (3) - (1) (4)	p-value of difference in means test (3) - (2) (5)
Female	0.680	0.659	0.599	0.000	0.000
Age admitted to university (years)	19.932	19.994	20.325	0.000	0.000
	(1.172)	(1.184)	(1.399)		
Residency status:					
Singapore citizen	0.937	0.932	0.903	0.000	0.002
Permanent resident	0.063	0.068	0.097	0.000	0.002
Housing type:					
1- to 3-room flat (public housing)	0.081	0.084	0.074	0.381	0.317
4-room flat (public housing)	0.277	0.271	0.295	0.169	0.125
5-room flat (public housing)	0.269	0.276	0.248	0.108	0.077
Executive condominium or equivalent	0.140	0.141	0.148	0.461	0.597
Private housing	0.233	0.229	0.235	0.856	0.670
Parents' highest education:					
Primary school	0.041	0.045	0.048	0.214	0.692
Secondary school or institute of technical education	0.379	0.407	0.397	0.192	0.586
Pre-university or diploma	0.283	0.288	0.278	0.729	0.533
University	0.298	0.260	0.276	0.112	0.293
Standardized primary school leaving examination score	0.029	-0.184	-0.370	0.000	0.000
	(0.986)	(0.924)	(1.100)		
Secondary school leaving examination score (GCE O level):					
L1R5	11.260	12.223	13.782	0.000	0.000
	(3.939)	(3.739)	(4.861)		
L1B4	8.713	9.438	10.559	0.000	0.000
	(2.946)	(2.820)	(3.543)		
Application year	2,010.814	2,010.854	2,010.621	0.000	0.000
	(1.363)	(1.322)	(1.300)		
Entry route:					
Junior college	0.876	0.892	0.787	0.000	0.000
Polytechnic	0.124	0.108	0.213	0.000	0.000
University admission score	4.789	0.442	-2.252	0.000	0.000
	(3.961)	(0.422)	(3.060)		
Final cumulative average point	3.801	3.560	3.547	0.000	0.485
	(0.518)	(0.510)	(0.507)		
Graduated with an honors degree	0.749	0.623	0.638	0.000	0.377
Years of study in college	3.832	3.748	3.756	0.000	0.671
	(0.494)	(0.515)	(0.535)		

Table 1 (cont.): Descriptive Statistics for the Discretionary Admission Sample and the Regular Admission Sample

	Regular admission sample N = 16,111	Bottom decile of regular admission sample N = 2,157	Discretionary admission sample N = 1,278	p-value of difference in means test	
				(3) - (1)	(3) - (2)
	(1)	(2)	(3)	(4)	(5)
Response rate in Graduate Employment Survey	0.781	0.774	0.785	0.721	0.451
Conditional on having responded:					
Overall employment rate	0.898	0.872	0.906	0.403	0.010
Conditional on being employed:					
Gross monthly salary (in 2014$)	3,185.942	3,086.411	3,248.505	0.044	0.000
	(847.789)	(878.204)	(902.967)		
Full-time permanent employment rate	0.791	0.752	0.828	0.007	0.000
Conditional on being full-time permanently employed:					
Gross monthly salary (in 2014$)	3,345.387	3,271.533	3,369.602	0.387	0.007
	(723.032)	(724.760)	(816.561)		

Notes: Standard deviations of continuous variables are shown in parentheses. The bottom decile of the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. Housing type and parents' highest education are retrospective data from when the students were taking the primary school leaving examination. L1R5 and L1B4 are the aggregate scores of six and five subjects respectively, where L1R5 takes the grades of one language and five most relevant subjects into account, while L1B4 takes the grades of one language and four relevant subjects into account. L1R5 is used to admit students to junior college, while L1B4 is used for polytechnic admission. A lower L1R5 or L1B4 score indicates better performance. The university admission score is centered around the cutoff score of the course that the student enrolled in. Students with university admission score below the cutoff score had to enroll into the course via discretionary admission. The overall employment rate is defined as the number of students who reported having a job as a proportion of all graduates whose response indicates that they are in the labor force. Full-time permanent employment is defined in the survey as employment of at least 35 hours a week and where the employment is not temporary, casual, interim or seasonal in nature. To handle wage outliers (most likely due to reporting errors), we trim the top and bottom 0.5 percentile of the gross monthly salary distribution in the Graduate Employment Survey data.

Table 2: Discretionary Admission to NUS by Year

	Application year				
	2009	2010	2011	2012	2013
Number of acceptance through DA	300	374	254	211	139
Total number of acceptances	3,851	4,011	3,889	3,050	2,588
% of acceptance through DA	7.79%	9.32%	6.53%	6.92%	5.37%

Notes: The sample is restricted to undergraduates who are admitted from a local junior college or polytechnic, and are enrolled to either the Faculty of Arts and Social Sciences, NUS Business School, School of Computing, Faculty of Engineering, Faculty of Science or School of Design and Environment (excluding Architecture and Industrial Design courses). International students are excluded from the sample. The relatively lower number of acceptances in 2012 and 2013 is due to the sample cutoff taken at admission year 2013. In particular, male Singapore citizens are required to serve a national service obligation of about 2 years. Male Singapore citizens therefore apply to NUS in year *X* (competing for placement against the pool of applicants in that same year) but only begin their university candidature in year *X+1* or *X+2*, after completion of their national service. Because national servicemen who applied in the year 2012 or 2013 for instance, but who are only admitted after 2013 are not captured in the sample, the number of applications pertaining to the years 2012 and 2013 in this table appear lower than they actually are. In reality, the number of applications is roughly the same across the years 2009 to 2013.

Table 3: Descriptive Statistics for the Full Sample, Sample with Graduate Employment Survey Data, and the Sample with Administrative Tax Records

	Full sample N = 17,389	GES sample with employment data N = 13,578	Sample with administrative tax records N = 16,372	p-value of difference in means test	
				(2) - (1)	(3) - (1)
	(1)	(2)	(3)	(4)	(5)
Enrolled through discretionary admission	0.073	0.074	0.074	0.900	0.768
Female	0.675	0.661	0.677	0.015	0.693
Age admitted to university (years)	19.874	19.977	19.869	0.227	0.759
	(1.506)	(1.191)	(1.507)		
Residency status:					
Singapore citizen	0.935	0.938	0.936	0.287	0.738
Permanent resident	0.065	0.062	0.064	0.287	0.738
Housing type:					
1- to 3-room flat (public housing)	0.080		0.081		0.796
4-room flat (public housing)	0.278		0.281		0.560
5-room flat (public housing)	0.268		0.269		0.863
Executive condominium or equivalent	0.141		0.140		0.920
Private housing	0.233		0.229		0.375
Parents' highest education:					
Primary school	0.041		0.042		0.644
Secondary school or institute of technical education	0.380		0.385		0.342
Pre-university or diploma	0.282		0.282		0.949
University	0.296		0.290		0.248
Standardized primary school leaving examination score	0.000		-0.006		0.568
	(1.000)		(1.001)		
Secondary school leaving examination score (GCE O level):					
L1R5	11.453		11.469		0.741
	(4.073)		(4.082)		
L1B4	8.854		8.870		0.657
	(3.035)		(3.044)		
Application year	2,010.799	2,010.836	2,010.798	0.020	0.925
	(1.359)	(1.361)	(1.359)		
Entry route:					
Junior college	0.870	0.870	0.868	0.952	0.673
Polytechnic	0.130	0.130	0.132	0.952	0.673
University admission score	4.271	4.314	4.235	0.392	0.435
	(4.313)	(4.329)	(4.293)		
Final cumulative average point	3.782	3.789	3.783	0.262	0.836
	(0.521)	(0.521)	(0.517)		
Graduated with an honors degree	0.741	0.747	0.746	0.194	0.262
Years of study in college	3.827	3.831	3.826	0.486	0.943
	(0.497)	(0.493)	(0.493)		

Table 3 (cont.): Descriptive Statistics for the Full Sample, Sample with Graduate Employment Survey Data, and the Sample with Administrative Tax Records

	Full sample N = 17,389	GES sample with employment data N = 13,578	Sample with administrative tax records N = 16,372	p-value of difference in means test	
				(2) - (1)	(3) - (1)
	(1)	(2)	(3)	(4)	(5)
Responded to Graduate Employment Survey	0.781	1.000			
Conditional on having responded:					
Overall employment rate		0.899			
Conditional on being employed:					
Gross monthly salary (in 2014$)		3,190.699			
		(852.227)			
Full-time permanent employment rate		0.793			
Conditional on being full-time permanently employed:					
Gross monthly salary (in 2014$)		3,347.283			
		(730.765)			
Annual income:					
2 years after graduation (in 2014$) N = 14,865			55,949.506		
			(21,837.333)		
3 years after graduation (in 2014$) N = 11,700			61,988.436		
			(25,021.337)		

Notes: Standard deviations of continuous variables are shown in parentheses. The sample with administrative tax records consists of students with employment income data that is captured in at least one of the three years after they have graduated. Housing type and parents' highest education are retrospective data from when the students were taking the primary school leaving examination. L1R5 and L1B4 are the aggregate scores of six and five subjects respectively, where L1R5 takes the grades of one language and five most relevant subjects into account, while L1B4 takes the grades of one language and four relevant subjects into account. L1R5 is used to admit students to junior college, while L1B4 is used for polytechnic admission. A lower L1R5 or L1B4 score indicates better performance. The university admission score is centered around the cutoff score of the course that the student enrolled in. The overall employment rate is defined as the number of students who reported having a job as a proportion of all graduates whose response indicates that they are in the labor force. Full-time permanent employment is defined in the survey as employment of at least 35 hours a week and where the employment is not temporary, casual, interim or seasonal in nature. To handle wage outliers (most likely due to reporting errors), we trim the top and bottom 0.5 percentile of the gross monthly salary distribution in the Graduate Employment Survey data. Similarly, we trim the top and bottom 5 percentile of the overall annual income distribution from the tax data.

Table 4: Academic Performance of Discretionary Admission Students Relative to Regular Admission Students (10 Quantiles) [Base Group = Bottom Quantile]

Outcomes:	Final cumulative average point			Awarded an honors degree (1 = yes)			Enrolled in a minor or a second major program (1 = yes)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Discretionary admission	0.016	0.008	0.005	0.026	0.023	0.020	0.038***	0.037***	0.035***
	[0.025]	[0.025]	[0.025]	[0.020]	[0.020]	[0.020]	[0.010]	[0.010]	[0.010]
Regular admission, d2	0.061***	0.061***	0.059***	0.034**	0.033**	0.032**	0.015	0.015	0.016
	[0.018]	[0.017]	[0.017]	[0.015]	[0.015]	[0.015]	[0.012]	[0.012]	[0.012]
Regular admission, d3	0.090***	0.091***	0.087***	0.052***	0.052***	0.050***	0.013	0.014	0.013
	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.008]	[0.008]	[0.008]
Regular admission, d4	0.156***	0.156***	0.153***	0.079***	0.079***	0.077***	0.018*	0.019*	0.019*
	[0.020]	[0.019]	[0.019]	[0.016]	[0.016]	[0.015]	[0.010]	[0.010]	[0.010]
Regular admission, d5	0.184***	0.188***	0.182***	0.104***	0.105***	0.102***	0.038***	0.040***	0.038***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.008]	[0.008]	[0.008]
Regular admission, d6	0.255***	0.256***	0.251***	0.154***	0.154***	0.151***	0.036***	0.038***	0.037***
	[0.022]	[0.022]	[0.022]	[0.017]	[0.017]	[0.017]	[0.011]	[0.011]	[0.011]
Regular admission, d7	0.326***	0.326***	0.319***	0.177***	0.177***	0.172***	0.037***	0.039***	0.036***
	[0.021]	[0.021]	[0.021]	[0.020]	[0.020]	[0.020]	[0.010]	[0.010]	[0.010]
Regular admission, d8	0.389***	0.387***	0.376***	0.219***	0.217***	0.210***	0.053***	0.055***	0.051***
	[0.026]	[0.026]	[0.026]	[0.020]	[0.020]	[0.019]	[0.012]	[0.012]	[0.012]
Regular admission, d9	0.533***	0.530***	0.515***	0.296***	0.294***	0.285***	0.053***	0.054***	0.050***
	[0.029]	[0.029]	[0.029]	[0.025]	[0.025]	[0.024]	[0.014]	[0.014]	[0.014]
Regular admission, d10	0.742***	0.734***	0.706***	0.356***	0.351***	0.335***	0.074***	0.075***	0.067***
	[0.031]	[0.031]	[0.031]	[0.025]	[0.025]	[0.024]	[0.014]	[0.014]	[0.014]
Controls:									
University level characteristics:									
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Demographic characteristics:									
Gender, race, age, residency status	no	yes	yes	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:									

Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes	no	no	yes
Observations	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389	17,389
R-squared	0.261	0.273	0.278	0.195	0.200	0.202	0.077	0.077	0.079

Notes: The 10 quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Table 5: Non-Academic Involvement of Discretionary Admission Students Relative to Regular Admission Students (10 Quantiles) [Base Group = Bottom Quantile]

Outcomes:	Has done any outbound program (1 = yes)			Enrolled in a residential college program (1 = yes)		
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.070***	0.067***	0.060***	0.033***	0.032***	0.031**
	[0.018]	[0.018]	[0.018]	[0.012]	[0.012]	[0.012]
Regular admission, d2	0.012	0.010	0.011	-0.002	-0.002	-0.002
	[0.017]	[0.017]	[0.017]	[0.007]	[0.007]	[0.007]
Regular admission, d3	0.037**	0.036**	0.036**	-0.008	-0.007	-0.007
	[0.017]	[0.017]	[0.016]	[0.006]	[0.006]	[0.006]
Regular admission, d4	0.055***	0.052***	0.052***	0.005	0.006	0.005
	[0.013]	[0.013]	[0.013]	[0.009]	[0.010]	[0.009]
Regular admission, d5	0.068***	0.068***	0.064***	0.001	0.002	0.001
	[0.011]	[0.011]	[0.012]	[0.007]	[0.007]	[0.007]
Regular admission, d6	0.081***	0.078***	0.074***	0.009	0.010*	0.009
	[0.013]	[0.013]	[0.013]	[0.006]	[0.006]	[0.006]
Regular admission, d7	0.103***	0.100***	0.092***	0.018**	0.019***	0.016**
	[0.017]	[0.017]	[0.016]	[0.007]	[0.007]	[0.007]
Regular admission, d8	0.145***	0.140***	0.126***	0.033***	0.034***	0.030***
	[0.016]	[0.015]	[0.015]	[0.009]	[0.009]	[0.009]
Regular admission, d9	0.223***	0.217***	0.203***	0.039***	0.040***	0.035***
	[0.018]	[0.018]	[0.018]	[0.008]	[0.008]	[0.007]
Regular admission, d10	0.297***	0.288***	0.260***	0.056***	0.056***	0.048***
	[0.020]	[0.020]	[0.019]	[0.012]	[0.012]	[0.011]
Controls:						
University level characteristics:						
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:						

Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes
Observations	17,389	17,389	17,389	17,389	17,389	17,389
R-squared	0.129	0.135	0.147	0.045	0.046	0.053

Notes: The 10 quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Table 6: Immediate Labor Market Outcomes of Discretionary Admission Students Relative to Regular Admission Students (10 Quantiles)
[Base Group = Bottom Quantile]

Outcomes:	Has full-time permanent job (1 = yes)		Has job (1 = yes)		Log gross monthly salary	
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.039*	0.038*	0.021	0.021	0.045***	0.039**
	[0.021]	[0.021]	[0.014]	[0.014]	[0.015]	[0.015]
Regular admission, d2	0.038*	0.036*	0.022	0.021	0.008	0.007
	[0.022]	[0.021]	[0.014]	[0.014]	[0.015]	[0.015]
Regular admission, d3	-0.003	-0.004	0.008	0.007	0.006	0.008
	[0.024]	[0.024]	[0.023]	[0.023]	[0.018]	[0.017]
Regular admission, d4	0.007	0.006	-0.000	-0.001	0.034**	0.035**
	[0.024]	[0.024]	[0.016]	[0.016]	[0.016]	[0.016]
Regular admission, d5	0.053**	0.051**	0.032***	0.031***	0.029	0.032
	[0.021]	[0.020]	[0.011]	[0.011]	[0.020]	[0.020]
Regular admission, d6	0.033**	0.030**	0.031***	0.029***	0.024**	0.026**
	[0.014]	[0.014]	[0.011]	[0.011]	[0.011]	[0.011]
Regular admission, d7	0.053***	0.052***	0.038***	0.038**	0.036**	0.038**
	[0.018]	[0.018]	[0.015]	[0.015]	[0.017]	[0.017]
Regular admission, d8	0.043*	0.038	0.016	0.013	0.059***	0.062***
	[0.026]	[0.026]	[0.017]	[0.017]	[0.014]	[0.013]
Regular admission, d9	0.097***	0.091***	0.066***	0.063***	0.078***	0.080***
	[0.022]	[0.022]	[0.014]	[0.014]	[0.016]	[0.015]
Regular admission, d10	0.120***	0.111***	0.077***	0.073***	0.131***	0.128***
	[0.026]	[0.025]	[0.018]	[0.018]	[0.015]	[0.015]
Controls:						
University level characteristics:						
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	no	yes	no	yes
Family background and educational achievement at earlier ages:						

Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	no	no	no	no
Observations	12,497	12,497	12,497	12,497	10,680	10,680
R-squared	0.082	0.092	0.046	0.050	0.125	0.137

Notes: The 10 quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Table 7: Longer-Run Labor Market Outcomes (up to 3 Years after Graduation) of Discretionary Admission Students Relative to Regular Admission Students (10 Quantiles) [Base Group = Bottom Quantile]

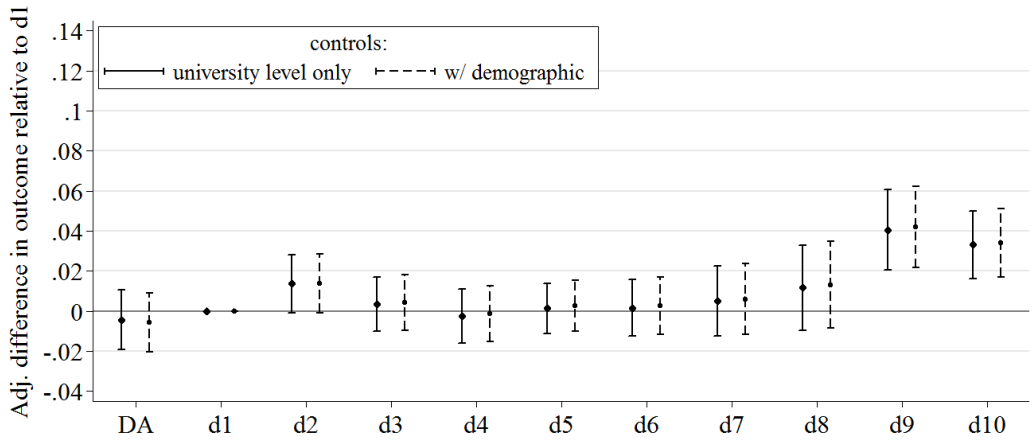
Outcomes:	Log annual income 2 years after graduation			Log annual income 3 years after graduation		
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.045***	0.039***	0.038***	0.053***	0.045***	0.044***
	[0.013]	[0.012]	[0.012]	[0.014]	[0.014]	[0.014]
Regular admission, d2	0.019*	0.021**	0.020**	0.025**	0.025**	0.024**
	[0.010]	[0.010]	[0.010]	[0.011]	[0.010]	[0.010]
Regular admission, d3	0.030***	0.033***	0.032***	0.044***	0.046***	0.045***
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Regular admission, d4	0.028***	0.031***	0.030***	0.034**	0.037***	0.036***
	[0.009]	[0.008]	[0.008]	[0.014]	[0.013]	[0.013]
Regular admission, d5	0.026**	0.031***	0.030***	0.029**	0.034***	0.031**
	[0.011]	[0.011]	[0.011]	[0.013]	[0.012]	[0.012]
Regular admission, d6	0.041***	0.045***	0.043***	0.040***	0.043***	0.040***
	[0.013]	[0.012]	[0.012]	[0.014]	[0.013]	[0.013]
Regular admission, d7	0.074***	0.076***	0.074***	0.078***	0.079***	0.076***
	[0.015]	[0.015]	[0.015]	[0.014]	[0.013]	[0.013]
Regular admission, d8	0.078***	0.082***	0.078***	0.080***	0.084***	0.080***
	[0.011]	[0.010]	[0.010]	[0.013]	[0.013]	[0.012]
Regular admission, d9	0.093***	0.097***	0.092***	0.107***	0.112***	0.106***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.011]	[0.010]
Regular admission, d10	0.170***	0.171***	0.162***	0.181***	0.184***	0.173***
	[0.011]	[0.012]	[0.012]	[0.011]	[0.011]	[0.010]
Controls:						
University level characteristics:						
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:						

Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes
Observations	14,865	14,865	14,865	11,700	11,700	11,700
R-squared	0.116	0.132	0.134	0.120	0.136	0.139

Notes: The 10 quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Appendix Figure A1: Enrollment in Graduate School - Discretionary Admission Students Relative to Regular Admission Students

Enrolled or Soon to Enroll in Graduate School (1=yes)



Appendix Table A1: Enrolled or Soon to Enroll in Graduate School 6 Months after Graduation – Discretionary Admission Students Relative to Regular Admission Students (10 Quantiles) [Base Group = Bottom Quantile]

Outcomes:	Enrolled/Soon to enroll in graduate school (1 = yes)	
	(1)	(2)
Discretionary admission	-0.004	-0.006
	[0.007]	[0.007]
Regular admission, d2	0.014*	0.014*
	[0.007]	[0.007]
Regular admission, d3	0.003	0.004
	[0.007]	[0.007]
Regular admission, d4	-0.003	-0.001
	[0.007]	[0.007]
Regular admission, d5	0.001	0.003
	[0.006]	[0.006]
Regular admission, d6	0.002	0.003
	[0.007]	[0.007]
Regular admission, d7	0.005	0.006
	[0.009]	[0.009]
Regular admission, d8	0.012	0.013
	[0.011]	[0.011]
Regular admission, d9	0.041***	0.042***
	[0.010]	[0.010]
Regular admission, d10	0.033***	0.034***
	[0.009]	[0.009]
Controls:		
University level characteristics:		
Cutoff score category fixed-effects	yes	yes
Application year, admission year, entry route, faculty fixed-effects	yes	yes
Demographic characteristics:		
Gender, race, age, residency status	no	yes
Family background and educational achievement at earlier ages:		
Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no
Observations	13,578	13,578
R-squared	0.042	0.043

Notes: The 10 quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered

at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Appendix Table A2: Academic Performance of Discretionary Admission Students Relative to Regular Admission Students in the Bottom Quantile [Base Group = Bottom Quantile]

Outcomes:	Final cumulative average point			Awarded an honors degree (1 = yes)			Enrolled in a minor or a second major program (1 = yes)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Discretionary admission	-0.010	-0.022	-0.026	0.018	0.010	0.006	0.036***	0.035***	0.034***
	[0.017]	[0.017]	[0.017]	[0.014]	[0.015]	[0.015]	[0.011]	[0.011]	[0.011]
Controls:									
University level characteristics:									
Cutoff score category fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Demographic characteristics:									
Gender, race, age, residency status	no	yes	yes	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:									
Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes	no	no	yes
Observations	3,435	3,435	3,435	3,435	3,435	3,435	3,435	3,435	3,435
R-squared	0.196	0.213	0.223	0.228	0.238	0.246	0.105	0.108	0.112

Notes: The quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Appendix Table A3: Non-Academic Involvement of Discretionary Admission Students Relative to Regular Admission Students in the Bottom Quantile [Base Group = Bottom Quantile]

Outcomes:	Has done any outbound program (1 = yes)			Enrolled in a residential college program (1 = yes)		
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.063***	0.058***	0.053***	0.038**	0.036**	0.035**
	[0.019]	[0.020]	[0.020]	[0.015]	[0.015]	[0.014]
Controls:						
University level characteristics:						
Cutoff score category fixed-effects	yes	yes	yes	yes	yes	yes
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:						
Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes
Observations	3,435	3,435	3,435	3,435	3,435	3,435
R-squared	0.168	0.178	0.186	0.079	0.081	0.090

Notes: The quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Appendix Table A4: Immediate Labor Market Outcomes of Discretionary Admission Students Relative to Regular Admission Students in the Bottom Quantile [Base Group = Bottom Quantile]

Outcomes:	Has full-time permanent job (1 = yes)		Has job (1 = yes)		Log gross monthly salary	
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.039**	0.040**	0.019*	0.019*	0.041***	0.034**
	[0.017]	[0.017]	[0.010]	[0.010]	[0.014]	[0.014]
Controls:						
University level characteristics:						
Cutoff score category fixed-effects	yes	yes	yes	yes	yes	yes
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	no	yes	no	yes
Family background and educational achievement at earlier ages:						
Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	no	no	no	no
Observations	2,488	2,488	2,488	2,488	2,090	2,090
R-squared	0.166	0.174	0.119	0.121	0.198	0.217

Notes: The quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Appendix Table A5: Longer-Run Labor Market Outcomes (up to 3 Years after Graduation) of Discretionary Admission Students Relative to Regular Admission Students in the Bottom Quantile [Base Group = Bottom Quantile]

Outcomes:	Log annual income 2 years after graduation			Log annual income 3 years after graduation		
	(1)	(2)	(3)	(4)	(5)	(6)
Discretionary admission	0.047***	0.037***	0.037***	0.066***	0.057***	0.056***
	[0.013]	[0.012]	[0.012]	[0.013]	[0.013]	[0.013]
Controls:						
University level characteristics:						
Cutoff score category fixed-effects	yes	yes	yes	yes	yes	yes
Application year, admission year, entry route, faculty fixed-effects	yes	yes	yes	yes	yes	yes
Demographic characteristics:						
Gender, race, age, residency status	no	yes	yes	no	yes	yes
Family background and educational achievement at earlier ages:						
Housing type, parents' highest education, standardized primary school leaving examination score, L1R5	no	no	yes	no	no	yes
Observations	2,944	2,944	2,944	2,397	2,397	2,397
R-squared	0.147	0.175	0.179	0.167	0.192	0.197

Notes: The quantiles for the regular admission students are derived based on the university admission score distribution within each application year cohort, entry route and faculty category. The reference point for age is age at the year of admission. Standard errors are in square brackets and are clustered at the application year cohort-faculty-entry route-admission track level. L1R5 is the standardized score of the secondary school leaving examination. Housing type and parents' highest education are collected when the students were taking the primary school leaving examination. * p<0.10, ** p<0.05, *** p<0.01.

Appendix 1

As discussed in Section II, students are admitted to NUS primarily based on academic performance. For students entering through the junior college route, admission is based on their performance on the GCE A level exams; and for students entering through the polytechnic route, admission is based primarily on their polytechnic grade point average (with a small weight based on their performance on the GCE O level exams). For ease of comparison, NUS converts each applicant's pre-university achievement to a numerical score known as the university admission score (UAS). A higher UAS indicates higher academic performance prior to admission. The UAS are standardized within entry route and admission cohort. Here, we detail how the UAS are computed for (a) students that enter through the junior college route and (b) students that enter through the polytechnic route. We confine the discussion of UAS computation to only these two groups of students since our sample considers only students entering through these two routes. These two routes represent the most conventional routes to university admission in Singapore. The overwhelming majority of undergraduates (roughly 83 percent each year) enter NUS through one of these two routes.

UAS for Applicants Entering through the Junior College Route

For applicants that enter through the junior college route, UAS are computed in the following way:

$$(2) \qquad max\left\{\begin{array}{c}\left[\sum_{i=1}^{3} H2\_CB_{RP,i} + H1\_CB_{RP} + H1\_PW_{RP} + H1\_GP_{RP}\right], \\ \left[\left(\sum_{i=1}^{3} H2\_CB_{RP,i} + H1\_CB_{RP} + H1\_PW_{RP} + H1\_GP_{RP} + H1\_MTL_{RP}\right)\Big/ 100 \times 90\right]\end{array}\right\}$$

where Higher 2 level content-based subjects (*H2_CB*), Higher 1 level content-based subjects (*H1_CB*), Project Work (*H1_PW*), General Paper (*H1_GP*) and Mother Tongue Language (*H1_MTL*) are subject combinations of a student who sits for the GCE A Level examination. *RP* is the rank point obtained for the subject. The maximum total rank points for admissions to university that a student can achieve is 90. Each subject's rank point is derived based on the conversion table shown in Table A6. Note that the above formula is applicable for students who take the three *H2_CB* and one *H1_CB* subject combination, which applies to the majority (at least 60 percent) of students entering through junior college. There are a few other variations

of subject combinations (such as taking four *H2_CB* subjects). However, for the sake of brevity we do not show the UAS calculation for these less common combinations. Nevertheless, the total rank points achievable for all types of subject combination is scaled to 90.

Subjects in the A level curriculum can be categorized along two dimensions: their intensity (from Higher 1 to Higher 3) and their subject area. A H2 level subject contains twice the breadth of its H1 level counterpart but they both have similar depth. At the H3 level, students learn H2 level contents at a more in-depth level.

There are two broad subject areas. General Paper and Project Work are classified as knowledge skills-based subjects and are predominantly taken at H1 level. These subjects seek to develop students' thinking process and communication skills. The other subject area - content-based subjects - can be further divided into disciplines. Mother Tongue Language is classified under the languages discipline. The 3 *H2_CB* and 1 *H1_CB* components on the other hand have to be fulfilled by selecting subjects from the humanities and arts discipline or the mathematics and science discipline.

Table A6: Concordance Between Letter Grade and Rank Points for Each Subject

Grade received	Rank point for H2 equivalent subjects	Rank point for H1 equivalent subjects
A	20	10
B	17.5	8.75
C	15	7.5
D	12.5	6.25
E	10	5
S	5	2.5
U	0	0

UAS for Applicants Entering through the Polytechnic Route

For applicants that enter through the polytechnic route, the UAS is based on a composite of their polytechnic grade point average (80 percent weightage) and GCE O level performance (20 percent weightage). These two metrics are on their own standardized scores, given that applicants may come from different polytechnic courses and have taken different O level subjects. The former is a grading scale of 0-4, while the latter is an aggregate of the grades achieved for the English Language subject, two relevant subjects and two other best subjects from the O level results.