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

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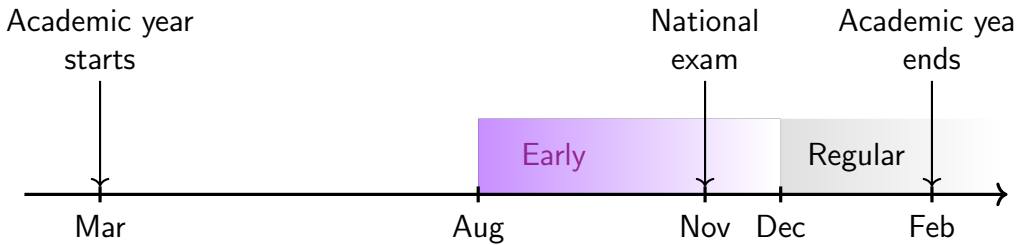
Policy Overview

- Beginning in 2013, the South Korean government limited the number of college applications to a maximum of 6 in early admission.
  - Goal: to reduce the costs from *"application fever"*– *fee, prep. for college-specific exams, counseling, and psychic costs.*
- The cap is only for 4-year general colleges
  - 2-year, industrial, and science and technology colleges are excluded.
- The cap is bound. Binding
  - 22% made 6^+ applications (2011)

College Application Process



- Early: evaluates HS GPA, extracurriculars, college-specific exams, etc.
- Regular: mostly national exam scores.

Research Questions

Korea, U.S., College, and Admission *(Blair and Smetters, 2021)*

- Does the application cap reduce the matching quality?
  (Chen and Kao, 2023; Avery, Lee, and Roth, 2014)
  - In terms of the number of desirable students in prestigious colleges
- Does application cap reduce the socioeconomic gap?
  (Hoxby and Avery, 2013; Avery and Levin, 2010)
  - Low-Socioeconomic Status (SES) students in prestigious colleges

This paper extends the model in *Chen and Kao (2023)* with application constraint, and tests with application cap in South Korea, 2013.

Colleges, Student Types, and Preference

College(j) A and B: Capacity k_j, Prestige $a > b$.

Student(i)

- utility $u_i(A) = a - e_i, u_i(B) = b + e_i$
- $e_i \sim F()$: relative pref. toward B controlling prestige. *e.g.) fit or distance*

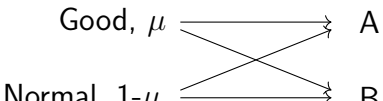
By assuming $k_A + k_B < 1$ and $k_A < k_B$,

- Some students have a risk of failing to be accepted.

- A continuum of students with desirability: $(Good, Normal) = (\mu, 1 - \mu)$
- A continuum of students with SES: $(High, Low) = (\nu, 1 - \nu)$

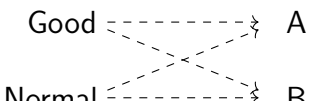
Sketch, Matching Quality

Before the Cap



Outcome: (m_A, m_B)

After the Cap



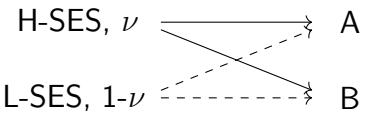
(n_A, n_B)

- Outcomes: the number of "Good" students enrolled in college j, $m_A > n_A$
- Assuming no application constraints but ability noise Info
- Before, applicants apply both. m_j depends on the prestige difference.
- After, the risk makes students apply to a "safe" school (B) with adjusted e, considering expected payoffs.

$\Rightarrow$ **A gets less desirable students. Matching quality is reduced.**

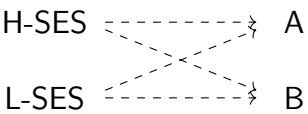
Sketch, Socioeconomic Gap

Before the Cap



Outcome: (v_A, v_B)

After the Cap



(w_A, w_B)

- Outcome: the number of L-SES students enrolled in college j, $v_A < w_A$
- Now, application costs exist but no ability noise.
- Before, only L types are constrained.
- After, H types are constrained as well. They adjust e, considering expected payoffs.

$\Rightarrow$ **A gets more L-SES students. The socioeconomic gap is reduced.**

Specification: Two-Way Fixed Effects

$$Y_{jt} = \alpha + \beta Rank_j \times Post_t + X_{jt}\gamma + \theta_j + \delta_t + \epsilon_{jt}$$

- Y_{jt}: % of freshmen graduated from selective high schools, and % of student loan debtors for tuition in college j at year t.
- $Rank_j$: rank. The bigger, the more prestigious.
- $Post_t$: $= 1$ after the academic year 2013.
- X_{jt}: characteristics-the number of faculty members, departments, and slots.
- θ_j, δ_t: college and year fixed effects.
- Standard errors are clustered at the college level.

College-level Panel Data

Annual college-level administrative records from the Korean Council for University Education (KCUE), including information about students, faculties, and colleges.

- Sample: **Top 46** among 190 4-year general colleges from 2007 to 2023 Desc
  - Selective colleges that are not competing with 2-year colleges.
  - Top college (SNU) is excluded because of more application requirements.
- Rank: The JoongAng (2010), correlated with national exam score. Rank

Results (1), Matching Quality Supp1 Hetero1

In average, ⇓ 13.5% of desirable students in top 23 colleges after the cap.

	(1)	(2)
	%From Selective High School	
Rank × Post	-0.065***	-0.061***
	(0.020)	(0.021)
Controls		X
College FE	X	X
Year FE	X	X
R sq.	0.166	0.172
Obs.	585	584

Results (2), Socioeconomic Gap

Supp2 Hetero2 A'sm Alt Robust

In average, $\Uparrow$ 25.1% of L-SES students in top 23 colleges after the cap.

	(1)	(2)
	%Student Loan Debtors (Tuition)	
Rank $\times$ Post	0.089***	0.092***
	(0.023)	(0.026)
Controls		X
College FE	X	X
Year FE	X	X
R sq.	0.701	0.699
Obs.	664	659

Summary

The cap reduces matching quality and the socioeconomic gap in college prestige.

- The theoretical model predicts that, in a more prestigious college,
  - less desirable students enroll
  - more L-SES students enroll
- Corresponding empirical results show that, in more prestigious colleges,
  - $\Downarrow$ 13.5% of desirable students.
  - $\Uparrow$ 25.1% of L-SES students.

Thank You!

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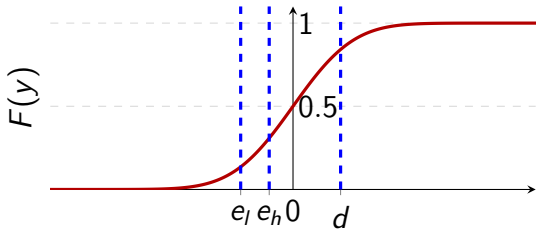
Explicit Formulas for p

The equilibrium strategy profile, (e_h, e_l), implies a pair of cutoff values.

- d changes into the cutoff value e_h or e_l depending on the signal.



- e_h where applicants with $s_i = h$ are indifferent between A and B.
- If $e_i > e_h$, then i prefer applying B.
- Given e_h, there exists an interior solution for e_l such that $p_A^l(e_h, e_l)(a - e_l) = p_B^l(e_h, e_l)(b + e_l)$ with ...

Explicit Formulas for p, cont'd

Return

- $$p_A^l(e_h, e_l) = \min\left[\max\left[0, \frac{k_A - \mu F(e_h)}{(1-\mu)(pF(e_h)+(1-p)F(e_l))}\right], 1\right]$$
  $$p_B^l(e_h, e_l) = \min\left[\max\left[0, \frac{k_B - \mu(1-F(e_h))}{(1-\mu)(p(1-F(e_h))+(1-p)(1-F(e_l)))}\right], 1\right]$$
  $$p_A^h(e_h, e_l) = \pi \min\left[\frac{k_A}{\mu F(e_h)}, 1\right] + (1-\pi)p_A^l(e_h, e_l)$$
  $$p_B^h(e_h, e_l) = \pi \min\left[\frac{k_B}{\mu(1-F(e_h))}, 1\right] + (1-\pi)p_B^l(e_h, e_l)$$

Evidence: The Application Cap is Bound

Return

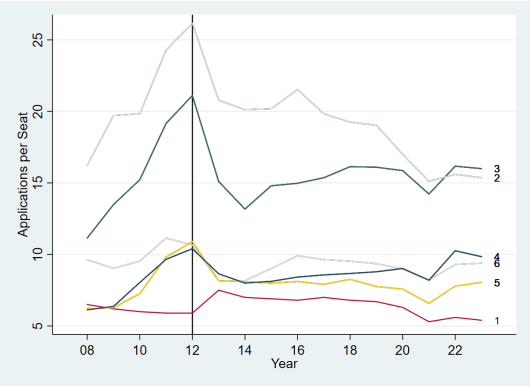


Figure: Time Trend in the Number of Applications per Seat

Consistent Rankings: JEDI (2010) and Daesung (2012)

Return

Table: Daesung (2012) and JEDI (2010)

Daesung (2012)		JEDI (2010)		
CSAT Score	Rank	Rank	Rank Group	University
384.21	1	1	1	Seoul National University
380.96	2	4	2	Yonsei University
377.03	4	5	2	Korea University
373.04	6	6	2	Sungkyunkwan University
364.76	12	7	2	Kyung Hee University
376.00	5	8	2	Sogang University
369.42	7	9	2	Hanyang University
367.30	9	13	3	Ewha Women's University
351.80	26	14	3	Inha University
363.20	14	15	3	Chung-Ang University
...	...	...	...	...

All the educational and science and technology-focused colleges are excluded.

- ρ=.77, Wilcoxon test reveals no significant difference (Z = -.83, p = .41)

Why There Exists a Decreasing Trend after 2013?

Return

Government Scholarship for Low-SES Students expand.

However, there still need for student loans among the income decile 4th and above.

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

Government Student Loan

Return

1. General Student Loan for Tuition
2. General Student Loan for Tuition and Living Costs

   1&2: repay right after graduation. for everyone.

3. After Employment Student Loan for Tuition
4. After Employment Student Loan for Tuition and Living Costs

   3&4: repay after being employed. bottom 90% available for tuition loan, bottom 80% available for living cost loan

- Type I: 1&3
- Type II: 2&4

Supplementary Results (1) Return

⇓ Desirable students in more prestigious colleges after the cap

	(1)	(2)	(3)	(4)
	Avg. Duration		P(Grad in 6yr)	
Rank × Post	0.002*	0.002**	-0.066	-0.066*
	(0.001)	(0.001)	(0.041)	(0.037)
Controls		X		X
College FE	X	X	X	X
Year FE	X	X	X	X
R sq.	0.420	0.434	0.599	0.601
Obs.	352	352	440	440

Supplementary Results (2)

Return

⇑ Low-SES students in more prestigious colleges after the cap

	(1)	(2)
	Share of Loan Debtor (Tuition and Living Costs)	
Rank × Post	0.044*	0.047*
	(0.022)	(0.024)
Controls		X
College FE	X	X
Year FE	X	X
R sq.	0.162	0.164
Obs.	664	659

Heterogeneous effect across Region and Public

Return

- Impact size decreases in the private because of the desirables' pref. to public.

	(1)	(1)	(2)
	%From Selective High School		
Rank× Post	-0.061***	-0.063***	-0.056**
	(0.021)	(0.022)	(0.021)
× Seoul Capital Area (SCA)		-0.006	
		(0.009)	
× Public			0.015*
			(0.008)
Obs.	584	584	584

Heterogeneous Effect across Region and Public

Return

- Impact size increases in colleges out of SCA because of H's pref. to SCA.
- Impact size decreases in private colleges because of L's pref. to public.

	(1)	(2)	(3)
	%Student Loan Debtors (Tuition)		
Rank × Post	0.092***	0.106***	0.067***
	(0.026)	(0.027)	(0.025)
× SCA		-0.043**	
		(0.021)	
× Public			0.057***
			(0.018)
Obs.	659	659	659

Descriptive Statistics

Return

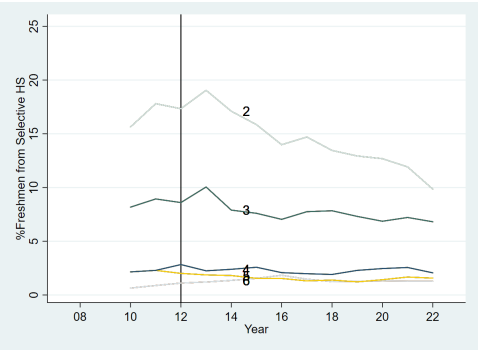
	Mean	SD	N
% Freshmen from Selective HS	4.94	6.19	598
% Student Loan Debtor	9.28	4.80	679
Seoul Capital Area	0.57	0.50	782
Public	0.30	0.46	782
Faculties	741	425	736
Departments	79	46	736
Number of Slots (Early)	1,968	848	734
Number of Slots (Regular)	1,359	644	734
Applications	30,215	19,019	734
Applications per Slot	11.18	5.79	734
Enrollment (Early)	1,698	819	734
Enrollment (Regular)	1,327	639	734
Enrollment Rate (Early)	85.29	12.43	734
Enrollment Rate (Regular)	97.49	5.98	734
Attendance	13,304	5,165	777

Assumptions for the Causal Estimates

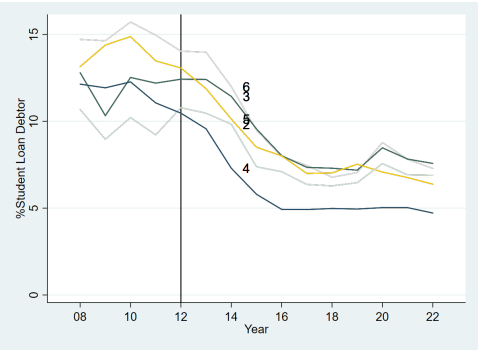
- No anticipatory effects: players cannot make any changes that affect outcomes
  - Announcement was made in Dec. 2011. Applicants have a half year to react. Colleges have about 4 months since they should announce admission details in Apr. 2012.
- Parallel pre-trends among colleges

Assumptions for the Causal Estimates, cont'd

Pre-parallel trends for main outcomes



(a) % From Selective HS

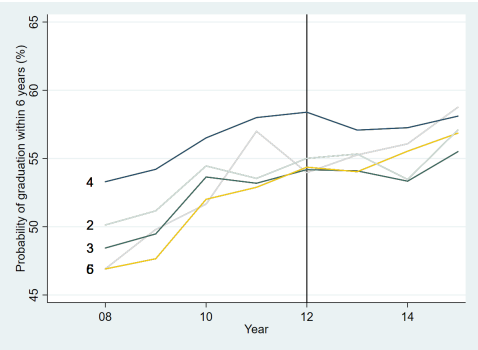


(b) % Student Loan Debtor (Tuition)

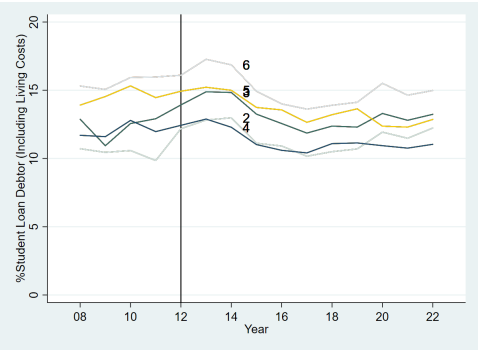
Assumptions for the Causal Estimates, cont'd

Return

Pre-parallel trends for supplementary outcomes



(c) % Prob. of Grad in 6-yr



(d) % Student Loan Debtor (Tuition and Living Costs)

Alternative Explanations

Return

- Other admission policies change that discriminate students from selective high schools.
  - No incentive to do that.
- A Lower interest rate for the loan attracts more students from H-SES households who are more financially knowledgeable.
  - Not only the rates for student loans but also market rates decrease.

Robustness Check: Including the Top School (SNU)

Return

Top students are less treated because of more requirements to apply

	(1)	(2)
	%From Selective High School	
Rank × Post	-0.057***	-0.052**
	(0.020)	(0.021)
	%Student Loan Debtors (Tuition)	
Rank × Post	0.090***	0.094***
	(0.021)	(0.023)
Controls		X
College FE	X	X
Year FE	X	X

Information Structure

Return

- Compared to perfectly screening colleges, students with ability noise incompletely know their type before taking the national exam.
- Students get signal $s_i \in \{h, l\}$ for their ability type.
  - Good type, $s_i = h$ always

$$\text{Normal type} \begin{cases} s_i = h, & \text{with } p \\ s_i = l, & \text{with } (1-p) \end{cases}$$

- Posterior probability
  - $s_i = h \begin{cases} \text{Good type}, & \text{with } \pi = \frac{\mu}{\mu + (1-\mu)p} \\ \text{Normal type}, & \text{with } (1-\pi) \end{cases}$

  $s_i = l$, Normal type always