Cap-and-Apply: Unintended Consequences of College Application Policy in South Korea*

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Abstract

This paper investigates the effects of a policy that restricts students to a maximum of six college applications. While the policy was designed to alleviate the financial burden arising from applications, this paper focuses on the unintended consequences of the policy: how it affects student–college match quality and socioeconomic equity in access to prestigious colleges. In the game theoretical model, uncertainty about true ability leads high-achieving students to apply to a safer college after the cap. When incorporating socioeconomic differences, the results show that the cap mitigates disparities in application decisions across socioeconomic status. To test the predictions, I compile a new college-level administrative dataset and exploit the event-study framework. The results support the theoretical prediction in that match quality declines after the cap, while more students from lower socioeconomic backgrounds enroll in top colleges. Results highlight efficiency-equity trade-offs in student–college assignment, offering policy implications for higher education markets facing excessive competition.

JEL Codes: C78, D83, I24, I28

Keywords: Application Cap, Match Quality, Inequality

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1 Introduction

An important but understudied question in the economics of education is how application limits influence the allocation of students across colleges. It includes effects on match quality, which reflects the alignment between student performance and college prestige, and on socioeconomic equity in access to prestigious colleges. Although the efficiency outcomes of application limits, such as the assignment of high-performing students to prestigious colleges, have been widely studied, evidence on their equity remains limited.[1] In this paper, I examine how the application limits shape match quality and socioeconomic equity, given the uncertainty of students' true ability and heterogeneity in socioeconomic status (SES).

To study the effects of application caps on equity and efficiency, I exploit Korea's 2013 reform that restricts students to six college applications. Korea ranks at the top in the share of private expenditure across all levels of education. Private spending represents 73.9% of total expenditure on tertiary education institutions, far exceeding the OECD average of 30.0%. For primary, secondary, and post-secondary non-tertiary education, the corresponding shares are 23.8% and 8.8%. Moreover, 65% of young adults hold a college degree, substantially higher than the OECD average of 38%, reflecting the intense competition for college admission (OECD, 2012). In such an environment, students are highly sensitive to the stakes of entering prestigious colleges. Socioeconomic equity matters because constraints by SES affect application decisions and opportunities for upward mobility. Affluent students can afford broad portfolios spanning reach, match, and safety schools, while those with fewer resources face stricter limits on choices (Hoxby & Avery, 2013).

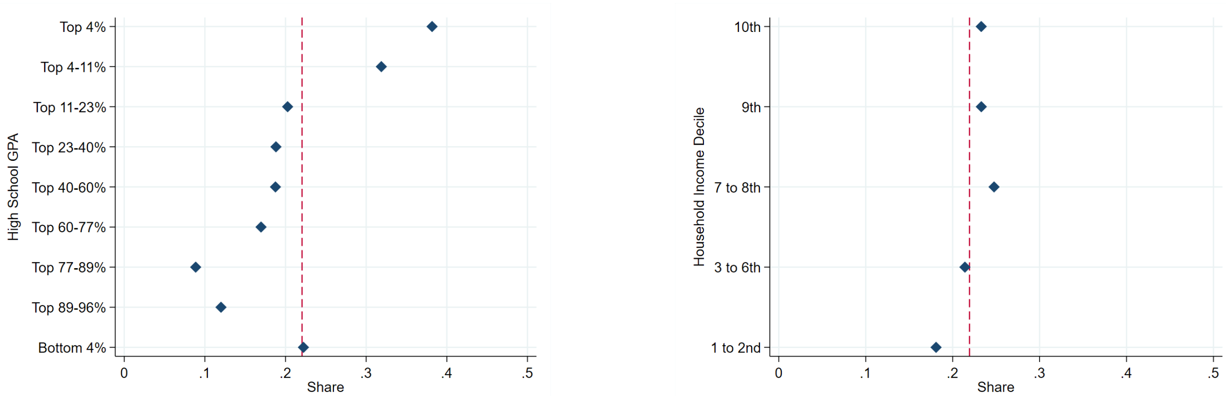
Figure 1 presents the share of students who submitted six or more early applications by high school GPA group and household income decile. The dashed line represents the mean calculated after excluding non-responses: 22.05% for panel (a) and 21.94% for panel

[1] For efficiency, see Calsamiglia et al., 2010; Che and Koh, 2016; Dillon and Smith, 2020; Haeringer and Klijn, 2009. For equity, see Dynarski et al., 2021; Hoxby and Turner, 2015, who show that providing information and financial aid to disadvantaged students increases their applications to and enrollment in selective colleges.

(b). Although household income is positively related to submitting more applications, the relationship is modest. Beyond the number of applications, application consulting and preparation for college-specific exams are significantly more expensive than the application fees. The average early-application fee is about $60 per application,[2] the consulting typically costs around $138 per session (Ministry of Education and Statistics Korea, 2018),[3] and preparation for college-specific exams exceeds $259 per month.[4] Consultants use private networks and up-to-date applicant-pool information to forecast admission chances, enabling high-SES students to turn the same number of applications into higher admission probabilities at prestigious colleges. In addition to monetary barriers, psychological costs may deter low-SES students from the application process. This is because the potential cost of reexamination makes them more risk-averse in their initial applications (Falk et al., 2021).

Figure 1: **Share of 6+ applications by High School GPA and Household Income**

(a) **Share of 6+ apps by High School GPA** (b) **Share of 6+ apps by HH Income Decile**



Notes: The Korean Educational Longitudinal Survey (KELS) 2005 follows a cohort of students who were first-year middle school students in 2005, and the author computes the shares based on the 2011 academic year when these students applied to colleges.

[2]Korea Consumer Agency, College Application Fee Survey (December 2007), available at: https://www.kca.go.kr/smartconsumer/sub.do?menukey=7301&mode=view&no=1000755357

[3]In 2018, when career and academic counseling services were first included in private education expenses, high school students spent an average of 138 USD at the 2018 average exchange rate (1,100 KRW = 1 USD).

[4]Based on the earliest available statistics from 2019, third-year high school students who participate essay tutoring spent an average of 259 USD (average exchange rate in 2019, 1,165 KRW = 1 USD). Available at: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1PE211_3&conn_path=I2

Building on these motivations, I extend an existing model of student-college matching (Chen & Kao, 2023) to examine how application constraints shape the match quality and socioeconomic equity. I then derive testable predictions and find empirical support. The results indicate a reduction in match quality, as fewer high-performing students enroll in more prestigious colleges following the cap's implementation. Simultaneously, socioeconomic equity improves, with an increased number of students from lower SES enrolling in more prestigious institutions post-cap.

This paper offers four main contributions to the literature on college admissions under application constraints. First, this paper contributes to the matching literature by incorporating socioeconomic heterogeneity into models of college admissions with application constraints. While Chen and Kao (2023) develops a model to explain how conflicting exam dates between two colleges can serve as implicit application caps, their setting assumes no application costs and allows all students to apply to any college regardless of socioeconomic background. As such, their framework cannot account for pre-existing disparities in application decisions across income groups. This modification captures the reality that high SES students were more likely to submit a greater number of applications due to their abundant resources. By incorporating socioeconomic heterogeneity into the matching framework, the model explains equity outcomes that prior theories could not capture.

Second, this study is the first to compile college-level annual disclosures from the Korean Council for University Education (KCUE) into a unified longitudinal dataset. The resulting panel integrates institution-, student-, and faculty-level information for all colleges in Korea, allowing comprehensive tracking of policy effects across the higher education sector.

Third, it reveals unintended consequences on match quality and socioeconomic equity beyond the policy's original objective, which have not been widely studied. The findings suggest that a policy designed to reduce excessive application decisions also reshaped student–college matching and equity outcomes.

Lastly, while the empirical analysis focuses on the Korean higher education market, the results offer broader policy implications for higher education markets that suffer from inefficiencies caused by excessive competition in the face of transaction costs. For example, as Blair and Smetters (2021) highlights, prestige competition among elite colleges leads to a socially inefficient equilibrium with artificially low enrollment and large welfare losses in the U.S. Similarly, Krishna et al. (2018) notes that intense competition for college admission induces many students to retake centralized entrance exams, imposing substantial private and social costs.[5]

The observed policy outcomes raise a theoretical question: how do application constraints alter the equilibrium matching of students and colleges? To address this, I extend the matching model of Chen and Kao (2023) by incorporating application constraints. It allows me to capture how the application cap affects socioeconomic disparities in access to prestigious colleges. In the framework of matching theory, capping the number of applications can distort the alignment between student ability[6] and college quality (Calsamiglia et al., 2010; Chade et al., 2014; Haeringer & Klijn, 2009). With the cap and uncertainty about admission chances, even high-performing students adopt "safety school" strategies, and it weakens assortative matching. This mechanism is consistent with evidence that student ability and risk aversion are positively associated (Falk et al., 2021). For socioeconomic equity, disadvantaged students tend to remain conservative in their choices (Hoxby & Avery, 2013; Pallais, 2015). By capping the number of applications, the policy curtails the extent to which affluent students can leverage their financial advantages, effectively narrowing the opportunity gap. In fact, after the cap, students from lower socioeconomic backgrounds became more likely to enroll in top-tier colleges. This shift toward equity is consistent with the view that these students were previously under-applying relative to their abilities (Hoxby & Avery, 2013; Pallais, 2015).

I consider a model of strategic application. There are two colleges[7] of differing prestige

[5] The percentage of students who retake the exam for 2008 CSAT is 21.7% and continuously increasing 31.7% in 2024, Korea Institute for Curriculum and Evaluation (KICE)

[6] In this paper, a student's ability is defined as readiness for college, rather than innate ability (Fu, 2014)

[7] I generally use the term "college," except when referring to specific institutions by name, in which case

and two types of students (high-performing and normal). I assume there is a scarcity of high-performing students in that prestigious colleges have more seats than there are high-performing students, and students have uncertainty about their true type. Colleges can perfectly screen student types at zero application cost. The model predicts a decrease in high-performing students at more prestigious colleges, potentially driven by competition from the second top-tier colleges. To address socioeconomic equity, I extend the model by adding SES as an additional dimension of student type. The model predicts an increase in the enrollment of students from lower SES students at more prestigious colleges.

The model's predictions are supported by empirical evidence drawn from a novel college-level dataset. To test these predictions, I exploit the distinctive cap policy in Korea, which was introduced in 2013 for early admissions to alleviate the high costs of "application fever," referring to a surge of applications fueled by intense competition for entry into elite colleges. The policy was implemented to reduce burdens for students, families, and educational institutions, and it was partially effective,[8] as Figure 2 represents. Although applications per seat fall after the policy, indicating a nominal easing of competition, it may also alter the distribution of applicants across colleges, which this study investigates.

I construct administrative panel datasets from KCUE records, combining separated college information to analyze outcomes across higher education institutions in Korea. The top 45 colleges are selected for the sample as the cap primarily affects prestigious institutions, distinguishing their applicant pool from those of other higher education institutions, such as 2-year colleges, not subject to the cap.

I analyze three outcome measures to examine the impact of the application cap on the

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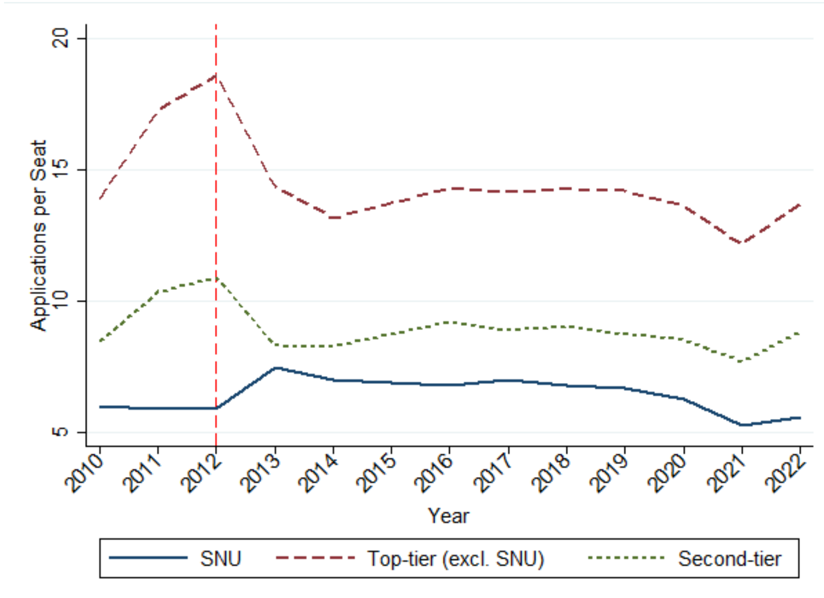
I use "university."

[8] "Before 2013, students faced significant burdens in preparing applications as they applied to dozens of admissions processes. Teachers were also overburdened with early admission-related tasks such as writing recommendation letters. Additionally, high schools experienced frequent class disruptions during the admissions period due to students taking university-specific entrance exams. Universities also faced difficulties in frontline management, including an excessive number of applications relative to enrollment capacity and the occurrence of innocent victims due to multiple admissions," by the Ministry of Education Official. The press release is available at the link following: https://www.kcue.or.kr/news/sub02/sub01.php?pagenumber=5&st=2013&at=view&idx=23687

Figure 2: **Time Trends of the Applications per Seat by Tiers**



Notes: This study focuses on the top 45 colleges. The top-tier group includes the top 22 colleges, excluding the very top school in Korea, Seoul National University (SNU), and the second-tier group includes the remaining 22 colleges. The y-axis represents the number of applications per seat, calculated as the total number of applications a college received in a given year divided by its admission quota. It is equivalent to the inverse of the acceptance rate.

match quality and socioeconomic equity. First, I examine the dropout rate. Previous research, such as Dillon and Smith (2020), demonstrates that student quality significantly influences this outcome. Second, I use the share of college freshmen who graduate from special-purpose high schools. The students from these schools serve as a proxy for high-performing students, as these graduates tend to achieve superior academic outcomes in terms of the College Scholastic Aptitude Test (CSAT) scores and admission to the top college. These special-purpose high schools have their own admissions requirements. Third, I use the share of student loan debtors to proxy the share of students with low SES.

The key findings are as follows: First, the share of high-performing students at more prestigious colleges decreases post-cap, as measured by the share of graduates from special-purpose high schools and the probability of graduating on time, which is consistent with existing literature (Avery et al., 2014; Chen & Kao, 2023). Second, the share of students from low socioeconomic backgrounds increases at more prestigious colleges, as indicated by the proportion of students who have received student loans. In other words, the socioeconomic equity in college prestige improves.

I perform a series of robustness and heterogeneity analyses to verify the validity and consistency of the findings. The results remain consistent when including Seoul National University, redefining top-tier thresholds, weighting by student enrollment, and addressing potential spillovers to exempt science and technology institutes. Heterogeneity analyses show stronger effects for Seoul Metropolitan and private colleges, where competition is highest, while public colleges saw modest loan increases driven by shifts toward more affordable options.

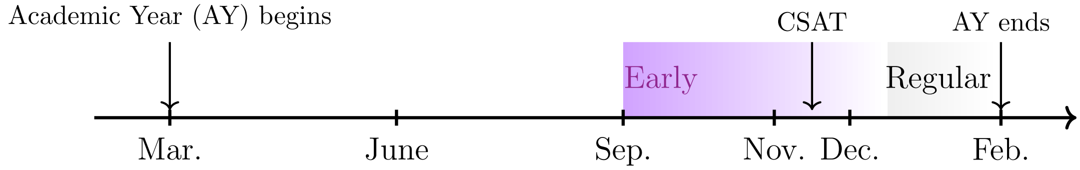
The remainder of this paper is organized as follows: Section 2 provides the institutional background. Section 3 outlines the theoretical models. Section 4 details the data, outcomes of interest, identification strategy and empirical results. I also present robustness checks and heterogeneous analysis to supplement the core findings. Section 5 concludes. The Appendix provides proofs of the theoretical model, additional outcome analyses, and discussions of alternative explanations for the empirical results.

2 Institutional Background

2.1 College Application Process in South Korea

The college application process in Korea is decentralized, as in the U.S. Figure 3 shows the timeline of college admission in South Korea. Students start school in March and graduate the following February. A student in her final year applies to colleges in either of two ways: early or regular admission. Early admission starts its process in September. The applicant submits her application along with her high school records and proof of extracurricular activities. If she passes the first stage of the admission, she may have interviews or college-specific exams. These exams take place around the date of the CSAT, a centralized national college entrance exam that is held annually in mid-November. For early admission, the CSAT score is generally not required, although some colleges set a minimum CSAT score as a threshold criterion.

Figure 3: **Timeline of College Admission in South Korea**



After taking the CSAT, if the student does not apply or is not accepted by any college in the early admission, she applies for regular admission, which starts its process in mid-December. The early admission is binding, which means that the student cannot apply for regular admission if she gets accepted for early admission. In regular admissions, all general colleges select from three different admission dates. Students can apply to up to three admission units, one for each date.

Applicants apply to colleges through application platform such as UwayApply or Jinhaksa.[9] Applicants insert common information, select the admission type, and upload statements or required materials for the colleges they apply to. Each college evaluates applicants with its own criteria and lets applicants know acceptance through the college website. The cost of early admission applications varies by school and admission type, but is approximately $60 per application, whereas a regular admission application costs about $30.

2.2 The 2013 College Application Cap Policy

The policy that limits the number of college applications has been implemented for early admission since the 2013 academic year. This means that the policy change is effective for students who have applied to colleges since 2012. A cap of six was decided by surveying

[9]Like Common App or Coalition App in the U.S.

parents and representatives in high schools and colleges multiple times. The government's official document described the background of the policy as follows: "The strong desire to enter prestigious colleges had led to an excessive number of applications and placed substantial strain on students, who were compelled to prepare for multiple types of early admission processes. High school teachers faced heavy workloads related to writing recommendation letters, and the absence from classes for taking college-specific exams or interviews. Excessive applications by students may cause colleges to lose applicants who are a good fit for them. At the same time, admission committees at colleges were overwhelmed by the task of screening."

The application cap policy only applies to four-year general and education colleges. There are two types of higher education institutions: 146 two-year vocational colleges and 200 four-year colleges. The four-year colleges are categorized into the following: general, education, industrial, cyber, and special-purpose colleges (Han et al., 2025).[10] Two-year vocational and four-year cyber colleges were excluded from the cap policy because of the lower intensity of competition among applicants. Industrial and special-purpose colleges were exempted because they were established under special laws to receive government-level support and nurturing. The government intended to ensure that applicants would not exclude these colleges when the limit on the number of college applications was imposed.

The cap is introduced for early admission. Among the top 45 colleges, early admission quotas increased steadily from 42% of the total in 2010, until their maximum at 64% in 2019, and have been stable since then. This increase reflects the government's reforms aiming to emphasize student record-based admission, reduce dependence on CSAT, and im-

[10]In 2013, the special-purpose colleges included the Korea Advanced Institute of Science and Technology (KAIST), the Gwangju Institute of Science and Technology (GIST), the Daegu Gyeongbuk Institute of Science and Technology (DGIST), the Korea Police University, the Korea Military Academy, the Korea Naval Academy, the Korea Air Force Academy, the Korea Armed Forces Nursing Academy, the Korea National University of Arts, the Korea National University of Cultural Heritage, and the Korea National Open University. The Ulsan National Institute of Science and Technology (UNIST) has been exempt from the early admission limitation since 2016 because it converted from a university to a science and technology institute in 2015.

prove admission predictability for colleges.[11] This expansion is associated with heightened competition: as more places are offered through the early admission, more students apply to multiple colleges, intensifying competition for limited seats.[12] While the rules for regular admissions remained unchanged during the analysis period, early admissions underwent significant changes with the application cap.

The admissions committee of KCUE announced the policy on December 22, 2011. There were exemptions for 4-year colleges that were founded for special purposes: industrial, open, online, military, science and technology, and music and art. Students can apply to up to six general 4-year colleges, but they can apply to exempt institutions with no limit. Because colleges were required to announce their admission plans only about five months after the government announced the policy, they had little time to develop strategies to attract high-performing students in response. Applicants had approximately eight months before applying for early admissions. Still, this period was too short to substantially revise their plans on whether to focus on early or regular admissions.

The application cap is enforced as follows. If an applicant attempts to submit more than six applications across the two aforementioned platforms, the platform notifies the applicant of the excess via a pop-up message. Since there is no technical restriction preventing submission, the KCUE informs the college and then cancels the application if the application is submitted. If the student is admitted to a college beyond the sixth application, that college can revoke the student's admission and enrollment at any time. Even if the applicant makes six applications, the number of colleges she applied to can be fewer than six. Since early admission is divided into the first and second rounds, students can submit multiple applications to the same college.[13]

[11] Through early admission, colleges can avoid the winner's curse problem that may occur in regular admission (Lee, 2009).

[12] This trend became even more pronounced when considering all universities. For instance, in 2010, 57.9% of total seats were through early admission, and aside from a 2 percentage point decline in 2015, the share steadily increased, reaching 77.3% in 2020.

[13] The main difference lies in the exam schedule. Round 1 conducts college-specific tests before the CSAT, while Round 2 holds them after. This allows Round 2 applicants to check their CSAT scores first and strategically decide whether to attend the college-specific tests. They can skip them if their scores are

There is evidence showing that the cap is binding. Figure 2 shows the number of applications per a seat by tier, and the degree of competition for admission has plummeted for all since 2013. Tier 1 refers to the most prestigious 22 colleges among the top 45. Furthermore, the Korean Educational Longitudinal Survey (KELS) in 2011 suggests that 38% of the early admission applicants made more than or equal to six applications. Given that their average national exam score is higher than the average, the cap would be binding for applicants to the top 45 colleges.

3 Theoretical Model

The model is an adaptation of the Chen and Kao (2023) framework. By adding structure to agent utility functions, the model acquires adequate analytic tractability to provide comparative static predictions for outcomes.

I use a model with two colleges of differing prestige and two types of students with different readiness to demonstrate that match quality deteriorates while the socioeconomic equity improves following the implementation of the cap. Regarding match quality, the model incorporates students' uncertainty about their true ability and predicts that less prestigious colleges attract more high-performing students. Originally, the model classified students only by ability type. I extend it by adding SES as another dimension, creating four types of students in total. This allows me to examine how application constraints differ across SES groups. The results show that socioeconomic equity improves after the cap, as measured by the prestige of colleges students attend.

Intuition is as follows. In the baseline model without socioeconomic differences, students differ only in their readiness. Before the cap, both high- and low-performing types apply to both colleges regardless of prestige or preferences, and are assigned according to colleges'

high enough for regular admission. Application periods also differ. Round 1 typically opens in September, while Round 2 varies by college. Some accept applications in September alongside Round 1, and others in November after the CSAT.

screening. After the cap, however, high-performing students who are uncertain about their true ability apply strategically to less prestigious colleges to avoid the risk of rejection. In a sufficiently competitive admission environment, this leads to more high-performing students enrolling in the less prestigious college. When SES is introduced, the pre-cap environment changes. High SES (H-type) students apply to both colleges, while low SES (L-type) students apply to only one. After the cap, all students can submit only one application. It removes the SES-driven disparity in application opportunities, leading to more L-type students enrolling in the more prestigious college.

The timeline of college application is as follows: First, students apply to colleges based on signals of their ability before the national-level college entrance exam. The signals are based on high school GPA, scores on mock tests, and extracurricular activities. Second, after the national exam, colleges screen applicants through their own admission tests, such as essays or interviews. I assume that through these college-specific assessments and their internal databases, colleges can perfectly screen students. Third, applicants make enrollment decisions based on the offer.

The basic framework is as follows. There are 2 colleges, A and B, with capacities k_A and k_B. The prestige of each college is a and b, assuming A is more prestigious than B ($a > b$). The objective of colleges is to maximize the number of high-performing students who enroll. There is a continuum of students. Student i's utility of enrolling in college A is $V_i(A) = a - e_i$. And $V_i(B) = b + e_i$ if enrolling B. e_i is defined over the real numbers and it refers to the relative preference toward B, controlling prestige. For example, it can be interpreted as the fit with the college or the distance from home. This is private information and is independently distributed by the cumulative distribution function $P(e_i \leq y) = F(y)$, where $F(0) = 1/2$.

Its advantage is as follows. Controlling the prestige, student i prefers enrolling B if $V_i(B) \geq V_i(A)$, that is, $e_i \geq (a - b)/2$. By denoting $(a - b)/2$ as d, the normalized prestige difference, $F(d) = P(e_i \leq d)$ is the normalized number of students who will choose to enroll in college A if they are admitted by both. Its probability density function $f(y)$ is supported by $[-\delta_B, \delta_A]$, which is in the range between $[-b, a]$ to ensure non-negative utility. In other words, for values in this range, student i prefers enrolling in either college rather than not enrolling.

3.1 Match quality

For simplicity, no application costs are assumed. A continuum of students is categorized into two types based on their performance: good(μ) and normal($1-\mu$). $\mu < k_A + k_B < 1$ is assumed for the total capacity of both colleges. That is, each college competes to get good type students, and some students have the risk of not being accepted by either college. Students have uncertainty about their true type because of ability noise.[14] Among two types of signal $s_i \in \{g, n\}$, truly good students always get g. Students of normal type get g with probability p and n with probability $(1-p)$. In that sense, the posterior probability that a student who got $s_i = n$ is always the normal type is 1. And students who get signal $s_i = g$ is high type with $\pi = \mu/((1-\mu)p + \mu)$ and normal type with $(1-\pi)$.

In what follows, I will delve into two cases: before and after the implementation of the cap. In the former case, students apply for both A and B since there are no application costs. Let m_A and m_B be the number of good students who enroll in colleges A and B, respectively, before the cap. In the latter case, students can apply only one because of the cap. Let n_A and n_B be the number of good students enrolled in each college after the cap. If n_B is greater than m_B, this can serve as evidence supporting the hypothesis that match quality declines after the implementation of the cap.

[14]Students can roughly gauge their chances of being accepted to a college based on their high school GPA, scores on national-level mock tests, and extracurricular activities. However, high school GPAs are not directly comparable with those from other high schools. Although students can take multiple mock tests, their performance may not be fully reflected because some repeat test-takers (re-examinees) participate only in the national exam. Extracurricular activities are meaningful mainly when considered together with other criteria.

3.1.1 Before the cap

In this case, applicants do not need to take signals into account. Without application costs, they apply to both colleges regardless of their probability of acceptance. Since colleges can perfectly screen applicants, the outcomes depend on each college's capacity, the number of high-performing students, and the distribution of preferences. It also depends on how competitive each college is.

Proposition 1. *Before the cap, (i)* $m_A = k_A$ *and* $m_B = \mu - k_A$ *when* $\mu F(d) > k_A$*. (ii)* $m_B = k_B$ *and* $m_A = \mu - k_B$ *when* $\mu(1 - F(d)) > k_B$ *(or equivalently,* $\mu F(d) < \mu - k_B$*). (iii)* $m_A = \mu F(d)$ *and* $m_B = \mu(1 - F(d))$ *when* $k_A \geq \mu F(d) \geq \mu - k_B$*.*

Under the condition, $\Sigma_j m_j = \mu$, and capacity constraints, $m_j \leq k_j$ for all $j \in \{A, B\}$, it is considered that all the cases depend on whether competition among applicants exists in either college. First, (i), if the number of applicants who would choose college A among good students is greater than the capacity of A, A can fill its entire capacity with good students. The remaining good students, except those enrolled in A, attend college B. Second, (ii), if the number of applicants who would choose college B among good students is greater than the capacity of B, B can fill its entire capacity with good students. The remaining good students, except those enrolled in B, attend college A. Third, (iii) when there is no competition among good students at either college, all good students who prefer a given college can enroll in that college. It cannot be the case that good students compete with each other in both colleges. That is, $\mu - k_B > \mu F(d) > k_A$. It is rewritten as $\mu > \mu F(d) + k_B > k_A + k_B$, which contradicts with the assumption $k_A + k_B > \mu$. For the cases (i) and (ii), m_B weakly decreases in d with capacity constraints. For the case (iii), m_B is strictly decreasing in d. The number of good students enrolling in each college depends on the prestige difference d.

3.1.2 After the cap

The cap restricts the number of applications to at most one. Now, students' application depends on the utility of enrolling in either college and the risk of failing to be accepted. Applicants with signal use their posterior belief to make application. Let's denote $p_j^{s_i}(e_g, e_n)$ as the equilibrium probability of being accepted by college j of an applicant i with signal s_i. It is given that all other students with either s_i are indifferent to applying to A or B. Then I can write down each of the $p_j^{s_i}(e_g, e_n)$ as following explicit forms:

$$p_A^n(e_g, e_n) = \min\left[\max\left[0, \frac{k_A - \mu F(e_g)}{(1-\mu)(pF(e_g) + (1-p)F(e_n))}\right], 1\right],$$

$$p_B^n(e_g, e_n) = \min\left[\max\left[0, \frac{k_B - \mu(1 - F(e_g))}{(1-\mu)(p(1-F(e_g)) + (1-p)(1-F(e_n)))}\right], 1\right],$$

$$p_A^g(e_g, e_n) = \pi \min\left[\frac{k_A}{\mu F(e_g)}, 1\right] + (1-\pi)p_A^n(e_g, e_n),$$

$$p_B^g(e_g, e_n) = \pi \min\left[\frac{k_B}{\mu(1-F(e_g))}, 1\right] + (1-\pi)p_B^n(e_g, e_n)$$

The equilibrium probability for $s_i = n$, $p_j^n(e_g, e_n)$, implies the acceptance rate among normal types. Colleges accept the normal types randomly after filling in the good types. The fraction is zero if the good types applying to the college exceed the capacity. The available seats after filling in good types are divided by normal types who get the signal of g with p or n with $(1-p)$ either. The equilibrium probability for $s_i = g$, $p_j^g(e_g, e_n)$, implies the weighted average for both cases of good type with $s_i = g$ and normal type with $s_i = n$. Without loss of generality, the first term is just π if the acceptance rate of either college among good students is larger than or equal to 1.

The equation for i who are indifferent between applying to colleges A and B is given by

$$p_A^{s_i}(e_g, e_n)(a - e_i) = p_B^{s_i}(e_g, e_n)(b + e_i)$$

For example, $p_A^g(e_g, e_n)(a - e_i) < p_B^g(e_g, e_n)(b + e_i)$ if and only if $e_i > e_g$. The number of good students for each college under the cap: $n_A = \mu F(e_g)$, $n_B = \mu(1 - F(e_g))$. This is based on the equilibrium strategy profile of students, (e_g, e_n).

Before proceeding, it is useful to present two lemmas. These lemmas clarify the conditions under which I should restrict the analysis to establish the hypothesis.

Lemma 1. *When $k_A < \mu$, n_B is 0 after the cap for all $p \in [0, 1]$ and for some large d.*

Proof. In the Appendix A.1.

In words, if there exists a big enough prestige difference that makes all the good students apply to A under the cap, it is possible that $n_B = 0$. This is because the probability of being accepted by A is small but still positive, and the probability of being accepted by B is 1. However, without the cap, the number of good students enrolling in B is bounded below $\mu - k_A > 0$.

Lemma 2. *When $p = 0$, $n_B < m_B$ if $\mu F(d) > k_A$, and $n_B = m_B$ if $\mu F(d) \leq k_A$.*

Proof. In the Appendix A.2.

In proposition 1, I examine m_B for the following cases: (i) competition among good students in A only, (ii) in B only, and (iii) neither. I will follow these cases to compare m_B and n_B. When there is no uncertainty, all the good students get $s_i = g$ and all the normal students get $s_i = n$. Their strategy is to apply to the college they prefer. When there is no competition in both A and B, there is indifference to the number of good students enrolling in both institutes with and without the cap. When there is competition only in B, the number of good students enrolled in B is equivalent in both with and without the cap as the capacity. For A, since some students switch their application decision with the cap, it loses the number of good students enrolled. Symmetrically, when there is competition only in A, B loses the number of good students under the cap.

Based on the proposition and lemmas above, college B is unlikely to benefit when the prestige difference d is large, $p = 0$, and μ is too high relative to capacity. These results provide guidance for setting the following environment in which college B can benefit after the implementation of the cap.

Under the assumptions that (a) $k_B > k_A > \mu F(0)$, (b) $d > 0$, and (c) $p > 0$, the goal is to show that college B enrolls more good students post the cap. The three assumptions imply that (a) there is no excessive competition among good students in either A or B, (b) college A is more prestigious than B (and there exists some $\bar{d} > 0$ such that $d < \bar{d}$ to ensure that d is not too large), and (c) some normal-type students have signal g.

Proposition 2. *With assumptions (a), (b), and (c), $n_B > m_B$ if d is sufficiently small.*

Proof. In the Appendix A.3.

From assumptions (a) and (b), there is no competition among good students in B. It can happen in A as well if d is small enough. Under the cap, applicants apply considering the probability of being accepted. It makes possible for them to apply to the college less preferred but more likely to be accepted. Since B has more capacities than A, there are more seats available in B for the normal students after fulfilling good students. Since some good students with signal g still have some probability of being normal type, they apply to B even if they prefer A a bit more than B.

Throughout the model and prediction regarding match quality, the cap results in a less efficient alignment between students and colleges.

3.2 Socioeconomic Equity

My second outcome is socioeconomic equity. To address this, I extend the model by introducing SES as an additional dimension to the original two-type framework, resulting in four types of students in total. This extension allows for a more detailed examination of how application constraints vary across SES groups. L-type students face greater burdens not only from application fees but also from the costs of preparing for college-specific exams, expenses for consulting on application strategies, and the psychic costs associated with application failure, compared to their H-type counterparts.[15] Application constraints play a significant role, particularly during early admissions (Avery & Levin, 2010; Hoxby & Avery, 2013; Kim, 2010), as the policy was implemented only for that stage of the admission process.

Consequently, the application decisions of L-type and H-type students differ in the model. Before the cap, H-type students apply to both colleges, while L-type students apply to only one. However, after the cap, both types of students apply to only one college. According to the prediction, after the cap, the number of L-type students enrolled in more prestigious colleges increased. When w_j and v_j refers to the share of L-type students who enroll in college j before and after the cap, the hypothesis is v_A is larger than w_A.

Now, applicants are divided into four types based on their ability and SES: High (H) and Low (L), which influences their application decision. They also have idiosyncratic preferences for colleges and uncertainty about their ability when applying.

3.2.1 Before the Cap

While H-type students (η) apply to both colleges, $(1-\eta)F(d)$ of L-type students apply to A and $(1-\eta)(1-F(d))$ apply to B. The acceptance rates of each college differ by signal the L-type gets:

$$p_A^g(e_g, e_n) = \pi \min\left[\frac{k_A}{\eta\mu + (1-\eta)\mu F(e_g)}, 1\right] + (1-\pi)p_A^n(e_g, e_n),$$

$$p_A^n(e_g, e_n) = \min\left[\max\left[0, \frac{k_A - (\eta\mu + (1-\eta)\mu F(e_g))}{(1-\mu)(\eta + (1-\eta)(pF(e_g) + (1-p)F(e_n)))}\right], 1\right]$$

This is because the students apply before their true ability is represented after the national exam, and colleges can perfectly screen students' true ability.

In equilibrium, students apply with a cutoff preference parameter (e_g, e_n), and colleges accept students in random manner with respect to SES. H-type students (η) and L-type

[15] There is a strong correlation between household income level (in quintiles) and applicant's decision to retake the college entrance exam (KELS 2005, 2013).

students $((1-\eta)F(e^*))$ are accepted by A under the following scenarios.

For H-type students, the enrollment probabilities are determined as follows: If the student is accepted by college A only, the joint probability for the case is $p_A^g(e_g,e_n)(1-p_B^g(e_g,e_n))$. If the student is accepted by college B only, the joint probability for the case is $(1-p_A^g(e_g,e_n))p_B^g(e_g,e_n)$. $p_A^g(e_g,e_n)p_B^g(e_g,e_n)$ denotes the probability that the student is accepted by both colleges. Lastly, $(1-p_A^g(e_g,e_n))(1-p_B^g(e_g,e_n))$ indicates the probability that the student is accepted by neither. These probabilities are divided depending on which college the student prefers to attend. There are 8 cases total for H-type. For students from L-type, the enrollment probabilities are simpler. $p_A^g(e_g,e_n)$ denotes the case that a L-type student is accepted by college A only. $p_B^g(e_g,e_n)$ refers to the probability that the student is accepted only by college B. This is because, for L-type, they apply to colleges they prefer.

The interest of outcome, w_A, is the share of L-type but good types enrolled in the college A before the cap. If m_j^{SES} is the number of H or L students who enrolled in college j, $m_A^L=(1-\eta)\mu F(e_g)p_A^g$, and $m_A^H=\eta(p_A^g p_B^g F(e_g)\mu+p_A^g(1-p_B^g)\mu)$. w_A is rewritten by $\frac{m_A^L}{m_A^L+m_A^H}=\frac{(1-\eta)F(e_g)}{(1-\eta)F(e_g)+\eta(p_B^g F(e_g)+(1-p_B^g))}$. $p_j^{s_i}(e_g,e_n)$ is simplified as $p_j^{s_i}$.

3.2.2 After the Cap

When the cap is implemented, both H-type and L-type students can apply to one college. Thus the acceptance rates for A are different with the pre-cap case.

$$p_A^g(e_g,e_n)=\pi\min\left[\frac{k_A}{\mu F(e_g)},1\right]+(1-\pi)p_A^n(e_g,e_n),$$

$$p_A^n(e_g,e_n)=\min\left[\max\left[0,\frac{k_A-\mu F(e_g)}{(1-\mu)(pF(e_g)+(1-p)F(e_n))}\right],1\right]$$

With these acceptance rates, the outcome is $v_A=\frac{n_A^L}{n_A^L+n_A^H}=1-\eta$. This is from the number of L-type students who enrolled in college A, $n_A^L=(1-\eta)\mu F(e_g)p_A^g$, and H-type students, $n_A^H=\eta\mu F(e_g)p_A^g$. Both are for good type of students.

Comparing before and after the cap cases, v_A is bigger than w_A because $p_B^g F(e_g)+(1-p_B^g)$ in w_A is larger than $F(e_g)$ in v_A from $1 > F(e_g)$. While H-type students could consider being admitted to both colleges before the cap, they can apply to only their preferred college after the cap, making enrollment at that college a dominant strategy if admitted.

4 Empirical testing

I now turn to the empirical analysis, which quantifies how the 2013 application cap reshaped college-level outcomes. To examine its effects, I construct a college-year panel combining administrative data from the Korean Council for University Education (KCUE) with information on college rankings, admissions results, and enrollment metrics for each institution. This rich dataset enables tracking annual changes in dropout rate and enrollment composition across colleges. The empirical framework compares top-tier and second-tier institutions before and after the policy, isolating the causal impact of the cap on match quality and socioeconomic equity. I first present the data and construction of key variables, then describe the identification strategy and report the main results, followed by robustness and heterogeneity analyses.

4.1 Data and Sample

I use the 2010 to 2022 administrative data from the KCUE to construct a college-by-year panel containing colleges' records. The KCUE annually collects comprehensive records from colleges,[16] covering areas such as admissions, enrollment, graduation, faculty, finances, and tuition, etc.[17] With this diverse set of college-level data, it becomes possible to examine the annual changes within the colleges and to evaluate the impact of the cap policy.

The KCUE provides two datasets at different unit levels: college-level and department-

[16] Available at: https://www.academyinfo.go.kr/intro/intro0320/intro.do

[17] Some higher-educational institutions subject to national defense are excluded according to *Act on Special Cases Concerning the Disclosure of Information by Education-related Institutions §2(5).*

level. While the two datasets share some variables, they also differ in coverage. To supplement the college-level data, I aggregate the department-level data to the college level for selected outcome variables that are not included in the former. The department-level data offer a finer level of detail. For example, they provide dropout information by reason. However, they do not include certain variables, such as the share of students from special-purpose high schools. Using college-level data as a primary source is beneficial because departments are frequently merged, closed, or renamed during the sample period.

Using data from 2010 to 2022, I restrict the sample to the top 45 colleges that the cap covers, as the cap is binding primarily for applicants to these prestigious institutions. The analysis period was restricted to this timeframe due to the availability of outcome variables. There were 188 4-year colleges in 2013 (KEDI). The top 45 colleges in my analysis sample represent approximately the top 25% of these colleges. In terms of the application pool, applicants to the top 45 are separated from applicants for 2-year colleges, which are not subject to the cap. Moreover, I restrict the data to colleges for which the ranking record is available.

For the college ranking, I use JoongAng in 2010. Korea JoongAng Daily publishes the ranking of colleges in Korea annually since 1995.[18] Goolsbee and Syverson (2023) uses schools' median SAT or ACT scores and Carnegie classifications of research universities (R1, R2, and R3) as prestige indicators. They demonstrate that these measures exhibit patterns consistent with U.S. News & World Report rankings. The JoongAng quantifies the educational environment, internationalization, research, and reputation.[19] The ranking serves as a proxy for college prestige when compared with admission data from a major cram school.[20] Table 1 shows that the estimated CSAT score cutoffs from Daesung (2012) are highly correlated with the rankings reported by JoongAng (2010). Daesung, one of the big cram schools, annually publishes tentative scores for applying to colleges. This ranking

[18]Not published in 2020 because of COVID-19.
[19]See Table D.2 for the detailed evaluation criteria.
[20]Private after-school academy specializing in college entrance exam preparation

is constructed using the following sources: the predicted distribution of current-year CSAT scores, admission records from previous years, and the results of two national mock CSAT exams administered in June and September.

I exclude Seoul National University (SNU) from the analysis because, as the top-ranked institution, it is largely unaffected by the cap policy. Notably, 38.7% of SNU's early admissions require a principal's recommendation, and each high school can nominate up to three students. This highly selective system already imposes its own restriction on the applicant pool, making the external cap policy less binding for SNU. Robustness checks, including the SNU are presented. I also exclude five science-and-technology-focused institutions: KAIST, UNIST, GIST, DGIST, and Pohang University of Science and Technology (POSTECH). KAIST, UNIST, GIST, and DGIST are exempt from the cap as they were established under the Special Act on Science and Technology Institutes. While POSTECH, as a private college, is technically subject to the cap, I exclude it because its applicant pool differs from the general 4-year colleges in my sample. It focuses predominantly on natural sciences and engineering majors rather than offering a diverse range of disciplines.

4.2 Outcomes of Interest

I examine two key outcomes of limiting the number of applications: match quality and socioeconomic equity. Match quality refers to how well high-performing students align with the prestige level of the college they attend. Accordingly, a decline in high-performing students' enrollment at top-tier colleges would indicate that match quality reduces. First, for the match quality, I use two measures: the dropout rate and the change in the share of freshmen from special-purpose high schools. The dropout rate can be viewed as a justifiable proxy for student-school match quality. This is supported by the findings of Dillon and Smith (2020), who demonstrated that an academic overmatch significantly increases the probability of dropping out.[21] In the college-level dataset, which I primarily use for the analysis, only the

[21]This finding is a key element within the broader academic debate of the mismatch hypothesis, which questions whether the benefits of attending a more prestigious institution outweigh the potential negative

Table 1: **Daesung (2012) and JoongAng (2010)**

Daesung (2012)[a]		JoongAng (2010)[b]		
CSAT Score	Rank	Rank	Rank Group	College
384.21	1	1	.	Seoul National University
380.96	2	2	1	Yonsei University
377.03	4	3	1	Korea University
373.04	6	4	1	Sungkyunkwan University
364.76	12	5	1	Kyung Hee University
376.00	5	6	1	Sogang University
369.42	7	7	1	Hanyang University
367.30	9	8	1	Ewha Women's University
351.80	26	9	1	Inha University
363.20	14	10	1	Chung-Ang University
347.93	29	11	1	Ajou University
351.65	27	12	1	Konkuk University
365.58	11	13	1	Hankuk University Of Foreign Studies
364.05	13	14	1	University Of Seoul
347.65	30	15	1	Dongguk University
335.64	35	16	1	Kyungpook National University
358.63	15	17	1	Sookmyung Women's University
332.71	37	18	1	Pusan National University
334.68	36	19	1	The Catholic University Of Korea
.	.	20	1	Jeonbuk National University
308.58	53	21	1	Chungnam National University
.	.	22	1	Yeungnam University
326.23	44	23	1	Chonnam National University
.	.	24	2	University Of Ulsan
352.83	25	25	2	Hongik University
295.98	57	26	2	Chungbuk National University
.	.	27	2	Korea University of Technology and Education
355.00	18	28	2	Handong Global University
.	.	29	2	Korea Aerospace University
344.40	33	30	2	Soongsil University
.	.	31	2	Kangwon National University
.	.	32	2	Hallym University
.	.	33	2	Inje University
291.07	58	34	2	Gyeongsang National University
346.70	32	35	2	Kookmin University
300.97	56	36	2	Pukyong National University
331.54	39	37	2	Dankook University
329.99	40	38	2	Myongji University
320.58	47	39	2	Kwangwoon University
.	.	40	2	National Korea Maritime & Ocean University
.	.	41	2	Soonchunhyang University
318.95	50	42	2	Incheon National University
331.80	38	43	2	Sejong University
.	.	44	2	Jeju National University
.	.	45	2	Dong-A University

Notes: (a) The sample is restricted to colleges that evaluate all 4 subjects in CSAT—Korean, Math, English, and Social Studies or Science. (b) All science- and technology-focused colleges are excluded. I recalculate the college rankings after excluding these colleges from the original ranking list.

consequences of a poor academic fit. For a comprehensive overview of the core arguments and evidence in this debate, the review article by Arcidiacono and Lovenheim (2016) is the essential reference.

total dropout rate is available. In contrast, the department-level data breaks down dropout numbers by reason: non-enrollment, non-return, voluntary withdrawal, academic probation, student activities, fail to progress, exceeding maximum enrollment period, and other. I focus on four types of dropouts: non-enrollment, non-return, voluntary withdrawal, and academic probation. They are likely attributable to mismatch, covering 97.9% of all dropouts.[22]

The change in the share of high-performing students is also used for measuring match quality. To measure high-performing students, I use the share of freshmen from special-purpose high schools: science, science for the gifted, foreign languages, and international high schools. In the KCUE data, high schools are categorized into academic, science, science for the gifted, foreign languages and international, art and physical education, meister[23], vocational, autonomous, etc.[24] Students from high schools for science, science for the gifted, foreign languages, and international are high-performing in terms of academic performance. High-performing students apply to these high schools with a middle school GPA, extracurricular activities, and interviews. According to an analysis by Chosun Ilbo, which obtained the "2013 College Scholastic Aptitude Test (CSAT) school-level performance data" in collaboration with Congressman Sang-Ki Seo's office, among the top 30 high schools nationwide with the highest proportion of students scoring in the top two grades across three CSAT subjects (Korean language, mathematics, and foreign language), 24 were classified as special-purpose high schools. This indicates that these schools account for a substantial share of the top-performing students in the country.[25] I examine whether the share of special-purpose high school graduates among incoming freshmen at top-tier colleges decreases after the application

[22]Specifically, non-enrollment accounts for 36.4%, non-return for 20.8%, voluntary withdrawal for 38.0%, academic probation for 2.7%, other for 1.9%, and the remainder for 0.1%.

[23]Meister high schools are vocational institutions in South Korea that provide firm-linked, industry-specific training. They aim to improve the school-to-work transition by nurturing skilled workers in sectors such as semiconductors, machinery, and finance.

[24]In 2013, there were 2,322 high schools. 1,359(58.5%) of high schools were academic. 669(28.8%) for vocational and meister, 165(7.1%) for autonomous, 63(2.7%) for science, foreign languages, international, and science for the gifted, and 42(1.8%) for arts and physical education high schools, 24(1.0%) for alternatives (KEDI).

[25]Autonomous private high schools are also selective. 29 out of the top 30 if autonomous private high schools are included. However, the data offers the discernible autonomous high schools with private and public since 2021.

cap.

Second, the outcome of interest is socioeconomic equity. I use the change in the share of the government's student loan borrowers as a proxy for the share of L-type students. Belley and Lochner (2007), Johnson (2013), and Lochner and Monge-Naranjo (2011) provides either theoretical or empirical grounds for using student loan borrowing status as a proxy for low-income background. If the cap improves the socioeconomic equity, the share of the loan borrowers would increase in more prestigious colleges. This government-administered student loan is available regardless of household income.[26] However, in practice, students from affluent backgrounds do not need student loans because their tuition is covered by their parents or through their parents' workplace benefits. Students from household in income deciles 2 or below are excluded from this analysis as they receive government grants and scholarships.[27] Therefore, students who take out loans in this study represent those from low-income families who need loans despite partial financial aid or cannot rely on parental support.

Table 2 shows summary statistics of the sample from the dataset. The number of observations depends on data availability in each year, with a total of 585 observations. The sample includes the top 45 colleges from the JoongAng ranking between 2010 and 2022: 23 top-tier colleges and 22 second-tier colleges, divided using a median. The dataset covers 3 pre-period years and 10 post-period years. The three outcome variables are measured in percentage units. The 45 colleges have an average dropout rate of around 3%, which increases for both tiers after the cap. For the share of freshmen from special-purpose high schools, top-tier colleges average 8 to 9%,[28] while second-tier colleges average 1.5%. Both tiers experienced a decrease over time. The share of student loan borrowers decreased for both groups after the cap.

[26] Freshmen at loan-restricted institutions, designated based on annual government accreditation and financial assessments, are ineligible. However, none of the universities in this analysis fall under this restriction.

[27] Please see the Table D.1

[28] Yonsei University recorded a high of 25.9% in 2010. Seoul National University recorded 21%, and Korea University 20.5% in the same year.

Table 2: **Descriptive Statistics by Rank and Policy Period**

Variable	Top-Before		Top-After		2nd Top-Before		2nd Top-After	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Dropout Rate	2.25	0.53	2.73	0.71	3.19	0.73	3.56	0.95
%Special HS	9.19	8.06	8.11	6.92	1.60	1.69	1.52	1.01
%Loan Debtor	10.97	3.59	6.86	3.84	14.02	3.61	8.42	4.73
Seoul Capital Area	0.74	0.44	0.74	0.44	0.41	0.50	0.41	0.49
Public College	0.30	0.46	0.30	0.46	0.32	0.47	0.32	0.47
Num. Departments	120	59	78	33	104	65	60	32
Num. Faculties	895	432	998	458	495	250	560	264
Num. Seats	3,063	936	3,195	942	2,398	913	2,285	861
Tuition	6,926	1,721	6,838	1,850	6,579	1,809	6,441	1,818
Enrollment	13,743	4,251	14,008	4,148	9,876	3,897	9,597	3,632
Early Enroll Rate	76.74	11.48	91.59	7.12	73.89	14.90	88.24	8.22
Regular Enroll Rate	100.71	9.09	98.81	2.22	99.13	2.46	95.16	7.25
Applications per Seat	16.12	8.33	13.46	5.89	9.91	4.15	8.63	3.34
Observations	69		230		66		220	

Notes: Each cell shows the mean and standard deviation by group. Group = Rank (Top/2nd Top) × Policy period (Before/After). "Top" includes 23 colleges and "2nd Top" includes 22. "Before" refers to 2010–2012 and "After" to 2013–2022. Tuition is annual and converted to USD using 1 USD = 1,000 KRW (2013 average: 1,094.97 KRW). Enrollment rate is the ratio of actual enrollees to planned admissions for each college, year, and admission type.

74% of top-tier colleges are located in the Seoul Capital Area, but the distribution is balanced in terms of public colleges. The number of departments, faculty members, and annual freshmen seats (quota) are smaller in the second tier. Colleges set their number of seats for freshmen within limits that meet government criteria regarding school building size, school site, faculty, and the value of for-profit assets.[29] Tuition is slightly lower in the second tier, as is enrollment. For enrollment rates, there is an increase in early admission and a slight decrease in regular admission. Since students who fail to be accepted in early admission have regular admission as a second chance, the enrollment rate is lower in early admission than in regular admission. The number of applications per seat, which can be interpreted as the degree of competition or the inverse of the acceptance rate, decreased for

[29]For more details, consult the *Enforcement Decree Of The Higher Education Act §28(1)*

both tiers after the cap. The average applications per seat among the top-tier colleges before the cap is 16.12, which is the inverse of the acceptance rate (6.2%). Chung-Ang University recorded the highest at 35.2, and Jeju National University had the lowest at 2.7.

4.3 Identification Strategy

To examine the dynamic evolution of the policy effect and the credibility of the results, I first estimate the following event–study specification:

$$Y_{it} = \alpha + \sum_{\tau=2010,\, \tau\neq 2012}^{2022} \beta_\tau \left(TopTier_i \times D_\tau\right) + X_{it}'\gamma + \theta_i + \delta_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} denotes college i's outcomes in year t: dropout rates and the share of freshmen from special-purpose high schools (match quality), and the share of government loan borrowers (socioeconomic equity). $TopTier_i$ is a dummy variable indicating whether a college i belongs to the top-tier group among the top 45 colleges. I used the median to divide the 45 colleges in my analytical sample into two groups: the top 22 colleges are designated as the treatment group (top-tier), while the remaining 22 serve as the control group. As a robustness check, I also divided the treatment and control groups using terciles rather than the median. Ranking in the year 2010 is used since that is the first year when the main outcome variable is available. D_τ is a dummy variable equal to one for year τ, and 2012 is omitted as the baseline year. Each coefficient β_τ captures the difference in outcomes between top-tier and second–top-tier colleges in year τ relative to 2012. A positive β_τ for dropout rates is consistent with the model's prediction, while a negative β_τ for the share of freshmen from special-purpose high schools aligns with the prediction regarding match quality. Similarly, a positive β_τ for the share of government student loan borrowers is also consistent with the model's prediction.

X_{it}' represents a vector of college-level covariates including Seoul metropolitan area, public colleges, the number of departments, faculty size, student enrollment, and tuition.[30] θ_i and δ_t denote college and year fixed effects, repectively. ε_{it} is the idiosyncratic error term. Standard errors are clustered at the college level. The analysis covers the period 2010–2022, allowing for a pre-trend test (2010–2012) and for tracing the dynamic effects of the policy in the post-implementation years (2013–2022).

As a complementary approach, I also estimate the following difference-in-differences (DiD) specification to summarize the overall impact of the policy by comparing pre- and post-policy periods:

$$Y_{it} = \alpha + \beta \left(TopTier_i \times \text{Post}_t \right) + X_{it}'\gamma + \theta_i + \delta_t + \varepsilon_{it}, \tag{2}$$

$Post_t$ equals one for years after the policy implementation (2013–2022). The coefficient β captures the average post-cap difference in outcomes between top-tier and lower-tier colleges. All other variables, controls, fixed effects, and clustering of standard errors remain identical to those in Equation 1.

4.4 Results

This section presents the estimation results from the two empirical specifications. I first present the results from the event-study estimates that illustrate the dynamic effects of the policy, followed by the difference-in-differences specification. Together, the two approaches offer consistent and comprehensive evidence on how the cap policy affected college-level outcomes.

Figure 4 presents the dynamic effects of the cap using an event study framework. Each panel corresponds to one of the three main outcomes: dropout rate, share of freshmen from special-purpose high schools, and share of loan borrowers. The coefficients are relative to

[30] While public colleges are under the direct maximum student number controls of the government, private colleges are free to set their seats, except for the Seoul Capital Area (SCA) and special majors such as medicine and education. *Enforcement Decree Of The Higher Education Act §28*

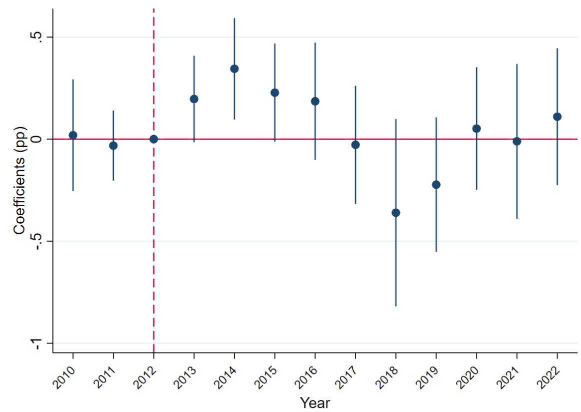
2012, which serves as the baseline year. Estimates capture how the outcomes evolved for top-tier colleges relative to second-tier colleges around the policy implementation in 2013.

Panel (a) shows the results for the dropout rate. The event study result indicates a gradual upward trend following the policy implementation. The estimates become positive after 2013, suggesting that the cap leads to an increase in dropout rates among top-tier colleges relative to the second-tier. Before the policy, the parallel trend assumption appears to hold. The joint F-test of the pre-treatment coefficients yields $F(2, 43) = 0.16$ ($p = 0.856$). Starting from 2013, the effect begins to emerge, with the dropout rate gap increasing by 0.20 percentage points (pp), which is a 23.6% rise from the baseline gap of 0.85 in 2012. The effect peaks in 2014 at 0.36 pp (41.6%) and gradually declines thereafter. Although statistically insignificant, in 2018 and 2019 the dropout rate gap between top-tier and second-tier colleges became smaller than in 2012.

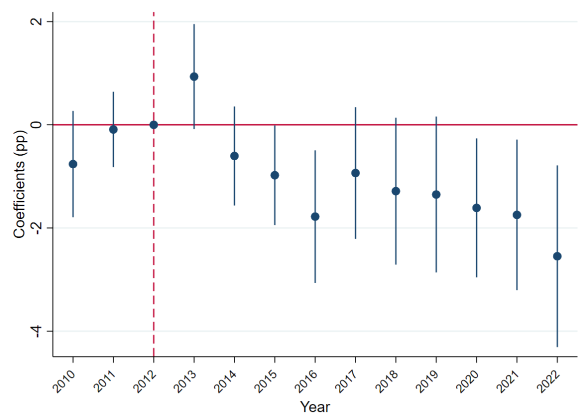
Panel (b) presents the estimates for the share of freshmen from special-purpose high schools. The event study reveals a sharp increase at first, but persistent declines in the outcome share. The negative coefficients remain stable for several years, indicating that the cap lowers high-performing freshmen in top-tier institutions. Before the policy, the parallel trend assumption appears to hold. The pre-trend coefficients are jointly insignificant with $F(2, 43) = 1.56$ ($p = 0.222$). Interestingly, in the first year of the cap, the share of high-performing students enrolling in top-tier colleges increased relative to second-tier colleges. This pattern quickly reversed in the following year and remained stable thereafter, suggesting convergence to a new equilibrium. This opposite result in the first year can be explained by the following: the application cap was announced without sufficient lead time for schools and students to adjust (no anticipatory effects). Special-purpose high schools typically have richer information and stronger counseling resources, and their students benefit from peer and private network effects that improve strategic targeting of selective programs (Cattan et al., 2022). In contrast, general high school students, who lack comparable information and networks, tended to apply "safety schools" when the cap was introduced. Over time,

Figure 4: **Event Study Estimates of the Cap on College Outcomes**

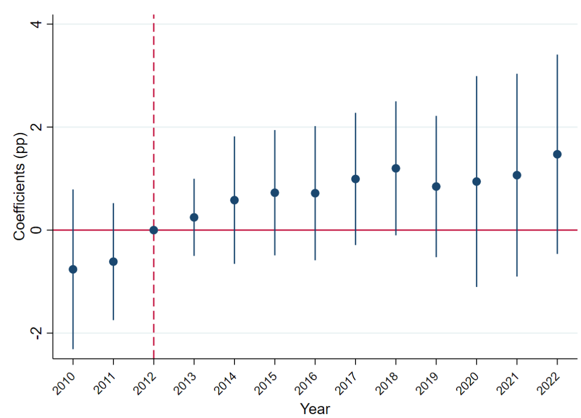
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**



(c) **Loan Borrower Rate**



Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

as both students and teachers in general high schools learned from prior admission cycles, this informational gap narrowed, and the system gradually converged to the equilibrium predicted by the model.

Panel (c) illustrates the results for the loan borrower share. The pre-treatment effects are not statistically different from zero ($F(2, 43) = 1.62$, $p = 0.210$). The estimates turn positive and remain so in the post-policy years. This suggests that the cap increased the proportion of students relying on student loans in top-tier colleges, likely reflecting a shift in student composition toward less affluent groups and greater financial need.

To complement the event-study results, Table 3 reports the DiD effects of the 2013 cap policy on key outcomes, comparing top-tier colleges to second-tier colleges. Columns (2), (4), and (6) include additional controls. The coefficient on $TopTier \times Post$ captures the differential change for top-tier institutions relative to second-tier ones after the implementation of the cap. Results indicate that, following the introduction of the cap, top-tier colleges experienced no statistically significant change in dropout rates compared to second-tier institutions (Columns (1)–(2)). This insignificance arises because the estimates for 2018–2019 show the opposite sign and are statistically insignificant, implying that the short-term spike observed immediately after 2013 did not persist in the longer run. However, the share of students from special-purpose high schools declined significantly among top-tier colleges, suggesting that the policy may have reduced the inflow of students from elite secondary schools (Columns (3)–(4)). In contrast, the share of loan borrowers increased significantly in top-tier colleges relative to second-tier ones after the cap was introduced (Columns (5)–(6)).

Overall, both analyses yield consistent results across key outcomes. Match quality declined more substantially at top-tier colleges. While dropout rates, though statistically insignificant in the DiD framework, show visible increases in the event study following the cap. Both the share of freshmen from special-purpose high schools and the share of loan borrowers align with model predictions across both analytical frameworks. These findings suggest that the cap policy reduces match quality while increasing access for lower-income

Table 3: **Estimated Effects of the Cap on the Outcomes**

	Dropout Rate		Special-Purpose HS		Loan Borrower	
	(1)	(2)	(3)	(4)	(5)	(6)
TopTier × Post	0.112	0.057	-1.059**	-0.878*	1.362**	1.317**
	(0.131)	(0.123)	(0.508)	(0.506)	(0.613)	(0.635)
Number of Departments		-0.002*		0.001		0.007
		(0.001)		(0.004)		(0.005)
Number of Faculties		0.001*		0.001		0.000
		(0.000)		(0.002)		(0.003)
Number of Seats		0.000		-0.001		-0.000
		(0.000)		(0.001)		(0.001)
Tuition		0.000		0.000		0.002***
		(0.000)		(0.001)		(0.001)
Constant	2.816***	1.464***	4.741***	5.817	13.345***	-1.278
	(0.071)	(0.543)	(0.264)	(5.036)	(0.359)	(3.847)
College FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
R sq.	0.575	0.589	0.135	0.145	0.716	0.729
Obs.	571[a]	571[a]	572	572	572	572

Notes: (a) The 2021 dropout rate data for Chungbuk National University is missing. Standard errors in parentheses are clustered at the college level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

students at top-tier colleges, illustrating a trade-off between efficiency and equity.

4.5 Robustness Check

I check the robustness of the results by (i) including the top school; (ii) adjusting the treatment group criteria by dividing colleges into terciles instead of using the median cutoff; (iii) weighting the regressions by student enrollment; and (iv) considering potential spillover effects from science- and technology-focused colleges.

Figure 5 presents the event–study estimates when SNU is included. Unlike other top-tier institutions, SNU faced a relatively weaker constraint from the cap, as a considerable portion of its early admissions relied on principal recommendations, which were restricted to three applicants per high school. This preexisting limitation, together with its highly selective admissions process, rendered SNU less responsive to the policy change. Compared with the baseline results excluding SNU, the magnitudes of the coefficients stay consistent across all the outcomes. It suggests that the main findings are not driven by the exclusion of SNU.

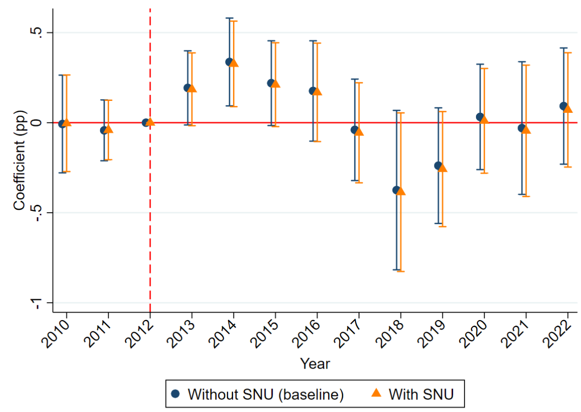
Figure 6 presents a robustness check of the event-study estimates by redefining the treatment group based on alternative rank thresholds. In the baseline specification, the sample of the top 45 colleges is divided into two halves, excluding the top school. The upper half (Top 22) serves as the treatment group (labeled TopTier: 2 to 23) and the lower half (Bottom 22) as the control group. To test whether the results depend on the cutoff, two alternative definitions are considered. The narrow definition treats only the top one-third out of 45 (Top 2 to 15, 14 colleges) as treated, while the broad definition expands the treatment group to include the top two-thirds out of 45 (Top 2 to 30, 29 colleges).

Across all three definitions, the post-policy decline in three outcomes among top-tier colleges remains robust. For the dropout rate, there is no significant difference between narrow, baseline, and broad definitions of the treatment group. Under the narrow definition, the initial decrease is somewhat smaller but follows a similar downward pattern, and under the broad definition, the magnitude is slightly attenuated yet consistently negative. These results suggest that the policy effect on dropout rates does not depend on how narrow or broad the definition of top colleges is. For the share of freshmen from special-purpose high schools, all specifications show a clear and persistent decline following the policy, except the year 2013. In 2013, the effect is strongest when the treatment group is narrowly defined, indicating that the policy's impact was most concentrated among the highest-ranked colleges. The narrow definition exhibits a moderate rise immediately after implementation, gradually converging to the baseline path. Lastly, the loan borrower rate increases after the policy in all cases. Taken together, these results indicate that the dynamics of all three outcomes are stable across alternative definitions of the treatment group. Narrower definitions produce somewhat stronger responses, whereas broader ones dampen magnitudes slightly, but the direction and timing of policy effects remain highly consistent.

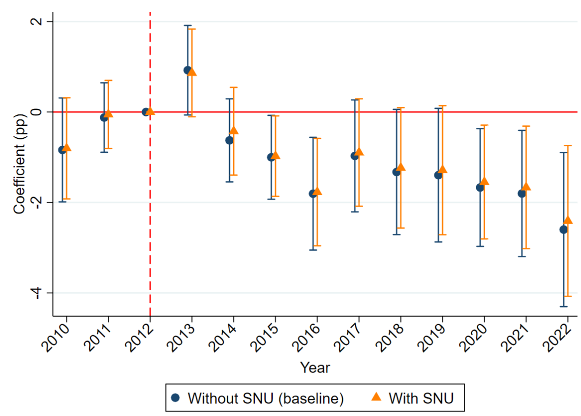
Figure 7 represents results from the analysis weighted by the number of enrolled students.

Figure 5: **Robustness Check: Including the Top School**

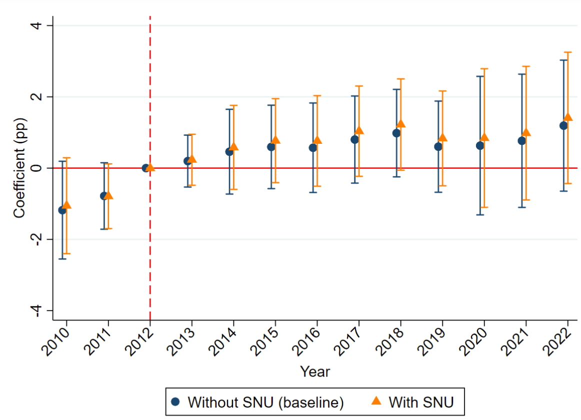
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**



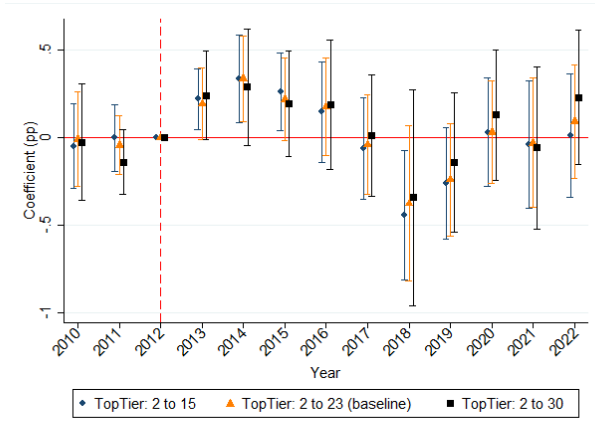
(c) **Loan Borrower Rate**



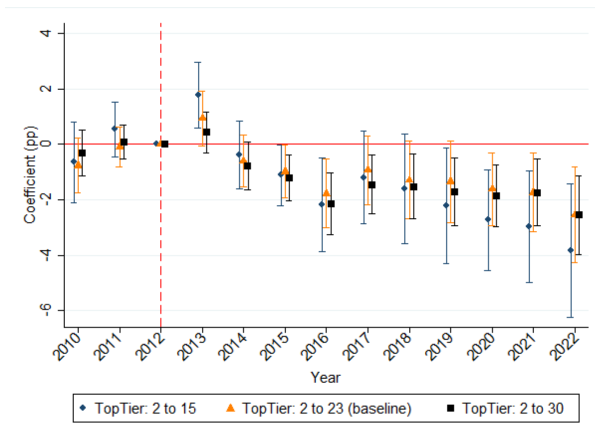
Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

Figure 6: **Robustness Check: By Three Different Tiers**

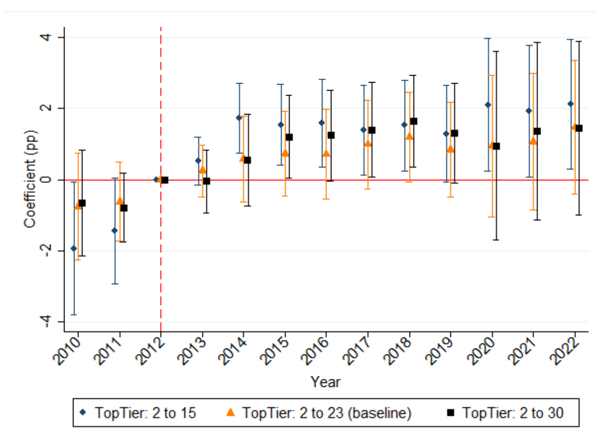
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**



(c) **Loan Borrower Rate**



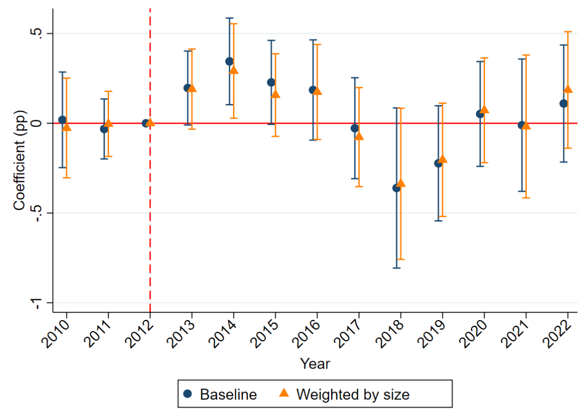
Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

The baseline analysis takes the colleges' perspective, using college-level data to examine aggregate changes in each institution and employs equal weighting across colleges. However, since the policy targets students and the admission process involves both colleges and applicants, I consider enrollment-weighted analysis to reflect the students' perspective. It is relevant given the substantial variation in college size, with the number of enrolled students ranging from 3,688 to 26,582. Weighting by enrollment reflects the perspective of an average student, and it captures the welfare implications. The results are largely similar across outcomes, although the increase in the loan borrower rate becomes less pronounced. This suggests that the unweighted results were driven primarily by smaller institutions, whereas larger colleges showed smaller changes once their size was accounted for.

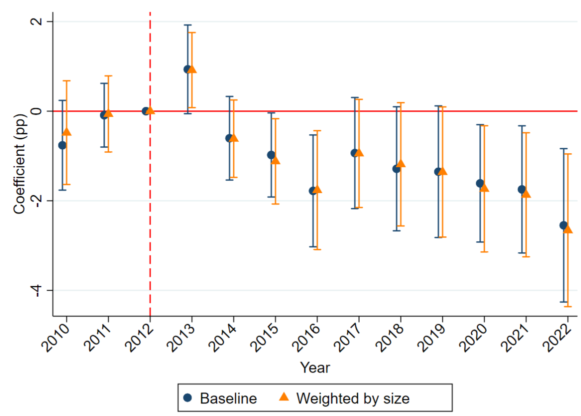
Figure 8 tests for potential spillover effects from science and technology institutes exempt from the cap policy. It checks whether the enrollment of high-performing students in these institutes affects the main results. The outcome variable, share of freshmen from special-purpose high schools, serves as a proxy for the proportion of high-performing students. Because the dataset distinguishes among types of special-purpose high schools, I separately identify graduates of foreign language high schools and international high schools. Students from these schools typically major in languages, business, or international studies, whereas graduates of science high schools and science high schools for the gifted overwhelmingly matriculate into science and technology institutes. Between the 2010 and 2022 academic years, the share of freshmen from foreign language and international high schools at POSTECH, KAIST, and GIST averaged only 1.15%. I only include these three colleges because UNIST has been exempt from the six-application cap since the 2016 academic year, and DGIST began admitting undergraduates in 2014. The figure compares the estimated coefficients for four types of special-purpose high school graduates (baseline) with those for graduates of foreign language and international high schools. The trajectories are nearly identical across years, and the downward shift after 2013 remains evident for both groups. This similarity confirms that the observed decline in the share of special-purpose high school freshmen at

Figure 7: **Robustness Check: Weighted by Enrollment**

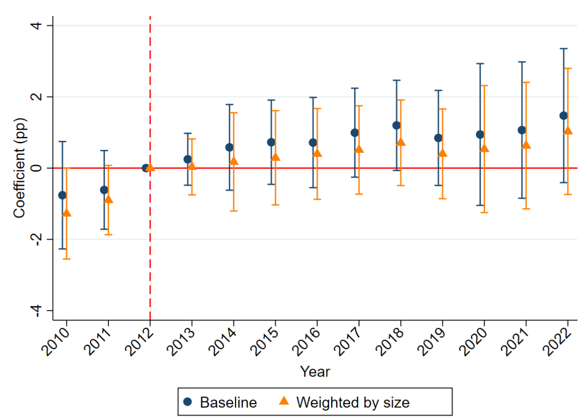
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**

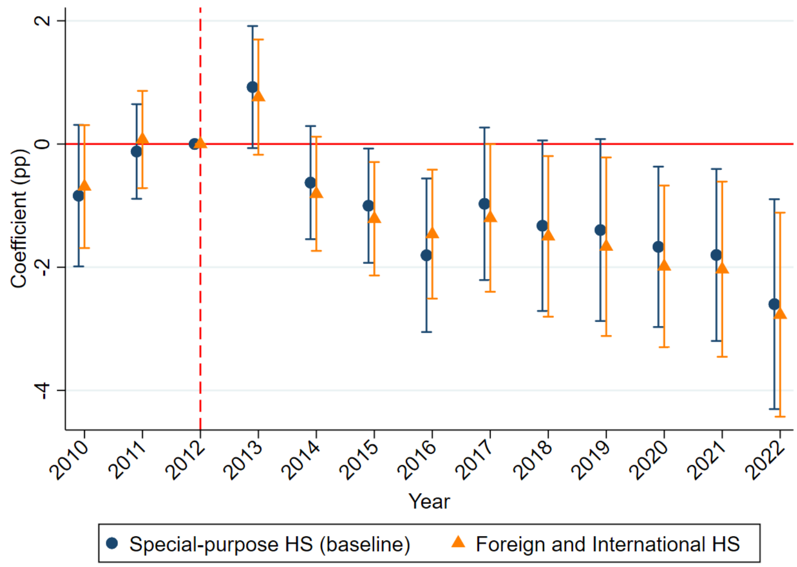


(c) **Loan Borrower Rate**



Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

Figure 8: **Robustness Check: No Spillover Effect**



Notes: The panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

top-tier colleges is not driven by reallocation of high-performing students to science and technology institutes. In other words, the policy effect is robust to the potential spillover channel.

4.6 Heterogeneous Effects

To explore the heterogeneous effects of the application cap policy, I examine whether the policy impact varies by colleges' location and ownership type. Figure 9 illustrates the geographic distribution of Korean colleges, distinguishing between public and private institutions. The area of Seoul is enlarged to highlight the strong spatial concentration of colleges, most of which are private. The Seoul Metropolitan Area (SMA)—Seoul, Gyeonggi, and Incheon— which serves as the focal region for this heterogeneity analysis, is shaded in the map. Across all three outcomes in Panels (a)–(c) in Figure 10, the estimated effects are more pronounced for colleges in the SMA, suggesting that the policy had a stronger impact where students' preferences were more concentrated. This pattern likely reflects students' greater preference for Seoul-based colleges.

Figure 9: **Geographic Distribution of Top 45 Colleges and Seoul Area**

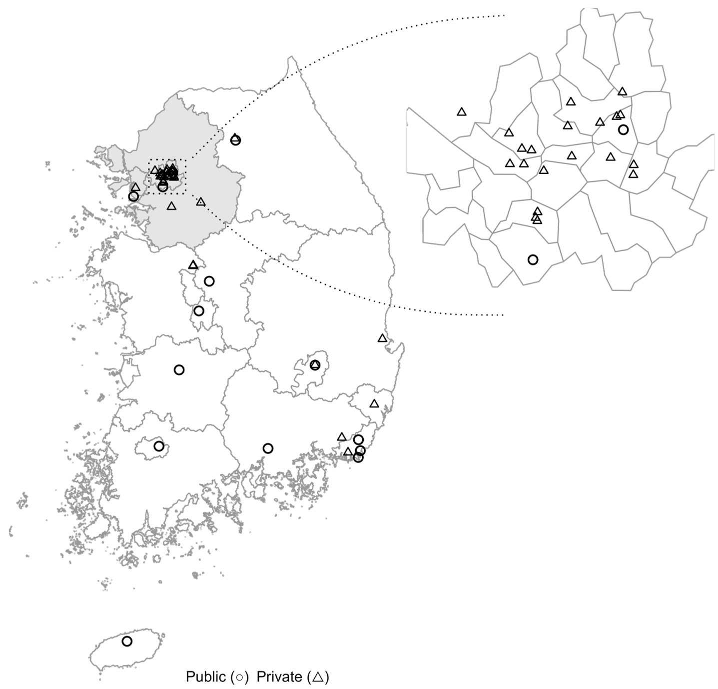
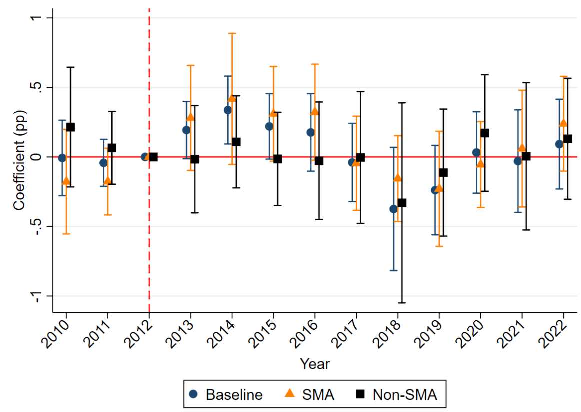


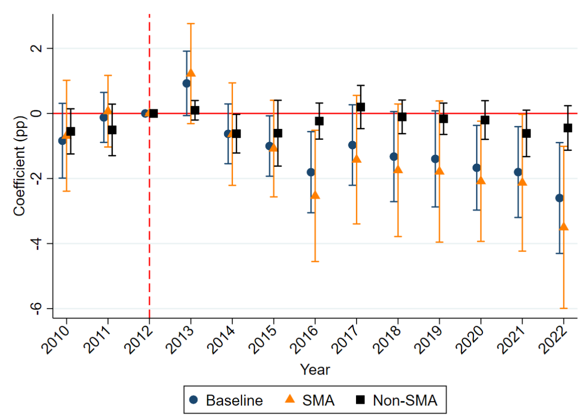
Figure 11 further investigates heterogeneity by ownership type. In Panels (a) and (b), outcomes related to match quality show stronger effects among private colleges, largely because most private institutions are concentrated in Seoul. By contrast, Panel (c) shows that the share of student loan borrowers increased more in public colleges. The average tuition at private colleges is 1.84 times that of public ones. Therefore, the increase in loan usage among public college students does not necessarily indicate a decline in socioeconomic equity, but rather a shift in enrollment toward more affordable institutions.

Figure 10: **Heterogeneous Effects: By Seoul Metropolitan Area (SMA)**

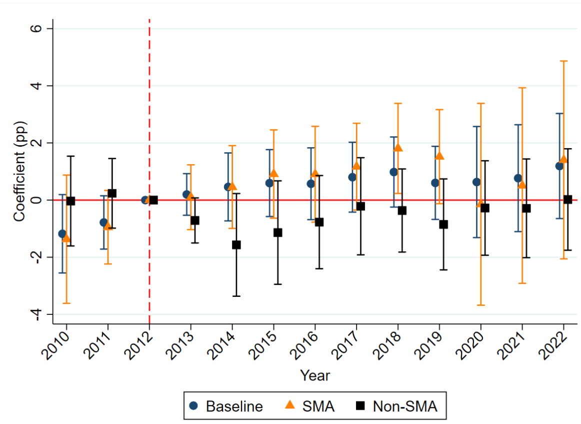
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**



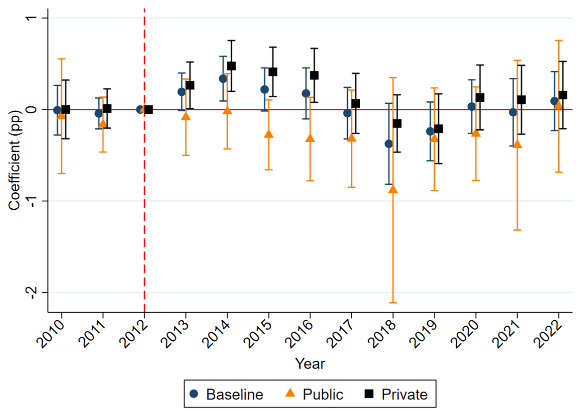
(c) **Loan Borrower Rate**



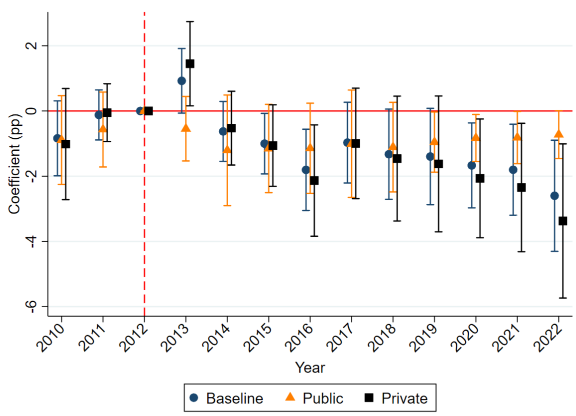
Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

Figure 11: **Heterogeneous Effects: By Ownership Type**

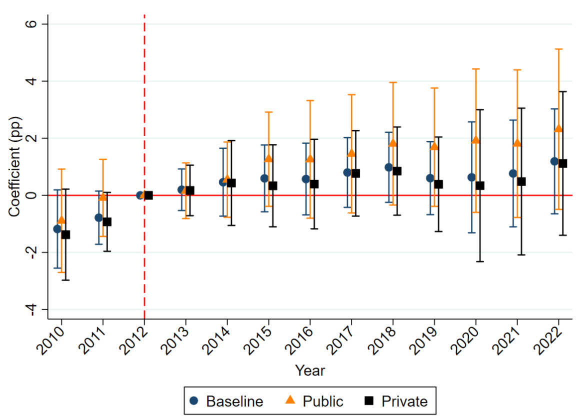
(a) **Dropout Rate**



(b) **% Freshmen from Special-Purpose HS**



(c) **Loan Borrower Rate**



Notes: Each panel reports the estimated dynamic effects of the 2013 cap policy comparing top-tier and second-tier colleges. The vertical dashed line indicates the year before the policy implementation. Dots represent point estimates and vertical bars show 95% confidence intervals.

5 Conclusion

I study how limiting college applications affects the allocation of students across colleges, focusing on the trade-off between efficiency and equity. Exploiting Korea's 2013 reform that capped the number of early admission applications, I provide both theoretical and empirical evidence on the unintended distributional impacts of this constraint. I show that while the policy achieved its intended goal of reducing excessive application pressure, it weakened match quality but improved socioeconomic equity. Relative to the second top-tier colleges, the top-tier colleges enrolled fewer high-performing students, whereas students from less affluent backgrounds became more likely to attend them. These findings are robust across multiple specifications. Heterogeneous analysis by college region and ownership type represents students' preference for the region of college they apply.

I make three main contributions to the literature on college admissions under application constraints. First, I extend the theoretical framework of constrained matching by incorporating both ability heterogeneity and socioeconomic stratification, thereby showing how uniform caps can simultaneously reduce efficiency and enhance equity. Second, I construct a novel college-level panel dataset by compiling annual disclosures from an umbrella organization coordinating higher education institutions in Korea. It allows a comprehensive analysis of institutional responses to the government policy. Third, the paper uncovers unintended consequences beyond the policy's original purpose, offering broader insights into how limiting applications can reshape matching outcomes and equity.

The results offer a policy-relevant insight for higher education markets experiencing an "application fever." While mechanical limits on college applications may enhance equity across socioeconomic groups, they can also diminish match quality, underscoring the importance of designing such policies to minimize efficiency losses. Rather than limiting applications directly, policies that alleviate informational or financial barriers to applying are more likely to achieve a balanced outcome between efficiency and equity.

Finally, several questions are left for future work. A more detailed welfare analysis can identify which groups of students benefited or lost from the policy and by how much. Such an analysis would shed light on the extent to which the policy serves the public interest. As Blair and Smetters (2021) note, excessive applications to elite colleges can generate substantial inefficiencies in the U.S., yet potential remedies such as capping applications face legal barriers under the Sherman Act. In this context, evaluating welfare implications is particularly meaningful. Furthermore, extending the theoretical model to explicitly link socioeconomic status with student performance would also enhance plausibility. Falk et al. (2021) show that children from H-type families are less risk-seeking. Incorporating this relationship into the model implies that students' uncertainty about their true ability is inversely related to their readiness to apply. Such an extension could further refine the model's predictions and help explain heterogeneous application decisions across socioeconomic groups.

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Appendix

A Proofs

A.1 Proof of Lemma 1

Because $k_A < \mu$, there exists $d_1 \in (-\delta_B, \delta_A)$ which satisfies $\mu F(d_1) = k_A$. Without the cap, $m_A = k_A$ regardless of whether $\mu F(d_1)$ is greater or less than k_A. This is by proposition 1. So does $m_B = \mu - k_A$. m_A and m_B have the same value for $d > d_1$. With the cap, the posterior probability should be taken into account. Since π is at least μ and the probability that good students are admitted by the college A is at least k_A/μ, $p_A^g(e_g, e_n) > k_A$. Back to the indifference equation, $n_B = 0$ when $p_A^g(e_g, e_n)(a - e_g) > p_B^g(e_g, e_n)(b + e_g)$. In other words, all applicants with $s_i = g$ apply to college A if their expected utility is larger in A. Then $n_A = k_A$, $n_B = 0$, and $p_B^g(e_g, e_n) = 1$. ■

Additionally, I have the range of d, which I noted as somewhat big. Using k_A, which is the lower bound of $p_A^g(e_g, e_n)$, I can rewrite the case that the expected utility is larger in A as follows. $k_A(a - \delta_A) > b + \delta_A$. The e_g is substituted by δ_A because now I show $n_B = 0$ for some large $d > d_1$. Since the upper bound of d_1 is δ_A, I set $e_g(= d) = \delta_A$. When I rewrite the inequality with $d = \frac{a-b}{2}$, $d > \frac{(1+k_A)\delta_A + (1-k_A)a}{2}$.

A.2 Proof of Lemma 2

Since $p = 0$, $\pi = 1$. I can rewrite the indifference equation for applicants with $s_i = g$ as

$$\min\left[\frac{k_A}{\mu F(e_g)}, 1\right](a - e_g) = \min\left[\frac{k_B}{\mu(1 - F(e_g))}, 1\right](b + e_g)$$

First, when there is no competition in both colleges ($k_A \geq \mu F(d) \geq \mu - k_B$), $\min\left[1, \frac{k_A}{\mu F(d)}\right] = 1 = \min\left[1, \frac{k_B}{\mu(1-F(d))}\right]$. It implies $e_g = d$. Therefore, $m_B = n_B = \mu(1 - F(d))$ and $m_A = n_A = \mu F(d)$. Second, when there is competition only in B ($\mu(1 - F(d)) > k_B \leftrightarrow \mu F(d) < \mu - k_B$), $\min\left[1, \frac{k_A}{\mu F(d)}\right] = 1 > \min\left[1, \frac{k_B}{\mu(1-F(d))}\right]$. It implies $\mu(1 - F(d)) > \mu(1 - F(e_g))$.

It is equivalent to $e_g > d$. Using $d = \frac{a-b}{2}$, it implies $b + e_g > a - e_g$. Then I need $\min\left[1, \frac{k_A}{\mu F(e_g)}\right] > \min\left[1, \frac{k_B}{\mu(1-F(e_g))}\right]$, which implies $k_B < \mu(1 - F(e_g))$ by the range I started with ($\mu(1 - F(d)) > k_B$) and $e_g > d$. By the proposition 1, $m_B = n_B = k_B$. $m_A = \mu - k_B = \mu - m_B > n_A = \mu F(e_g)$ by $k_B < \mu(1 - F(e_g))$.[31] Third, when there is competition only in A ($\mu F(d) > k_A$), the results of $n_B = \mu(1 - F(e_g)) < m_B = \mu - k_A = \mu - m_A(n_A = m_A = k_A)$ can be derived by symmetrically with the second case. ■

A.3 Proof of Proposition 2

It is possible to find some $\bar{d} > 0$ such that $n_B > m_B$ for $d < \bar{d}$. To establish this, it is claimed that $e_g < d$ whenever (i) $\mu \leq k_A$ or (ii) $\mu > k_A \geq \mu F(d)$.

The inequality $e_g < d$ can be shown by contradiction. Suppose $e_g \geq d$. From (i) and the assumptions, $k_B > k_A > \mu$, which implies $k_B > \mu(1 - F(d))$. From (ii) and the assumptions, $k_B > k_A \geq \mu F(d)$, which also implies $k_B > \mu(1 - F(d))$. Given $e_g \geq d$, it follows that $k_B > \mu(1 - F(e_g))$. Then $p^g_B(e_g, e_n)$ can be rewritten as $\pi + (1 - \pi)p^n_B(e_g, e_n)$, where $p^n_B(e_g, e_n) = \min\left[\frac{k_B - \mu(1-F(e_g))}{(1-\mu)(p(1-F(e_g))+(1-p)(1-F(e_n)))}, 1\right]$. However, since $e_g \geq d$, $p^g_A(e_g, e_n) > p^g_B(e_g, e_n)$, which implies $p^n_A(e_g, e_n) > p^n_B(e_g, e_n)$.

This requires $e_n \geq d > 0$. Given that $F(d) > 0.5$, the denominator of $p^n_A(e_g, e_n)$ is greater than that of $p^n_B(e_g, e_n)$. Moreover, since $k_B > k_A$, the numerator of $p^n_B(e_g, e_n)$ is greater than that of $p^n_A(e_g, e_n)$. These together imply $p^n_A(e_g, e_n) < p^n_B(e_g, e_n)$, which contradicts $p^n_A(e_g, e_n) > p^n_B(e_g, e_n)$.

Rewriting the claim, $e_g < d$ for all $d > 0$ when $\mu \leq k_A$, or $e_g < d$ when $\mu > k_A \geq \mu F(d)$. In the former case, $k_A > \mu F(d)$ when $\mu \leq k_A$, leading to $m_B = \mu(1 - F(d))$. However, since $e_g < d$, $n_B = \mu(1 - F(e_g)) > m_B$. In the latter case, the range can be expressed as follows: for all $d \in (0, d_1]$ such that $\mu F(d_1) = k_A$. In this case, $m_B = \mu(1 - F(d))$ for $d < d_1$ and $\mu - k_A$ for $d \geq d_1$, because $k_A \geq \mu F(d)$ for $d \geq d_1$. In both cases, $n_B > m_B$. By continuity, there exists $\bar{d} > d_1$ such that $n_B > m_B$ for $d \in (d, d_1)$. ■

[31]If $\mu(1 - F(d)) > k_B, k_A > \mu F(d)$ by $\mu - k_B > \mu F(d)$ and $k_A + k_B > \mu$.

B Graduation Outcomes with Department-level Data

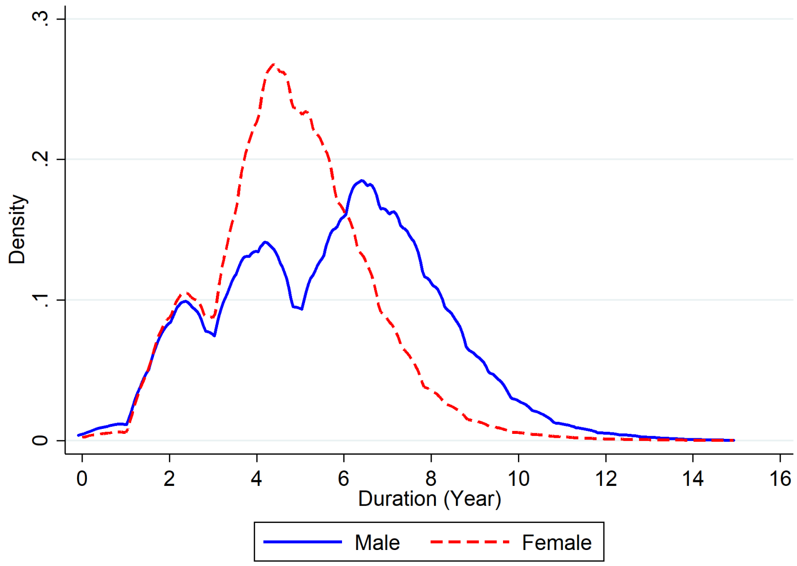
In this part, I examine an alternative outcome measure of match quality. Although the main analysis already uses dropout rates and the share of freshmen from special-purpose high schools, it is also useful to check graduation outcomes, which are commonly employed in the literature to measure student performance. In particular, the probability of graduating on time provides a complementary explanation. Chen and Kao (2023) uses the share of students graduating within two years as a proxy for desirable students in the context of Taiwanese master's programs. And Light and Strayer (2000) finds that students are more likely to graduate when their ability levels are well aligned with the quality of the colleges they attend.

I merge the KCUE department-level data into the college-level dataset. I primarily rely on the department-level data because the college-level data report only the number of graduates by gender and graduation year, without information on the year of entry. Consequently, they cannot capture changes in graduation outcomes among students who entered college after the cap policy. In contrast, the department-level data provide graduation counts by department, entry year, and gender. By appending all available years and reorganizing the dataset by students' entry year, I can track graduation outcomes by entry cohort. Using both entry and graduation years, I calculate each student's duration until graduation and exclude those with durations shorter than 3.5 years to remove transfer students, who typically complete their degrees in about two years.

Figure B.1 presents the distribution of time-to-graduation by gender. The figure shows that the distributions begin to diverge around 3.5 years, with the modal duration being five years for women and seven years for men. Although the standard undergraduate program lasts four years, many students take leave for job preparation or study abroad. The longer duration among men primarily reflects Korea's two-year mandatory military service, typically undertaken during the first or second year of college.[32]

[32] According to the 2013 national enlistment statistics, 94% of enlisted men were aged 20–22, corresponding

Figure B.1: **Non-parametric Distribution of Duration by Gender**



Notes: Kernel densities were estimated using an Epanechnikov kernel with a bandwidth of 0.4, chosen for visual smoothness.

Table B.1 reports the probability of graduating on time for the full sample and by gender. The probability is defined as the share of students who graduate within four to seven years among those who entered a college in a given year. Due to systemic differences in program length, the standard graduation window is four to five years for women and six to seven years for men. Roughly 60% of students graduate within these time frames, and the probabilities show a gradual increase across all groups after the cap policy.

Table B.2 confirms that the merged department-level data are broadly consistent with the college-level dataset. While overall patterns are similar, the department-level data only report the aggregate enrollment rate because the data do not separately report the rate for early and regular admissions. The most notable difference from Table 2 lies in the number of faculties. This arises because departments in medicine, dentistry, oriental medicine, pharmacy, and veterinary science are excluded from the department-level dataset. These programs are omitted because they require six years to complete, which could bias the grad-

to the first to third years of college. Available at: https://kosis.kr/statHtml/statHtml.do?orgId=144&tblId=TX_14401_A057&conn_path=I2

Table B.1: **Descriptive Statistics by Rank and Policy Period**

	Top-Before			Top-After			2nd Top-Before			2nd Top-After		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
%Grad. $\leq$ 6-yr (Total)[a]	54.27	8.37	115	58.25	7.82	115	50.85	8.33	110	57.92	7.35	110
%Grad. $\leq$ 7-yr (Total)[b]	73.12	7.07	115	75.39	5.23	92	69.46	6.93	110	74.21	4.74	88
%Grad. $\leq$ 6-yr (Male)[a]	32.49	6.68	105	37.07	6.62	105	30.91	9.49	110	39.64	9.12	110
%Grad. $\leq$ 7-yr (Male)[b]	59.07	8.92	105	62.52	5.76	84	57.88	9.14	110	64.44	6.26	88
%Grad. $\leq$ 4-yr (Female)[c]	22.34	6.95	115	24.14	6.64	161	26.77	11.42	110	28.88	11.01	154
%Grad. $\leq$ 5-yr (Female)[d]	53.02	9.87	115	56.72	8.72	138	59.12	10.78	110	63.60	9.08	132

Notes: Each cell reports the mean, standard deviation (SD), and number of observations (N) by group. Group = Rank (Top/2nd Top) × Policy period (Before/After). The 'Before' period includes 2008–2012 for all variables. The 'After' period varies by graduation horizon: [a] 6-year completion: 2013–2017. [b] 7-year completion: 2013–2016. [c] 4-year completion: 2013–2019. [d] 5-year completion: 2013–2018. Latest available year = 2022. The difference in the number of observations between the Total and Male variables for the top-college group arises because two women-only colleges are included in this group.

uation outcomes depending on whether a college offers such programs.

Table B.2: **Descriptive Statistics by Rank and Policy Period (Department-level)**

	Top-Before		Top-After		2nd Top-Before		2nd Top-After	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Seoul Capital Area	0.74	0.44	0.74	0.44	0.41	0.49	0.41	0.49
Public College	0.30	0.46	0.30	0.46	0.32	0.47	0.32	0.47
Num. Departments	110	58	78	33	94	62	60	32
Num. Faculties	612	256	674	227	389	169	448	189
Num. Seats	3,100	941	3,044	925	2,326	881	2,245	842
Tuition	6,913	1,670	6,838	1,850	6,535	1,765	6,441	1,818
Enrollment	13,755	4,332	13,254	4,069	9,457	3,723	9,384	3,518
Enroll Rate	99.54	0.61	99.62	0.30	99.59	0.72	99.51	2.31
Applications per Seat	13.97	7.63	13.28	5.77	9.10	4.15	8.57	3.39
Observations	115		230		110		220	

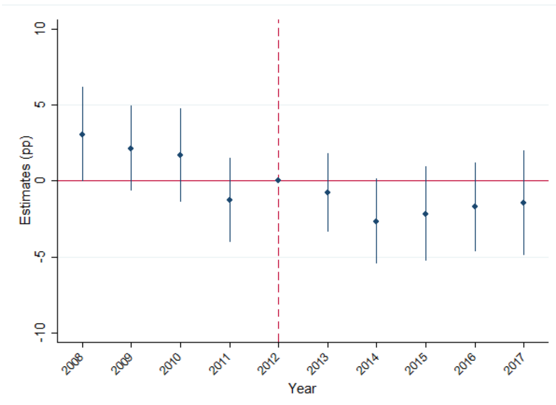
Notes: Each cell shows the mean and standard deviation by group. Group = Rank (Top/2nd Top) × Policy period (Before/After). "Top" includes 23 colleges and "2nd Top" includes 22. "Before" refers to 2010–2012 and "After" to 2013–2022. Tuition is annual and converted to USD using 1 USD = 1,000 KRW (2013 average: 1,094.97 KRW). Enrollment rate is the ratio of actual enrollees to planned admissions for each college, year, and admission type.

Figure B.2 represents the event-study results of the probability of graduating within time by subgroup: total, male, and female. Across all outcome measures (panels (a) to (f)), the probability of graduating on time declined for top-tier colleges relative to second-tier institutions after the introduction of the cap. However, the pre-treatment coefficients do not show a clear parallel trend, indicating that these estimates should be interpreted with caution. Nevertheless, considering the results from other proxies of match quality presented earlier, such as the share of students from special-purpose high schools and dropout rates, the overall evidence suggests that match quality among top-tier colleges deteriorated after the cap policy.

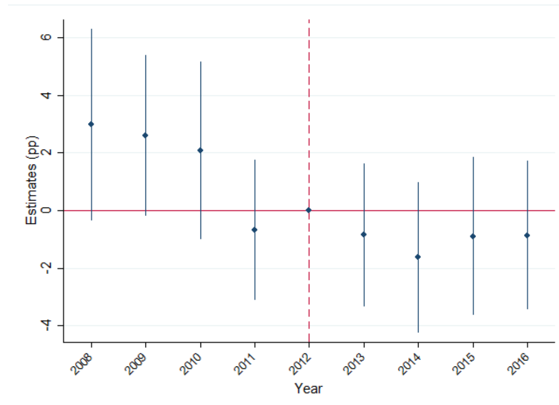
Table B.3 presents the DiD estimates of the probability of graduating within the specified time horizon across subgroups. The coefficients on TopTier × Post are negative in all columns, indicating that, after the introduction of the cap, top-tier colleges experienced a decline in the share of students graduating on time relative to second-tier institutions. The

Figure B.2: **Event-study Estimates of the Cap on the Graduation Outcomes**

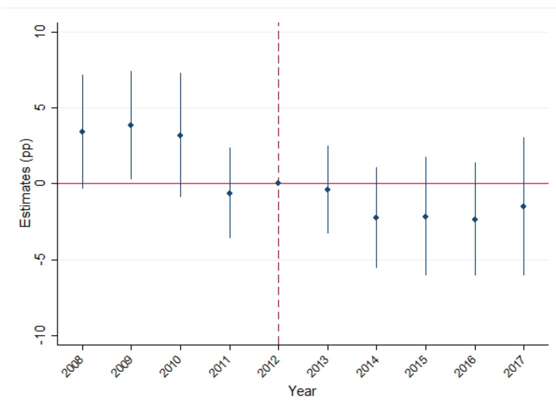
(a) **%Graduate within 6 years (Total)**



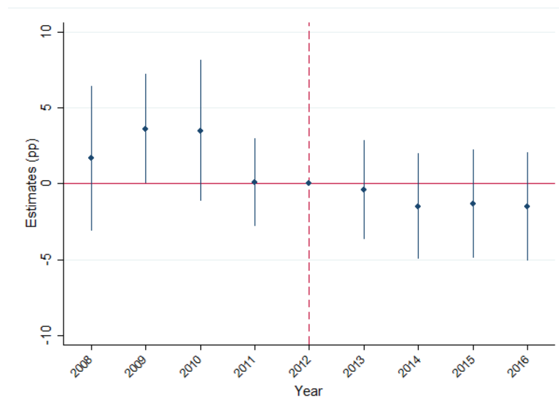
(b) **%Graduate within 7 years (Total)**



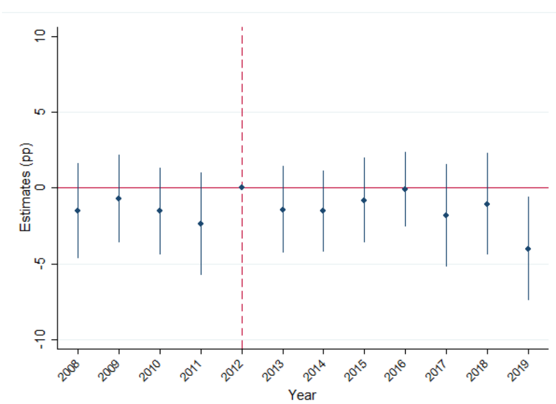
(c) **%Graduate within 6 years (Male)**



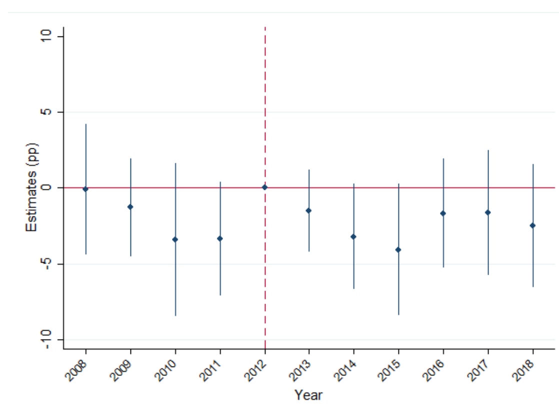
(d) **%Graduate within 7 years (Male)**



(e) **%Graduate within 4 years (Female)**



(f) **%Graduate within 5 years (Female)**



decline is statistically significant for the total and male groups, ranging from about –2.5 to –3.7 percentage points, while the corresponding estimates for female students are small and statistically insignificant. These results suggest that the cap disproportionately affected male-dominated top-tier colleges, possibly reflecting longer average durations due to military service or differences in field composition.

Table B.3: **DiD Estimates of the Cap on the Graduation Outcomes**

	Total		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\leq$6-yr[a]	$\leq$7-yr[b]	$\leq$6-yr[a]	$\leq$7-yr[b]	$\leq$4-yr[c]	$\leq$5-yr[d]
TopTier × Post	-2.880***	-2.453***	-3.702***	-2.946***	-0.322	-0.806
	(0.929)	(0.860)	(1.020)	(0.981)	(0.956)	(1.284)
Number of Departments	0.003	0.001	-0.008	-0.004	0.016**	0.025**
	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.009)
Number of Faculties	0.008	0.010*	0.006*	0.010**	0.007	0.012**
	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)	(0.005)
Number of Seats	-0.003	-0.004	-0.002	-0.003	-0.002	-0.003
	(0.004)	(0.007)	(0.004)	(0.008)	(0.002)	(0.004)
Tuition	0.000	-0.000	-0.001	-0.001**	0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	50.687***	73.035***	33.758**	64.435***	19.618**	55.575***
	(12.401)	(18.819)	(13.247)	(21.870)	(7.846)	(9.962)
College FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
R sq.	0.627	0.448	0.660	0.512	0.244	0.377
Obs.	440	396	420	378	528	484

Notes: Observations vary by graduation horizon: [a] 6-year completion: 2008–2017. [b] 7-year completion: 2008–2016. [c] 4-year completion: 2008–2019. [d] 5-year completion: 2008–2018. Latest available year = 2022. The difference in the number of observations between the Total and Male variables for the top-college group arises because two women-only colleges are included in this group.. Standard errors in parentheses are clustered at the college level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Consistent with the event-study evidence in Figure B.2, which shows a post-cap drop in the graduation rate among top-tier institutions, the DiD estimates reinforce the interpretation that the policy reduced the match quality at the top of the college hierarchy. Together, the findings imply that high-performing students became less concentrated in top-tier colleges following the cap, leading to a modest decline in timely graduation outcomes.

C Potential Alternative Explanations

Given that college admission policies are highly complex and subject to frequent changes, it is important to consider whether the observed effects could be driven by factors other than the cap policy. One possible concern is the interaction with the regular admission, which relies heavily on CSAT scores. For example, if there had been a policy change that increased the quota for regular admissions, the relative attractiveness of early admission could have been altered. However, for regular admission, there is a consistent downward trend in the number of available seats among the top 45 colleges between 2010 and 2022, with a particularly steep decline among the most selective institutions. Although the data do not distinguish high-performing students by early versus regular admission, the total trend suggests that changes in the outcomes are primarily driven by early admission decisions, since the availability of seats for regular admission shows a steady decline.

Another potential alternative is the introduction of the waiting list in early admission. Prior to the 2012 academic year, no such system existed. In that year, colleges were allowed to adopt it voluntarily. Initially, only those on the waiting list who expressed their intent to enroll were barred from applying through the regular admission. Beginning in 2013 academic year, however, all of those on the waiting list were prohibited from applying to the regular admission, regardless of their enrollment intent. This change plausibly made applicants more cautious about their early applications, discouraging "safe" choices and encouraging more "reach" applications. Such a policy would predict results opposite to those observed in this study. Thus, it is reasonable to conclude that the cap, rather than the waiting list rule, is the primary driver of the outcomes identified.

A third possible alternative, especially for the second outcome, is that colleges may have become less inclined to admit students from special-purpose high schools due to changes in evaluation criteria. Students from these high schools tend to have an advantage in extracurricular activities and award records. It may have been reduced, potentially putting them at a disadvantage. While this argument is plausible, students from special-purpose high schools remain objectively high-performing, as shown by their CSAT scores and high rates of admission to top colleges such as SNU. Moreover, these changes in evaluation standards vary by college. Therefore, it is unlikely that such heterogeneous shifts can fully explain the aggregate patterns found in this analysis.

The last alternative explanation is that the results might be driven by anticipatory effects, as applicants and colleges could have adjusted their behavior between the policy announcement and implementation. However, this is unlikely because there is little time to react before the policy is implemented. A series of official documents corroborates this, indicating that no such anticipatory responses occurred. KCUE typically announces admission guidelines one year in advance, yet the "2013 Academic Year College Admission Basic Guidelines" posted on August 31, 2011, explicitly stated that application limits would not be implemented, citing concerns about restricting student choice. This position was maintained in the December 12, 2011 "Implementation Plan," which made no mention of restrictions. The final policy decision came abruptly after a December 20, 2011 forum, with confirmation just two days later on December 22nd. This left students less than one semester to revise application strategies and colleges less than four months before their April announcements to redesign admission processes. Such a compressed timeframe was insufficient for meaningful strategic adjustments by either party, making anticipatory effects an implausible explanation for the observed patterns.

Taken together, these considerations suggest that the observed effects are best interpreted as consequences of the six-application cap policy rather than artifacts of concurrent admission reforms or shifts in evaluation practices.

D Table

Table D.1: **Tuition Support Rate by Income Decile**

Income Decile	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
% Median Income	30	70	90	110	130	155	180	220	290	-
% Supporting Tuition	100	100	75	55	32	23	13	13	0	0

Source: Ahn and Kim (2017)

Table D.2: **University Evaluation Indicators, 2010 JoongAng**

Indicator	**Weight**
I. Educational Conditions (95 points)	
Student-to-Faculty Ratio	10
Faculty Securing Rate	10
Scholarship Rate relative to Tuition	15
Dormitory Acceptance Rate	5
Library Material Cost per Student	5
Education Cost per Student	15
Education Cost Return Rate	10
Ratio of Tuition in Revenue	10
Student Recruitment Rate	5
Dropout Rate	5
Donations relative to Revenue	5
II. Internationalization (70 points)	
Foreign Faculty	20
Foreign Students in Degree Programs	15
Proportion of Outbound Exchange Students	10
Proportion of Inbound Exchange Students	5
English-Taught Courses	20
III. Faculty Research (115 points)	
External Research Funding per Faculty	15
Internal Research Funding per Faculty	10
Domestic Publications per Humanities/Social Sciences Faculty	15
2009 SSCI, A&HCI Publications per Humanities/Social Sciences Faculty	20
2009 SCI Publications per Science/Engineering Faculty	20
2009 SCI Impact Factor per Science/Engineering Faculty	5
2009 Citations per Faculty for SCI, SSCI, A&HCI (last 5 years)	10
Intellectual Property Registrations per Science/Engineering Faculty	10
Technology Transfer Income per Science/Engineering Faculty	10
IV. Reputation & Social Advancement (70 points)	
University Preferred for New Hires (Survey)	10
University Providing Proper Education for Work (Survey)	10
University with High Future Potential (Survey)	10
University Recommended for Admission (Survey)	10
University Preferred for Donations (Survey)	10
University Contributing to Nation/Community (Survey)	10
Employment Rate (linked to National Health Insurance DB)	10

Notes: Indicators are based on the 2010 JoongAng college evaluation.