Test-optional Policies: Overcoming Strategic Behavior and Informational Gaps

Zhi Liu[1] and Nikhil Garg[1,2]

[1]Operations Research and Information Engineering, Cornell University [2]Cornell Tech and Technion

Background

Test-optional admissions is gaining popularity

- Due to COVID-19, more than 500 US-based colleges adopted "test-optional" policies for college admissions and together signed a pledge to "not penalize" students without a test score

Empirical studies suggest unfairness in implementation

- Bi-modal income distribution among non-submitters [1], higher enrollment rate among admitted non-submitters [2], and drastically increased average reported SAT score for test-optional institutions [3] suggest strategic behavior in score reporting and unfairness towards students without test access
- It is still unclear what fairness in test-optional admissions mean and what admission policy can meet it

Main Questions

- **How to formally define fairness in test-optional admissions?**
- **What admission policy would meet the fairness criteria?**

Model

Student groups. Indicator Z - whether the student has *access to tests*, assumed to be deterministic and pre-set

Latent skill. $q \sim N(\mu, \sigma^2)$, independent of test access (Z) groups

Student features. $\{\theta_1, \theta_2, \dots, \theta_K\}$ - each $\theta_k = q + \epsilon_k$, with noise $\epsilon_k \sim N(0, \sigma_k^2)$, independent of test access (Z) groups

– We refer to the last feature, θ_K, as *"the test score"*

Student decisions/actions. Indicators Y and X - whether the student *takes the test* (Y) and *reports the score* (X), decisions made by each student upon observing available information

– We assume that $\{\theta_k\}_{k=1}^{K-1}$ is always observed by the school, but whether θ_K is observed is a result of Z, Y and X

References

[1] William C. Hiss and Valerie W. Franks. Defining promise: Optional standardized testing policies in american college and university admissions. Arlington, VA: National Association for College Admission Counseling (NACAC), 2014.

[2] Hillary Morgan. *Estimating Matriculation with a Focus on Financial Aid and Test Optional Policies: Data from a Liberal Arts Institution in the Northeast.* PhD thesis, Seton Hall University, 2016.

[3] Andrew S. Belasco, Kelly O. Rosinger, and James C. Hearn. The test-optional movement at america's selective liberal arts colleges: A boon for equity or something else? *Educational Evaluation and Policy Analysis*, 37(2):206–223, 2015.

Model - continued

School. A single school estimates student skill with an estimation policy P based on the information known I, through function $f_P(I)$, which may depend on students' decision functions, the school's submission requirements, etc.

- E.g., if the school uses optimal Bayesian estimation, the estimated skill will be the posterior mean of q given the information: $\tilde{q} = f_P(I) = \mathbb{E}[q|I]$

Equilibrium[1]. The estimation function $f_P(I)$ and decision functions $Y(\cdot), X(\cdot)$ constitute an equilibrium if:

- all decisions satisfying the school's reporting requirements are feasible
- given $Y(\cdot), X(\cdot)$, $f_P(I)$ follows its definition and is known to the students
- given $f_P(I)$, all students weakly prefer their current courses of actions

Fairness Criterion for Admission Policy Evaluation[2]

- **Observable fairness**: if estimates for students who share observable features $\{\theta_k\}_{k=1}^{K-1}$ are equal in distribution across Z, $\forall \{\theta_k\}_{k=1}^{K-1}$:

$$\tilde{q}|Z = 1, \{\theta_k\}_{k=1}^{K-1}, P \overset{\mathcal{D}}{=\!=} \tilde{q}|Z = 0, \{\theta_k\}_{k=1}^{K-1}, P.$$

Main Results

1. When school does not know test access (Z): we encounter *strategic withholding.*
2. When school *knows* test access (Z)[3]: strategy proof, still unfair due to *informational gaps.*
3. A proposed *resampling policy* with observable and demographic fairness guarantees.

Resampling policy P_S. Assuming the school knows test access,

- For students with access, use the Bayesian optimal estimation, exclude strategic behavior
- For students without access, randomly draw a test score from the inferred distribution given the submitted features $\{\theta_k\}_{k=1}^{K-1}$:
$$\tilde{\theta}_K \sim \theta_K | \{\theta_k\}_{k=1}^{K-1}$$
and then use estimated q given $\{\theta_k\}_{k=1}^{K-1}, \tilde{\theta}_K$. This excludes informational gaps stochastically

→ P_S does not suffer from strategic behavior or informational gaps, and is observably fair!

[1] Student strategies to report depend on the school's estimation function, which in turn depends on the decisions of the students, thus an equilibrium should be specified. The way the equilibrium changes with the policy is a central part to this work.
[2] We considered a range of fairness criteria in our paper, which covers three different levels. We showed that among them, observable fairness is the most stringent one that we could achieve.
[3] While a school may never have true knowledge of Z in practice, it may be able to approximate it by, for example, using submission information from others in the same socio-economic contexts. It may also ask students to credibly attest to a lack of access, or pursue other verification techniques. Our work provides an upper bound for how beneficial such knowledge may be.

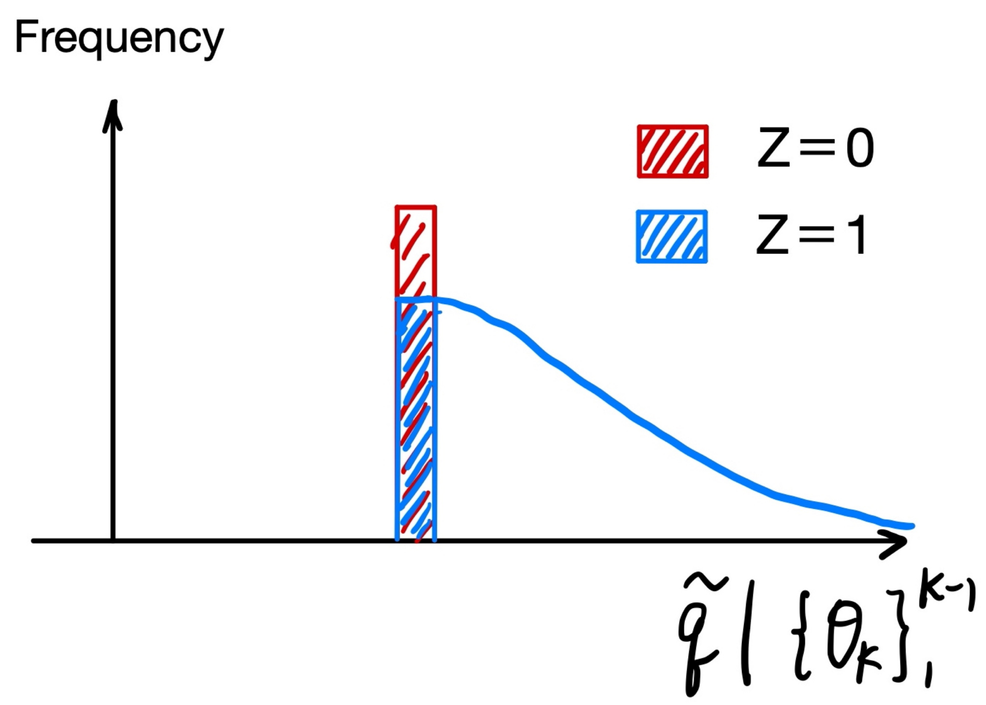

Fig. 1: School does not know access

Strategic behavior + informational gaps

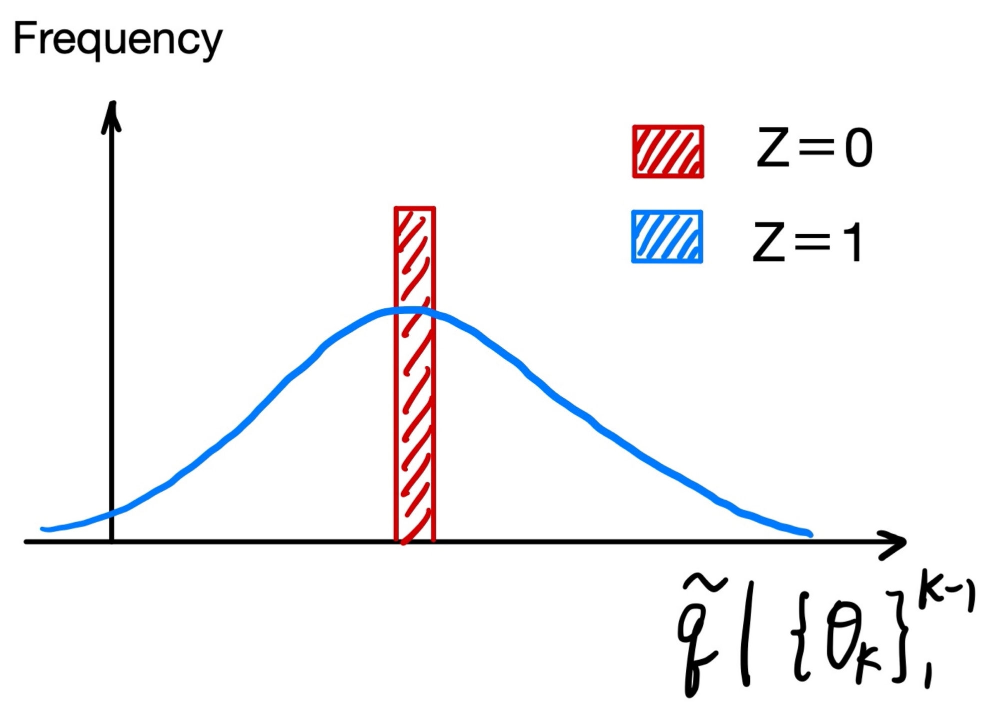

Fig. 2: School knows access

Strategic behavior is gone, but we still have informational gaps

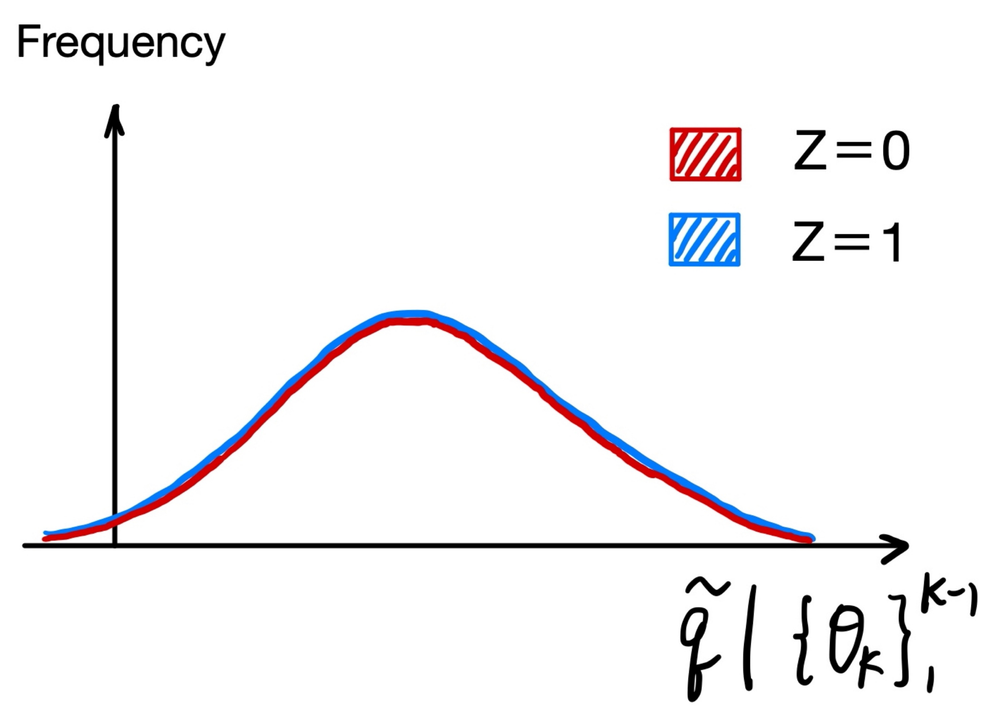

Fig. 3: Knows access + resampling policy

Observably fair!